Breast cancer risk tied to grandmother's diet

Washington, DC – Eating too much fat in pregnancy may be an indulgence that has a less-than-beneficial effect on generations to come, say researchers at Georgetown Lombardi Comprehensive Cancer Center. Their unique study in rats shows that pregnant females that ate a high fat diet not only increased breast cancer risk in their female daughters but also in that daughter's offspring – the "granddaughters." Details of the study will be presented at the AACR 101st Annual Meeting 2010.

The researchers say they don't know why this risk is passed on through two generations, but they believe it occurs through as-yet unknown "epigenetic" changes that result in an increase in terminal end buds in the breast tissue – an increase that apparently can then be passed on through generations. These buds are believed to be the structures where breast cancer can develop, and having more of these structures seems to increase breast cancer risk, says the study's lead investigator, Sonia de Assis, Ph.D., a postdoctoral fellow in Leena Hilakivi-Clarke's laboratory at Lombardi. "That is our theory, but we really don't know how it is happening – just yet."

The researchers add that while the grandmother ate a diet that was 43 percent fat, she didn't eat more calories than a control population of rats, and both her daughters and granddaughters ate a normal chow.

The researchers also found that the risk appears to not only extend from mother to daughter and granddaughter, but also from mother to son to granddaughter. For example, the daughters of male and female rats born from mother rats that ate a lot of fat had an 80 percent chance of developing breast cancer, but the risk was about 69 percent if the granddaughter's mother or father was born from a rat that ate normally and the other parent came from a high-fat-consuming parent. By contrast, granddaughters of grandmother rats who ate a normal chow had a 50 percent chance of developing breast cancer.

They also studied a different control populations of rats given estradiol- a form of estrogen – and saw no increase in breast cancer risk in granddaughters. That suggests that the increased estrogen production related to eating more fat is not the source of the problem, they say.

"The implications from this study are that pregnant mothers need to eat a well balanced diet because they may be affecting the future health of their daughters and granddaughters," says de Assis.

Study finds treatment-resistant ringworm prevalent among children in metro elementary schools

Kansas City, Mo– Approximately 7 percent of elementary school children across the bi-state, Kansas City metropolitan area are infected with the fungus Trichophyton tonsurans (T. tonsurans), the leading cause of ringworm in the U.S., according to a new study published today in Pediatrics. This is the largest study to date aimed at defining infection prevalence of the scalp fungus in children living in a metropolitan area and has implications for children nationwide.

"The organism T. tonsurans has become the leading cause of scalp infection in the U.S., and we believe it is on the rise in inner city areas," said Susan Abdel-Rahman, Pharm.D., lead study author and professor of pediatrics and pharmacy at Children's Mercy Hospitals and Clinics. "This study supports what I and many of my peers are seeing – children with scaly, itchy scalps and hair loss are prevalent in metropolitan areas. If not treated, ringworm can lead to permanent hair loss, which can damage a child's self image. There is also some evidence that it may worsen seemingly unrelated problems such as asthma and allergic rhinitis."

Although its name suggests otherwise, ringworm is caused by a fungus, not a worm. In the past, Microsporum species were the main cause of ringworm, often passed to humans from cats and dogs. However, in recent years, T. tonsurans emerged, which spreads directly between humans, and is more challenging to screen for and treat.

The study of 10,514 children in grades K through 5 across 44 schools found that 6.6 percent of the children evaluated were infected with T. tonsurans. Infection rates varied markedly based on age and race, with African American children at greatest risk. More than 18 percent of the youngest African American children evaluated (kindergarten and first grade) were infected, with that number dropping to 7 percent by the time they reached fifth grade. In contrast, infection rates in Hispanic (1.6 percent) and Caucasian children (1.1 percent) were significantly lower. The reason for the dramatically higher prevalence in African Americans is not clear.

Current treatment regimens for T. tonsurans require a course of oral antifungal medicine typically for six to eight weeks until the symptoms resolve. However, in many of these children the fungus will not be completely eliminated. Consequently, children can still spread the infection to their classmates after being treated. "T. tonsurans has learned how to stay on the host and avoid eradication. This can be very frustrating for children who keep getting re-infected and for their parents who are doing everything they can to prevent this," added Abdel-Rahman. "We have only recently started to appreciate just how many children carry this pathogen so we don't yet know the best way to tackle this problem. However, I do advise parents to limit the sharing of items

that come into contact with the scalp such as hats, combs, brushes and pillows. Watch closely for signs of infection such as flaking that looks like dandruff, white patchy scaling, itching, hair thinning or loss, and small pus-filled bumps, especially when your child has come in contact with another infected child. Make an appointment to see your doctor if you suspect that your child is infected and make sure to take the prescribed medicine as directed along with the application of a medicated shampoo two to three times a week."

Study suggests indoor tanning may be an addictive behavior

Individuals who have used indoor tanning facilities may meet criteria for addiction, and may also be more prone to anxiety symptoms and substance use, according to a report in the April issue of Archives of Dermatology, one of the JAMA/Archives journals.

"Despite ongoing efforts to educate the public about the health risks associated with natural and non-solar UV radiation, recreational tanning continues to increase among young adults," the authors write as background information in the article. "In addition to the desire for appearance enhancement, motivations for tanning include relaxation, improved mood and socialization." Given these reinforcements, repeated exposure to UV light may result in behavior patterns similar to those observed with substance-related disorders, the authors note.

Catherine E. Mosher, Ph.D., of Memorial Sloan-Kettering Cancer Center, New York, and Sharon Danoff-Burg, Ph.D., of University at Albany, State University of New York, in 2006 recruited 421 college students. Two written questionnaires typically used to screen for alcohol abuse or substance-related disorders were modified to evaluate students for addiction to indoor tanning. Participants were also assessed using standardized measures of anxiety, depression and substance use.

Among 229 participants who had used indoor tanning facilities, the average number of visits during the past year was 23. A total of 90 (39.3 percent) met criteria for tanning addiction on one measure and 70 (30.6 percent) met criteria on the other measure. Students who did meet these criteria were more likely to report symptoms of anxiety and use of alcohol, marijuana and other substances than those who did not meet these criteria.

"If associations between affective factors and indoor tanning behavior are replicated, results suggest that treating an underlying mood disorder may be a necessary step in reducing skin cancer risk among those who frequently tan indoors," the authors write. "Researchers have hypothesized that those who tan regularly year round may require more intensive intervention efforts, such as motivational interviewing, relative to those who tan periodically in response to mood changes or special events."

"Further research should evaluate the usefulness of incorporating a brief anxiety and depression screening for individuals who tan indoors. Patients with anxiety or depression could be referred to mental health professionals for diagnosis and treatment."

(Arch Dermatol. 2010;146[4]:412-417. Available pre-embargo to the media at www.jamamedia.org.)

Editor's Note: The work of Dr. Mosher was supported by a grant from the National Cancer Institute. Please see the article for additional information, including other authors, author contributions and affiliations, financial disclosures, funding and support, etc.

Taped consultations help patients understand heart surgery

Patients who receive an audiotape of their consultation before undergoing heart surgery appear to have more knowledge about their procedures and their health, and also have reduced anxiety and depression, according to a report in the April issue of Archives of Surgery, one of the JAMA/Archives journals.

"Patients facing heart surgery are understandably anxious in the outpatient clinic and, as a consequence, are unlikely to absorb all the information presented to them," the authors write as background information in the article. "They also find it difficult to remember the various percentage figures quoted for risk of complication, success rate of alternative therapeutic options and other pertinent facts." This can impair the informed consent process, since valid consent must be obtained from a patient who is informed about the proposed treatment, any alternatives and the nature of the underlying condition.

Pankaj Kumar Mishra, M.R.C.S., of the Glasgow Royal Infirmary, Scotland, and colleagues studied 84 patients who had first-time coronary artery surgery conducted by one surgeon between February 2005 and March 2006. All of the patients' pre-surgery consultations were audiotaped; 30 participants were randomly assigned to receive this tape and told they could listen to it whenever they desired, 25 received a general 11-minute tape about coronary artery surgery and 29 received no tape. The patients were then interviewed upon being admitted to the hospital for surgery.

All patients who received the audiotaped consultations confirmed that they had listened to them; the duration ranged from 13 minutes to 32 minutes (average 24 minutes). The average knowledge score of patients in the consultation tape group was much higher than that of individuals who received no tape. In addition, they

reported a greater sense of control with regard to their own health and also scored lower on measures of anxiety and depression.

"Concerns have been raised that detailed information can cause undue anxiety and distress to patients," the authors write. "However, it has also been shown that a well-informed patient copes more effectively with surgery, and this factor can result in earlier discharge and decreased incidence of psychological problems."

"Consultation audiotaped recordings offer patients a chance to listen to information that might have been missed during the consultation and refresh their memory; the recordings facilitate understanding of illness and treatment," they continue. "They also encourage patients to seek clarification of previously imparted information in subsequent encounters with health care professionals. The addition of an audiotaped recording of an outpatient consultation to written communication significantly increases patients' recall of information and satisfaction level, particularly in elderly patients."

Additional research is needed to ensure there are no adverse effects of providing these tapes in any subgroup of patients, and also to understand how best to integrate them into clinical practice, the authors conclude.

(Arch Surg. 2010;145[4]:383-388. Available pre-embargo to the media at www.jamamedia.org.)

'Fatness' gene may thin your brain

* 17:16 19 April 2010 **by Celeste Biever**

A gene variant that helps us gain weight may shrink our brains into the bargain. Elderly obese people are more likely to develop dementia and their brains tend to be smaller than those of people of normal weight.

This has been put down to clogged arteries slowing the blood flow to the brain, killing neurons. But now Paul Thompson's team at the University of California, Los Angeles, has found that a gene variant linked to obesity may harm the brain directly. Half of Europeans and West Africans have a variant of a gene called FTO that increases the risk of obesity by two-thirds. The variant is thought to affect metabolism and fat storage.

Problem-solving

When Thompson's team looked at brain scans of 206 healthy people aged 70 to 80, they found that those with at least one copy of the FTO variant had 8 per cent less volume in their frontal lobes and 12 per cent less in the occipital lobes, compared with their counterparts lacking the variant. The brains of those with the variant "looked 16 years older", Thompson reckons.

The study's participants did not have cognitive problems. However, these brain areas are critical to problem-solving and perception, and brain atrophy there increases the risk of dementia and memory problems, Thompson says.

The FTO variant could be damaging the brain indirectly by helping to make people fatter, but Thompson reckons it plays a more direct role, too, as FTO is expressed at high levels in the brain.

Journal reference: Proceedings of the National Academy of Sciences, DOI: 10.1073/pnas.0910878107

Meat, especially if it's well done, may increase risk of bladder cancer

Genetic variants in metabolism pathway further raise likelihood

WASHINGTON, D.C. - People who eat meat frequently, especially meat that is well done or cooked at high temperatures, may have a higher chance of developing bladder cancer, according to a large study at The University of Texas M. D. Anderson Cancer Center presented at the American Association for Cancer Research 101st Annual Meeting 2010. This risk appears to increase in people with certain genetic variants.

"It's well known that meat cooked at high temperatures generates heterocyclic amines (HCAs) that can cause cancer," said study presenter Jie Lin, Ph.D., assistant professor in M. D. Anderson's Department of Epidemiology. "We wanted to find out if meat consumption increases the risk of developing bladder cancer and how genetic differences may play a part."

Meat-eating habits examined

According to the American Cancer Society, almost 71,000 new cases of bladder cancer were diagnosed in this country last year, and more than 14,000 people died because of the disease. Men are at much higher risk of developing bladder cancer than women.

HCAs form when muscle meats, such as beef, pork, poultry or fish, are cooked at high temperatures. They are products of interaction between amino acids, which are the foundation of proteins, and the chemical creatine, which is stored in muscles. Past research has identified 17 HCAs that may contribute to cancer.

This study, which took place over 12 years, included 884 M. D. Anderson patients with bladder cancer and 878 people who did not have cancer. They were matched by age, gender and ethnicity.

Using a standardized questionnaire designed by the National Cancer Institute (NCI), researchers gathered information about each participant's dietary habits. They then categorized people into four levels, ranging from lowest to highest red meat intake.

Well-done red meat nourishes cancer risk

The group with the highest red-meat consumption had almost one-and-a-half times the risk of developing bladder cancer as those who ate little red meat.

Specifically, consumption of beef steaks, pork chops and bacon raised bladder cancer risk significantly. Even chicken and fish - when fried - significantly raised the odds of cancer.

The level of doneness of the meat also had a marked impact. People whose diets included well-done meats were almost twice as likely to develop bladder cancer as those who preferred meats rare.

Further questioning of a subset of 177 people with bladder cancer and 306 people without bladder cancer showed that people with the highest estimated intake of three specific HCAs were more than two-and-a-half times more likely to develop bladder cancer than those with low estimated HCA intake.

"To quantify intakes of HCAs, we began three or four years ago to gather information on meat-cooking methods and doneness level, and then used a program developed by the NCI to estimate intakes of three major HCAs," Lin said. "These data gave important information about the relationship between HCAs and bladder cancer."

Genetic variants increase incidence

To take the investigation a step further, researchers analyzed each participant's DNA to find if it contained genetic variants in the HCA metabolism pathways that may interact with red meat intake to increase the risk of cancer. People with seven or more unfavorable genotypes as well as high red-meat intake were at almost five times the risk of bladder cancer.

"This research reinforces the relationship between diet and cancer," said Xifeng Wu, M.D., Ph.D., professor in M. D. Anderson's Department of Epidemiology and lead author on the study. "These results strongly support what we suspected: people, who eat a lot of red meat, particularly well-done red meat, such as fried or barbecued, seem to have a higher likelihood of bladder cancer. This effect is compounded if they carry high unfavorable genotypes in the HCA-metabolism pathway."

Wu said this research is a step toward a future in which a comprehensive cancer-risk prediction model will integrate environmental, diet and genetic risk factors to predict an individual's chances of developing cancer.

Co-authors with Lin and Wu included Jian-Ming Wang, M.D., Ph.D., and Meng Chen, Ph.D., also of M. D. Anderson's Department of Epidemiology, and H. Barton Grossman, M.D., and Colin P. Dinney, M.D., of the Department of Urology. This research is supported by funding from National Cancer Institute.

Quantum broadband becomes reality

* 10:52 20 April 2010 **by Colin Barras**

The first high-speed network link that is so secure it is theoretically unbreakable has been created, thanks to quantum physics.

A team at Toshiba Research Europe in Cambridge, UK, has sent encrypted data at over 1 megabit per second along 50 kilometres of optical fibre. That's fast enough to stream video.

Secure links like Toshiba's involve one user sending a secret "key" to the other, encoded into the quantum properties of a string of single photons. Quantum mechanics ensures that any attempt to intercept this quantum key will change it, revealing the attack.

Until now, the fastest way to send the encoded photons was through the air, but the best spanned not much more than 700 metres. For quantum encryption to be practical, the photons need to travel further and use existing infrastructure, such as the optical fibre that already forms the internet's backbone.

Unfortunately, optical fibre can only transmit light over long distances when it is of a certain wavelength. Individual photons of that wavelength are difficult to detect, but Toshiba has now developed a detector that can pick them up. *Journal reference: Applied Physics Letters (DOI: 10.1063/1.3385293)*

Aged female patients taking low-dose aspirin should be paid special attention

Low-dose aspirin (LDA) is one of the main agents used for the prevention of thromboembolic vascular events, and has the advantages of both low cost and a prolonged duration of antiplatelet action; however, it is associated with a doubling of the risk of gastrointestinal bleeding, even at doses as low as 75 mg daily. The gender differences in the clinical manifestations of LDA-associated gastroduodenal mucosal injury have not been well studied.

A research team from Japan examined the clinical factors associated with LDA-associated peptic ulcer in 453 patients under treatment with LDA (298 males, 155 females) who underwent esophagogastroduodenoscopy at the Department of Gastroenterology and Hepatology of Hiratsuka City Hospital between January 2003 and December 2007. Their study will be published on April 21, 2010 in the World Journal of Gastroenterology.

Their results illustrated that a history of peptic ulcer was found to be the risk factor for LDA-associated peptic ulcer common to both sexes. In female patients, age greater than 70 years was a significant risk factor,

and the time to diagnosis as having LDA-associated peptic ulcer by endoscopy was significantly shorter than that in male patients. The results may represent a future strategy for prevention of LDA-associated gastroduodenal mucosal injury.

Reference: *Okada K, Inamori M, Imajyo K, Chiba H, Nonaka T, Shiba T, Sakaguchi T, Atsukawa K, Takahashi H, Hoshino E, Nakajima A. Gender differences of low-dose aspirin-associated gastroduodenal ulcer in Japanese patients. World J Gastroenterol 2010; 16(15): 1896-1900 http://www.wjgnet.com/1007-9327/full/v16/i15/1896.htm*

Cystic fibrosis and Crohn's disease treated successfully with infliximab

Cystic fibrosis (CF) is the most common life-threatening autosomal recessive disease in Caucasian children; it has an incidence of 1 case in every 2500 children born alive. CF involves an anomalous function of the exocrine glands, caused by a mutation of a gene (cystic fibrosis transmembrane conductance regulator, CFTR) located on chromosome 7, which codes for a protein involved in ion transport through the cell membrane.

Pulmonary complications are the most common causes of mortality, but the presenting symptoms are very often linked to gastrointestinal and pancreatic biliary diseases. These are mainly caused by the unusual viscosity of the secretions in hollow organs and in the ducts of solid organs. Crohn's disease (CD) is a chronic inflammatory bowel disease which may be localized throughout the gastrointestinal tract. The association between CD and CF is known; there are reports of a prevalence of CD in patients suffering from CF 17 times higher than in controls.

A research article to be published on April 21, 2010 in the World Journal of Gastroenterology addresses this question. A research team led by Professor Gian Luigi de' Angelis, reported the first case of a patient with CF and CD treated with infliximab.

After initiation of infliximab in this patient, there was an improvement of colonic lesions and general condition without any infective complication and particularly without any decline of lung function.

This report confirms the preliminary data regarding the possibility that airway inflammation in CF plays a crucial role in lung damage and that the inflammation is mediated by tumor necrosis factor alpha. Therefore, the use of anti-tumor necrosis factor alpha antibody improved CD and did not generate any complications of lung function, perhaps promoting an anti-inflammatory effect both on colon and lung.

Reference: *Vincenzi F, Bizzarri B, Ghiselli A, de' Angelis N, Fornaroli F, de' Angelis GL. Cystic fibrosis and Crohn's disease: Successful treatment and long term remission with infliximab. World J Gastroenterol 2010; 16(15): 1924-1927 http://www.wjgnet.com/1007-9327/full/v16/i15/1924.htm*

Beetles stand out using 'Avatar' tech

A new study suggests that jewel scarab beetles find each other - and hide from their enemies - using the same technology that creates the 3D effects for the blockbuster movie Avatar.

According to researchers from the University of Texas, the jewel scarab species Chrysina gloriosa can distinguish between circularly polarized and unpolarized light. That ability could provide the beetles with a tremendous advantage, the researchers say, because most of the light reflected off these beetles' colorful bodies happens to be circularly polarized.

"The trait would allow the beetles to easily see each other while simultaneously hiding from predators that cannot see circular polarized light," said physicist Parrish Brady, who conducted the research with Molly Cummings. Their research is published in the May issue of the American Naturalist.

Circular polarization (CP for short) is a way of filtering light that causes the light's electric field to travel in a circular pattern, as opposed to oscillating in all directions as is does in unpolarized light. CP filters are now used to create 3D effects in movies, such as James Cameron's Avatar. Human eyes don't have the ability to perceive CP light, which is why we need special glasses to view films that use CP.

Scientists have known that jewel scarabs reflect CP light since the renowned physicist Albert Michelson discovered it in 1911. But to find out if they can also detect CP light (without the snazzy glasses), Parrish and Cummings took advantage of beetles' propensity to fly toward light. Through a series of experiments, they tested to see if jewel scarabs alter their flight patterns in the presence of CP light.

"We found significant differences in the beetles' flights toward circularly polarized and unpolarized light sources, suggesting that their eyes are outfitted to be sensitive to circularly polarized light," Brady said.

The finding makes Chrysina gloriosa only the second species on Earth known to be sensitive to CP light - the other being a species of shrimp.

Because ability to see CP light is very rare in nature, it's not likely that any of the beetles' predators can see it. So the ability to both see and reflect CP light probably evolved to allow jewel scarabs to communicate with each other while staying hidden from predators, but Brady and Cummings are planning more research to see exactly how these beetles use this very rare way of seeing and being seen.

Substance in breast milk kills cancer cells

A substance found in breast milk can kill cancer cells, reveal studies carried out by researchers at Lund University and the University of Gothenburg, Sweden.

Although the special substance, known as HAMLET (Human Alpha-lactalbumin Made LEthal to Tumour cells), was discovered in breast milk several years ago, it is only now that it has been possible to test it on humans. Patients with cancer of the bladder who were treated with the substance excreted dead cancer cells in their urine after each treatment, which has given rise to hopes that it can be developed into medication for cancer care in the future.

Discovered by chance

HAMLET was discovered by chance when researchers were studying the antibacterial properties of breast milk. Further studies showed that HAMLET comprises a protein and a fatty acid that are both found naturally in breast milk. So far, however, it has not been proven that the HAMLET complex is spontaneously formed in the milk. It is speculated, however, that HAMLET can form in the acidic environment of the babies´ stomachs. Laboratory experiments have shown that HAMLET kills 40 different types of cancer, and the researchers are now going on to study its effect on skin cancer, tumours in the mucous membranes and brain tumours. Importantly, HAMLET kills only cancer cells and does not affect healthy cells.

Studying the integration of the substance

Researchers at the University of Gothenburg are focusing on how HAMLET can be taken up into tumour cells. The researchers, Roger Karlsson, Maja Puchades and Ingela Lanekoff, are attempting to gain an in-depth understanding of how the substance interacts with cell membranes, and their findings were recently published in the prestigious journal PLoS One.

New research finds bureaucracy linked to a nation's growth

A state's collective organizational structure, procedures and protocols develop hand-in-hand

"Bureaucracy is the death of all sound work," said Albert Einstein, sharing a popular view about bureaucracy grinding progress to a halt.

But it now appears that the organizing functions of bureaucracy were essential to the progressive growth of the world's first states, and may have helped them conquer surrounding areas much earlier than originally thought. New research conducted in the Valley of Oaxaca near Monte Albán, a large pre-Columbian archaeological site in southern Mexico, also implies that the first bureaucratic systems may have a lasting influence on today's modern states.

The research by the American Museum of Natural History (AMNH), funded in part by the National Science Foundation (NSF) through its Social, Behavioral and Economic Sciences directorate, is published in this week's Proceedings of the National Academy of Sciences (PNAS).

"The earliest evidence of state organization is contemporaneous with the earliest evidence of long-distance territorial expansion," said lead researcher Charles Spencer, curator of Mexican and Central American Archaeology at the AMNH. "This pattern was consistent with the territorial-expansion model of primary state formation, which I have proposed in a number of publications over the years."

Spencer's territorial-expansion model argues that states arise through a mutual-causal process involving simultaneous territorial expansion and bureaucratization. Spencer's model breaks with previous ideas that suggest states rise through a protracted, step-by-step process--first the state forms, then an organizing bureaucracy takes hold, and sometime later, the state begins to expand into other regions in an "imperialistic" fashion, thus giving birth to an empire.

Archaeological research conducted by Spencer in an Oaxaca canyon some 50 miles north of Monte Albán suggests that the old distinction between state and empire probably is not useful.

In the Oaxaca Valley, Spencer found evidence of a royal palace and a multi-room temple dating to 300-100 B.C. Most Oaxaca archaeologists consider the royal palace to be evidence of a specialized ruling class and the multi-room temple to be evidence of a specialized priestly class.

Spencer notes that around 300 B.C., the first signs of state organization start to appear in the Oaxaca Valley where Monte Albán is situated. It also is the same time that the ancient Monte Albán state started conquering the surrounding regions.

Spencer suspects that all bureaucratic states--even modern ones--may be inherently predisposed, or "hard-wired," to engage in predatory expansion as a legacy of the original process of primary state formation.

The PNAS paper compares Spencer's work in Mesoamerica with archaeological data from five other states most anthropologists recognize as the only other locations of true primary state formation in history: Peru, Egypt, Mesopotamia, the Indus Valley and China. Primary states are first-generation states that evolved without contact with other pre-existing states. In each case, Spencer's territorial-expansion theory holds. But he says more research needs to be done at the other locales.

"This result may provide a cautionary lesson as we think about international relations in our contemporary world," said Spencer. "Since the bureaucratic state as a political form originally evolved through a process of predatory expansion, we should not be surprised if states continue to have predatory tendencies, regardless of their particular ideologies."

Spencer said his research results could be seen as reason to support development of international organizations such as the United Nations to serve as a check on the expansionistic tendencies of individual states. "But, the administration of those organizations is also likely to be bureaucratic, so we should be watchful for predatory behavior from them as well," he said.

Vitamin K May Protect Against Developing Non-Hodgkin Lymphoma, Say Mayo Clinic Researchers

WASHINGTON - In the first study of vitamin K and Non-Hodgkin lymphoma risk, researchers at the Mayo Clinic campus in Minnesota have found that people who have higher intakes of vitamin K from their diet have a lower risk of developing Non-Hodgkin lymphoma. Non-Hodgkin Lymphoma is a cancer of the immune system and is the most common hematologic malignancy in the United States.

At the 101st Annual Meeting of the American Association for Cancer Research (AACR), the researchers report that the risk of developing Non-Hodgkin lymphoma was approximately 45 percent lower for participants who had vitamin K intakes in the top quartile of intake in the study (>108 ug/day), compared to participants who had intakes in the bottom quartile (<39 ug/day).

This association remained after accounting for other factors such as age, sex, education, obesity, smoking, alcohol use and intake of foods with high amounts of antioxidants.

Vitamin K is a fat-soluble vitamin and is derived from either plants (phylloquinone or vitamin K1) or bacterial synthesis. This study estimated intake of the plant form of vitamin K from diet and supplement use. The most common sources of vitamin K1 in the diet include leaf lettuce and spinach, with smaller amounts found in other vegetables, vegetable oils and some fruits.

Researchers at the Mayo Comprehensive Cancer Center are studying the connection between diet and Non-Hodgkin lymphoma risk, and they became interested in a potential role for vitamin K.

While vitamin K is best known for its essential function in several proteins involved in blood clotting (the name of the vitamin is derived from the German word "Koagulations"), it also appears to be important in other biological processes, including inhibition of inflammatory cytokines thought to play a role in Non-Hodgkin lymphoma, as well as pathways involved in cell cycle arrest and cell death.

"These results are provocative, since they are the first work we have done on the connection between vitamin K and Non-Hodgkin lymphoma, and this is a fairly strong protective effect," says the study's lead investigator, James Cerhan, M.D., Ph.D., a cancer epidemiologist. "However, as with all new findings, this will need to be replicated in other studies."

The Mayo study enrolled 603 patients who were newly diagnosed with Non-Hodgkin lymphoma as well as 1,007 matched cancer-free "control" participants. Researchers asked the participants to answer a food questionnaire about their usual intake of over 120 food items two years prior to their cancer diagnosis or enrollment into the study (controls). They also asked about use of a variety of supplements. Vitamin K intake was estimated from this data.

While there was a clear trend showing that a greater intake of vitamin K from dietary sources was associated with a lower risk of Non-Hodgkin lymphoma, the use of vitamin K supplements presented a slightly different picture. Increasing intake of vitamin K from supplements did protect against Non-Hodgkin lymphoma, but reached a point where the highest intake offered no reduction in risk.

"The significance of this finding is unclear," notes Dr. Cerhan, "but suggests that taking high doses of supplements is unlikely to be helpful." Dr. Cerhan also notes that people taking certain oral anticoagulants or seizure medications should closely follow their physician's dietary recommendations with respect to vitamin K intake, since vitamin K can interfere with these drugs.

"Whether the protective effect we observed is due to vitamin K intake, or some other dietary or lifestyle exposure, cannot be definitely assessed in this study," notes Dr. Cerhan. "But these findings add to a lot of other data that support a diet that includes plenty of green leafy vegetables in order to prevent many cancers as well as other diseases." *The study was funded by the National Cancer Institute.*

The remarkable effects of fat loss on the immune system

Australian scientists have shown for the first time that even modest weight loss reverses many of the damaging changes often seen in the immune cells of obese people, particularly those with Type 2 diabetes.

The immune system is made up of many different kinds of cells that protect the body from germs, viruses and other invaders. These cells need to co-exist in a certain balance for good health to be maintained. Many factors, including diet and excess body fat, can tip this balance, creating immune cells that can attack, rather than protect, our bodies.

It has been known for some time that excess body fat, particularly abdominal fat, triggers the production of 'pro-inflammatory' immune cells, which circulate in the blood and can damage our bodies. In addition, other inflammatory immune cells, known as macrophages, are also activated within fat tissue.

The recent study looked at obese people with Type 2 diabetes or prediabetes who were limited to a diet of between 1000 and 1600 calories a day for 24 weeks. Gastric banding was performed at 12 weeks to help restrict food intake further. The study determined the effects of weight loss on immune cells

Undertaken by Dr Alex Viardot and Associate Professor Katherine Samaras from Sydney's Garvan Institute of Medical Research, the results showed an 80% reduction of pro-inflammatory T-helper cells, as well as reduced activation of other circulating immune cells (T cells, monocytes and neutrophils) and decreased activation of macrophages in fat. They are published in the prestigious Journal of Clinical Endocrinology Metabolism, now online.

"Excess weight disorders now affect 50% of adult Australians, with obesity being the major cause of Type 2 diabetes and some cancers," said Associate Professor Samaras.

"The situation has reached crisis point, and people must be made aware that excess fat will affect their immune systems and therefore their survival. We have found that a modest weight loss of about 6 kg is enough to bring the pro- inflammatory nature of circulating immune cells back to that found in lean people. These inflammatory cells are involved in promoting coronary artery disease and other illnesses associated with obesity."

"This is the first time it has been shown that modest weight reduction reverses some of the very adverse inflammatory changes we see in obese people with diabetes. We also showed that the activation status of immune cells found in fat predicted how much weight people would lose following a calorie restricted diet and bariatric surgery. Those with more activated immune cells lost less weight."

"It's the first time this has been described and is important because it helps us understand why some people lose weight more easily than others, and that inflammation is involved in regulating the response to bariatric surgery."

The Garvan study reinforces a message we hear regularly – to optimise your health, keep your weight and waist in the healthy range.

Clever crows can use three tools

By Rebecca Morelle Science reporter, BBC News

New Caledonian crows have given scientists yet another display of their tool-using prowess.

Scientists from New Zealand's University of Auckland have found that the birds are able to use three tools in succession to reach some food. The crows, which use tools in the wild, have also shown other problem-solving behaviour, but this find suggests they are more innovative than was thought. The research is published in the Proceedings of the Royal Society B.

The team headed to the South Pacific island of New Caledonia, the home of Corvus moneduloides . They are the only birds known to craft and use tools in the wild. The discovery that they whittle branches into hooks and tear leaves into barbed probes to extract food from hard-to-reach nooks astounded scientists, who had previously thought that ability to fashion tools was unique to primates.

And further research in the laboratory and the field has revealed that New Caledonian crows are also innovative problem solvers, often rivalling primates. Experiments have shown that the birds can craft new tools out of unfamiliar materials, as well as use a number of tools in succession.

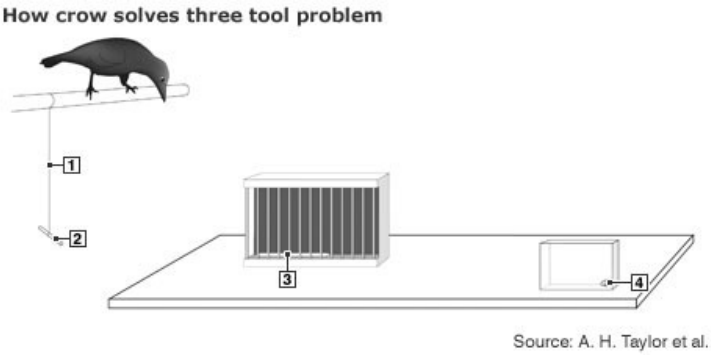
To further understand how the birds perform these tasks, the University of Auckland team set seven wild crows, which had temporarily been captured and placed in an aviary, a complicated problem.

The birds were presented with some out-of reach food; a long tool, which could be used to extract the food, but which was also out of reach, tucked behind the bars of a box; and a short tool, which could be used to extract the long tool, but which was attached to the end of a dangling piece of string tied to the crow's perch.

Professor Russell Gray, from the University of Auckland, explained: "The crows needed to understand they needed the short tool on the piece of string to get the long tool, and then use the long tool to get the food."

The seven birds were split into two groups.

The first group of birds were given the chance to try out every individual step in the set-up, before they were presented with the complete multi-stage task. Professor Gray said: "All these birds had to do was to put together things they could already do in the right sequence." Each of the three birds managed to solve the three-stage problem on their first attempt.



1. String is attached to perch
2. Short stick attached to string
3. Long stick out-of-reach behind bars - can be reached with short stick
4. Out-of-reach scrap of meat - can be reached by long stick

A second group of birds was presented with a less familiar situation. While they had previously been shown tasks where food was directly attached to string, and sticks could be used to grab out of reach food, they had never been given a situation where a tool was linked to the string or where one tool was needed to collect a second tool. However, when presented with the multi-stage task, these birds also managed to reach their treat.

One bird, Sam, spent 110 seconds inspecting the apparatus before completing each of the steps without any mistakes. Another bird, Casper, also completed on his first try, although he was initially puzzled by the string.

The other two birds solved the problem on their third and fourth attempts.

Alex Taylor, the lead author of the paper, said: "Finding that the crows could solve the problem even when they had to innovate two behaviours was incredibly surprising." The researchers say that the experiments are helping to shed light on how the crows are carrying out these complicated tasks.

Dr Taylor said that while using or creating a single tool could be underpinned by simple learning processes, solving a set of linked problems, suggested that the basis for their innovation is much more complex.

New Caledonian crows form part of the corvid family of birds, which also include crows, ravens, rooks, jackdaws, jays and magpies. Over the decades, these birds have been studied for their apparent intelligence.

Scientists have been surprised to find western scrub jays that try to deceive their fellow birds by pretending to bury food while they are being watched, jays which perform remarkable feats of memory, and possibly even self-recognition in magpies.

More recent studies have also found that rooks too are able to create and use tools - even though, unlike New Caledonian crows, they have not been seen to use them in the wild. And these birds have also surprised scientists with their problem-solving abilities - most recently, they have been shown to repeat Aesop's fable, by working out that dropping stones into water will raise its height, giving them access to some floating food.

But it might not just be birds and primates with tool-using skills - in late 2009, a paper published in the journal Current Biology suggested that veined octopuses in Australia were using halved coconut shells as tools, by scooping them from the seabed, galloping off with them and then later using them as a shelter.

However, some researchers debate whether this kind of behaviour fits the definition for tool-use.

Green Tea May Strengthen Your Teeth

Researchers suspect antimicrobial molecules contained within green tea helps preserve teeth (as long as you don't add sugar).

By Jessica Marshall

THE GIST:

**** People aged 40-64 who drank one cup of green tea a day were less likely to lose teeth.***
**** Drinking unsweetened coffee had no effect on keeping teeth.***
**** Antimicrobial molecules called catechins may account for green tea's benefits.***

A cup of green tea a day may keep the dentist away.

That's the finding of new research published in Preventive Medicine. The findings show that drinking at least one cup of green tea a day increases the odds of keeping your teeth as you age.

The researchers suspect that antimicrobial molecules called catechins present in green tea and in lesser amounts in oolong tea provide the benefit. But be careful if you like your tea with sugar: sweetener may negate the effect, the team found. "Green tea may have bacteriocidal effects, which would affect teeth, but only if you drink it without sugar," said Alfredo Morabia, of Columbia University in New York and editor of Preventive Medicine, who wrote an editorial accompanying the new research.

"They also reported that drinking sweet coffee was actually deleterious," he added. "Coffee alone had no problem, but sweet coffee would actually make you lose your teeth."

Yasushi Koyama of the Tohoku University Graduate School of Medicine and colleagues looked at more than 25,000 Japanese men and women between age 40 and 64 in making the determination.

They found that men who drank at least one cup of tea a day were 19 percent less likely to have fewer than 20 teeth (a full set including wisdom teeth is 32) than those who did not drink green tea. Tea-drinking women had 13 percent lower odds.

One possible explanation for the benefits of tea drinking is that warm drinks wash out your mouth. But coffee, which also provides a mouth rinse, had no benefit, suggesting something else is going on.

Catechins have been shown to kill mouth bacteria associated with tooth decay and gum disease, so the researchers suspect this is what gives green tea its dental benefits.

"Previous research has indicated that regular consumption of green tea may lead to a lower instance of periodontal disease, a leading cause of tooth loss in adults," said Samuel Low of the University of Florida College of Dentistry and President of the American Academy of Periodontology in a statement to Discovery News.

Maintaining healthy teeth and gums is part of maintaining a healthy body, Low said. "That is why it is so important to find simple ways to boost periodontal health, such as regularly drinking green tea -- something already known to possess certain health-related benefits."

Scientists sever molecular signals that prolific parasite uses to puppeteer cells

Team liberates cellular hostages by silencing Toxoplasma gondii's back-seat driving

Scientists studying a cunning parasite that has commandeered the cells of almost half the world's human population have begun to zero in on the molecular signals that must be severed to free the organism's cellular hostages.

While Toxoplasma gondii is not as widely known by the public as some of its more notorious parasitic brethren, it has been hijacking the cells of human and animal hosts for eons and is particularly dangerous to those with compromised and/or underdeveloped immune systems.

"We have understood for some time now that Toxoplasma can co-opt the biological processes of its host cell, but there's still a lot we don't know about how this happens and what benefit the parasite derives," said Dr. Amos Orlofsky at Albert Einstein College of Medicine of Yeshiva University, one of the co-authors of a new paper in the Journal of Biological Chemistry that reveals how blocking certain signals within a cell can liberate it from its captor.

Toxoplasma is a crafty single-celled organism that typically begins its life cycle in the warm body of a small mammal, such as a rat. While there, it reprograms the rat's gut instinct to avoid cats and, thus, makes the rat far more likely to get gobbled up. Toxoplasma's ultimate goal is, in fact, to get eaten by a cat, because, once it settles into the feline's gastrointestinal tract, it begins the second stage of its life cycle: laying the next generation of eggs that will be shed in feces and acquired by the next rat.

Seeing as how humans usually aren't eaten by cats, Toxoplasma doesn't seek them out as hosts. But, humans are exposed to the parasite at a fairly high rate, usually while changing cat litter or eating unwashed vegetables or undercooked meat.

"Toxoplasma is a major cause of mortality in AIDS patients worldwide, and it's also a serious problem for transplant recipients and for infants whose mothers became infected during pregnancy. There is also some reason to be concerned about possible neurologic effects in those who are infected but apparently healthy," Orlofsky explained. "Current medications are limited by side effects, and new approaches to dealing with this highly sophisticated and successful microbe are urgently needed."

In collaboration with colleague Louis M. Weiss and then-graduate-student Yubao Wang, who is now a postdoctoral fellow at Harvard University, Orlofsky set out to identify which cellular signals are used by Toxoplasma to capture and rearrange key structures in the host cell. He described those cellular signals as, essentially, the strings used by the parasite-puppeteer to manipulate the behavior of the cell.

They focused on one particular cellular structure known as the centrosome, which serves as the networking hub for fibers that direct traffic within the cell. The centrosome also controls the direction in which the cell moves within the body, but, when infected with Toxoplasma, it doesn't take its normal routes. Orlofsky said this suggests that Toxoplasma disables the steering of the host cell by taking hold of the cell's "rudder."

"We infected cells in a Petri dish with Toxoplasma and then scratched the dish to create a 'wound.' Normally, cells next to the wound sense the new emptiness next to them and respond by trying to fill the wound, and the cell then starts moving in that direction," Orlofsky said. "We discovered that Toxoplasma-infected cells don't do this: Their captured centrosomes fail to move toward the wound, and the entire cell fails to move as well."

When the team "liberated" the centrosome of the infected cell, by inhibiting certain signals, it re-oriented itself toward the wound and was able to move in the proper direction.

"These results give us some insight into what the parasite may be trying to accomplish. That is, it seems to be crippling the ability of host cells to respond to signals that say 'move over here'. That could make all the difference for the body's ability to make a quick immune response, which may depend on infected cells and immune-response cells moving toward each other and interacting."

Orlofsky's team hopes learning more about these signals and how to manipulate them may yield tools for protecting multiple host-cell functions from total parasite takeover. These tools could lead to improved treatments or preventive measures.

"If our speculation is correct about the effects of the parasite on the immune response, then one could envisage a live vaccine based on disabled Toxoplasma that, among their other engineered defects, lack the ability to hold the cell's rudder and so elicit a stronger immune response," Orlofsky said.

The team's research was carried out at the departments of medicine and pathology at Albert Einstein College of Medicine and was funded by the National Institutes of Health. The resulting paper was published on the Journal of Biological Chemistry's Web site March 17 and will appear in a forthcoming print issue.

Lice hang ancient date on first clothes

Genetic analysis puts origin at 190,000 years ago

By Bruce Bower

Buggy duds - ***A genetic analysis of head and body lice suggests that people may have begun making and wearing clothing as early as 190,000 years ago.***
Janice Harney Carr, Center for Disease Control

ALBUQUERQUE - For once lice are nice, at least for scientists investigating the origins of garments.

Using DNA to trace the evolutionary split between head and body lice, researchers conclude that body lice first came on the scene approximately 190,000 years ago. And that shift, the scientists propose, followed soon after people first began wearing clothing.

The new estimate, presented April 16 at the American Association of Physical Anthropologists annual meeting, sheds light on a poorly understood cultural development that allowed people to settle in northern, cold regions, said Andrew Kitchen of Pennsylvania State University in University Park. Armed with little direct evidence, scientists had previously estimated that clothing originated anywhere from around 1 million to 40,000 years ago.

An earlier analysis of mitochondrial DNA from the two modern types of lice indicated that body lice evolved from head lice only about 70,000 years ago. Because body lice thrive in the folds of clothing, they likely appeared not long after clothes were invented, many scientists believe.

Though well suited to gauging the timing of evolutionary events, mitochondrial DNA is a relatively small part of the genome. Kitchen's team examined both mitochondrial and nuclear DNA samples from head and body lice, yielding the much older, and presumably more accurate, estimate of when body lice first evolved.

It makes sense that people, or perhaps Neandertals inhabiting cold parts of Europe, started making clothes around 190,000 years ago, Kitchen explained, since both species had already lost most body hair and knew how to make stone tools for scraping animal hides. Homo sapiens originated approximately 200,000 years ago.

The researchers calculated relatively fast mutation rates for both forms of lice, so the new age estimate for the divergence of body lice from head lice is a conservative one. It's possible for body lice to have evolved from head lice in only a few generations, according to laboratory studies, Kitchen said. No evidence indicates that head lice can evolve from body lice.

An Alcoholic's Savior: God, Belladonna or Both?

By HOWARD MARKEL, M.D.

In October 1909, Dr. Alexander Lambert boldly announced to a New York Times reporter that he had found a surefire cure for alcoholism and drug addiction. Even more astounding, he stated that the treatment required "less than five days." The therapy consisted of an odd mixture of belladonna (deadly nightshade), along with the fluid extracts of xanthoxylum (prickly ash) and hyoscyamus (henbane). "The result is often so dramatic," Lambert said, "that one hesitates to believe it possible."

Dr. Lambert was hardly a quack looking for headlines. He was widely known as Theodore Roosevelt's personal physician, a professor of medicine at Cornell Medical College and an expert on alcoholism. Dr. Lambert had years of experience taking care of thousands of alcoholics at Bellevue Hospital's infamous "drunk ward." In fact, it was on this storied hospital ward where he experimented with the belladonna cure.

He had obtained the recipe from a layman named Charles B. Towns, who, in turn, claimed to have learned about it from a country doctor. In 1901, Mr. Towns opened a substance abuse hospital in New York City at 293

Central Park West, between 89th and 90th Streets. He needed Dr. Lambert because he lacked a medical degree and, hence, professional credibility; Dr. Lambert needed Mr. Towns, because for all his medical knowledge, he had relatively little to offer his patients in terms of an effective treatment.

The Towns Hospital attracted only the wealthiest alcoholics and addicts, who gladly paid exorbitant fees for a treatment that "successfully and completely removes the poison from the system and obliterates all craving for drugs and alcohol." Because of Prohibition and the paradoxical rise in alcoholism in 1920, the Towns Hospital restricted its practice to drying-out well-to-do alcoholics.

Perhaps the most famous patient was William Griffith Wilson, better known as Bill W., the co-founder of Alcoholics Anonymous. In the early 1930s, Mr. Wilson was consuming more than two quarts of rotgut whiskey daily, a definite health risk according to Alexander Lambert, who found in his copious research that consumers of cheap or bootlegged alcohol were far more prone to seizures, delirium tremens and brain damage than those who drank the expensive stuff. Between 1933 and 1934, at his wife's urging and on his wealthy brother-in-law's dime, Mr. Wilson was admitted to Towns four times. The cost upon admission was steep: up to $350 (roughly $5,610 today) for a four- to five-day stay.

Although Mr. Wilson made some progress in temporarily abstaining, he relapsed after each of the first three hospitalizations. It was around this time that he reunited with a drinking buddy named Ebby Thacher. Unlike previous times, when they went out on wild binges, Mr. Thacher told him that he quit booze and was a member of the Oxford Group, a church-based association devoted to living on a higher spiritual plane guided by Christianity. As a demonstration, on Dec. 7, 1934, Mr. Thacher took Mr. Wilson to the Calvary Mission on East 23rd Street and Second Avenue, where the most drunken of New York's Depression-era down-and-outers went to be fed and, it was hoped, "saved."

A few days later, a drunken Wilson staggered back into the Towns Hospital. There, his physician, William D. Silkworth, sedated him with chloral hydrate and paraldehyde, two agents guaranteed to help an agitated drunk to sleep, albeit lightly. This was especially important because the medical staff members had to wake patients every hour for at least two days to take the various pills, cathartics and tinctures of the belladonna regime.

On the second or third day of his treatment, Mr. Wilson had his now famous spiritual awakening. Earlier that evening, Mr. Thacher had visited and tried to persuade Mr. Wilson to turn himself over to the care of a Christian deity who would liberate him from the ravages of alcohol. Hours later, depressed and delirious, Mr. Wilson cried out: "I'll do anything! Anything at all! If there be a God, let him show himself!" He then witnessed a blinding light and felt an ecstatic sense of freedom and peace. When Mr. Wilson told Dr. Silkworth about the event, the physician responded: "Something has happened to you I don't understand. But you had better hang on to it."

Hang on to it he did. Indeed, this experience ultimately led Mr. Wilson to abstain from alcohol for the remaining 36 years of his life and to co-create the novel program whereby one alcoholic helps another through a commitment to absolute honesty and a belief that a higher power can help one achieve sobriety.

Long before Mr. Towns touted his cure for alcoholism, belladonna (as well as henbane) was known to cause hallucinations. The hallucinations brought on by alcoholic delirium tremens tend to be a transmogrification of things the alcoholic is actually seeing or experiencing into a realm of sheer terror. A stray coil of rope may appear to be a poisonous cobra; a pattern on the wallpaper seems to transform into a poisonous spider. But they can also be tactile, like the sensation of insects crawling on the skin. Other hallucinations associated with alcohol withdrawal, or alcoholic hallucinosis, tend to be brief and involve hearing accusatory or threatening voices.

Belladonna hallucinations, on the other hand, are typically based on recent discussions the person had but become far more fantastic. Many times, these visions appear to fulfill the wishes one might have had during the inspiring experience.

Several decades after his 1909 announcement, Alexander Lambert took great pains to distance himself from belladonna. Although Dr. Lambert found the detoxification process to be useful in the short run, he became discouraged by its toxicity, its propensity to induce hallucinations and the fact that many of those he treated at Bellevue relapsed and returned for subsequent treatment. Something more was needed, he declared, and that task fell to Bill Wilson and an alcoholic physician from Ohio named Bob Smith, who created Alcoholics Anonymous in 1935.

Were Bill Wilson's spiritual awakening and influential sobriety the products of a belladonna hallucination shortly after his discussions with his friend Ebby Thacher? Could they have been incited by his alcohol withdrawal symptoms? Or did something else happen to him that science cannot explain? In the end, millions of people who have benefited from Alcoholics Anonymous and similar 12-step programs around the world would say that such pharmacological, physical or spiritual parsing hardly matters.

Study provides new insights into the implications of autism onset patterns

Children with developmental regression at increased risk for more severe autism

Baltimore, MD – Kennedy Krieger Institute announced today new study results showing that when and how autism symptoms appear in the first three years of life has vital implications to a child's developmental, diagnostic, and educational outcomes. Published this month in the Journal of Autism and Developmental Disorders (Epub ahead of print), this study found children with early developmental warning signs may actually be at lower risk for poor outcomes than children with less delayed early development who experience a loss or plateau in skills.

Researchers collected data from 2,720 parents through the Interactive Autism Network (www.ianproject.org), the nation's largest online autism research project. Through custom questionnaires and standardized rating scales, researchers examined differences in early milestone achievement (e.g., first words, walking, phrase speech, etc.), autism symptom severity and diagnosis, and educational supports between children with three different patterns of autism symptom onset:

**** Regression (n=44%): A loss of previously acquired social, communication or cognitive skills prior to 36 months***

**** Plateau (n=17%): Display of only mild developmental delays until the child experiences a gradual to abrupt developmental halt that restricts further advancement of skills***

**** No Loss and No Plateau (n=39%): Display of early warning signs of autism spectrum disorders without loss or plateau***

Results from the study, currently the largest to have examined regression in autism spectrum disorders, provides strong evidence for poorer developmental outcomes in children who experienced regression, a controversial topic among autism researchers. More specifically, children with regression had a significant increase in severity of autism symptoms, the greatest risk for not attaining conversational speech, and were more likely than any other group to require increased educational supports. These findings were markedly worse for the children whose parents reported the regression as severe.

This study was also one of the first to examine the implications of developmental plateau, which tended to occur around the child's second birthday. When compared to children with No Loss and No Plateau, these children were more likely to need educational supports and receive an autistic disorder diagnosis, which is typically more severe than other diagnoses on the autism spectrum (i.e., Asperger's syndrome or Pervasive Developmental Disorder – Not Otherwise Specified). Children with No Loss and No Plateau were at the least risk for poor outcomes.

"Children who plateau or regress have a later manifestation of autism, but when it manifests it devastates their development," said Dr. Paul Law, corresponding study author and Director of the Interactive Autism Network at Kennedy Krieger. "Children with developmental plateau are an especially under-researched group, and these findings have important implications for those designing and prioritizing clinical evaluations."

Previous studies have reached a variety of different conclusions concerning outcomes for children with regression. Some research has found these children fared worse in the long-term, while other studies found no differences in outcome between these children and those without regression. In examining these discrepancies, the current study suggests researchers who require children to have near typical development prior to regression may be missing the most severely impaired children in their findings. In fact, 35 percent of parents in this study had concerns about their child's general development before they noticed the more obvious signs of skill loss.

"Parents have good instincts when it comes to their children," said Dr. Rebecca Landa, co-author and director of Kennedy Krieger's Center for Autism and Related Disorders. "If they're concerned, they shouldn't wait to see a professional for immediate in-depth screening and developmental surveillance. We know from other research that the sooner you can diagnose autism and start intervention, the better the child's outcomes."

In addition to Landa and Law, authors of this paper are Luther Kalb and J. Kiely Law, both of Kennedy Krieger Institute. Lead author, Luther Kalb, will present these findings in May 2010 at the International Meeting for Autism Research in Philadelphia, PA. This research study was supported by grants from Autism Speaks.

Contraband could hide in plain sight, Duke research shows

DURHAM, N.C. -- As airport security employees scan luggage for a large variety of banned items, they may miss a deadly box cutter if they find a water bottle first.

According to new research at Duke University, identifying an easy-to-spot prohibited item such as a water bottle may hinder the discovery of other, harder-to-spot items in the same scan.

Missing items in a complex visual search is not a new idea: in the medical field, it has been known since the 1960s that radiologists tend to miss a second abnormality on an X-ray if they've found one already. The concept -- dubbed "satisfaction of search" -- is that radiologists would find the first target, think they were finished, and move on to the next patient's X-ray.

Does the principle apply to non-medical areas? That's what Stephen Mitroff, an assistant professor of psychology & neuroscience at Duke, and his colleagues set out to examine shortly after 2006, when the U.S. Transportation Security Administration banned liquids and gels from all flights, drastically changing airport luggage screens. "The liquids rule has introduced a whole lot of easy-to-spot targets," Mitroff said.

In the new study, published online in the Journal of Experimental Psychology: Applied, Mitroff and his group asked college students to identify specific targets on a computer display – in this case, two perpendicular lines that form the letter "T" amid distracters, such as Ls and non-Ts. In some cases, Ts were easy to spot, and in other cases more difficult because they blended in with the background.

In an initial set of experiments, Mitroff and his colleagues altered the frequency of easy- and hard-to-spot targets. When the two kinds of targets appeared with equal frequency, subjects apparently had no trouble finding the hard-to-spot target in the presence of an easy one. But when the easy-to-spot item was two or three times more common, the subjects tended to overlook the hard-to-spot targets.

When Mitroff's group doubled the time allowed for each search, they saw that the students used barely a second of extra time but were significantly more accurate.

"It didn't seem to do with time itself, but it seems to be the time pressure," Mitroff said. "When you have the impending time pressure of going quickly, you are more likely to miss a second target."

Intriguingly, the data do not suggest subjects miss the second targets because they are too quick to end their search, an idea that would have bolstered the original satisfaction-of-search principle. "There seems to be some other mechanism, but it's not exactly clear what it is," Mitroff said.

One possible explanation is an idea called "attentional set," which suggests that finding one kind of target will make you more likely to find that same type of target rather than a new, different one. In radiology, it is like finding a fracture, which makes you more likely to find a second fracture rather than some other anomaly. In an additional set of experiments, the researchers added time and accuracy pressure to the test by introducing small baggage icons that appeared along the top of the screen, mimicking a new bag on the security conveyer belt. One bag disappeared when subjects finished searching each display. They earned points for each display and the more quickly and accurately the subjects could identify the targets, the higher the points they received.

For one group of subjects, researchers set the speed of bags based on the each person's performance in a previous practice session. That group wasn't any worse at finding the second target than the first. In contrast, subjects following a brisk rate set by the researchers were worse at finding the second target.

"The results fit with what we think would happen if you remove the searcher from seeing the line," Mitroff said. In a remote search, the screeners will not know whether there is one person or 500 people waiting. "It's not in use, but these data suggest that it might be something worth trying."

Mitroff's group next has plans to replace T-targets with multiple targets of different types, such as tools and bottles.

***Citation**: Generalized "satisfaction of search": Adverse influences on dual-target search accuracy. Fleck, Mathias S.; Samei, Ehsan; Mitroff, Stephen R. Journal of Experimental Psychology: Applied. Vol 16(1), Mar 2010, 60-71. doi: 10.1037/a0018629*

Early humans may have bred with other species – twice

Ewen Callaway, reporter

Human evolution is looking more tangled than ever. A new genetic study of nearly two thousand people from around the world suggests that some of our ancestors bred with other species of humans, such as Neanderthals, at least twice.

"The researchers suggest the interbreeding happened about 60,000 years ago in the eastern Mediterranean and, more recently, about 45,000 years ago in eastern Asia," Nature News reports from the annual meeting of the American Society of Physical Anthropologists in Albuquerque, New Mexico. That conclusion is based on a study of over 600 genetic markers, called microsatellites, sequenced in nearly 100 different populations.

As humans began fanning out from Africa, between 50 and 100,000 years ago, these markers changed, allowing researchers to determine the relationship between different populations and to estimate when they split from one another. If humans bred only with other humans, all these markers would create a neat phylogenetic tree, showing that human genetic diversity can be traced to a single population that existed in Africa in the last 100,000 years.

Instead, a team led by Jeffrey Long, at the University of New Mexico, found evidence that some of the markers looked far too old to have come from humans. Inbreeding with other ancient species is the likeliest explanation. "It means Neanderthals didn't completely disappear," he told Nature.

True, Neanderthals are the likeliest contenders for our ancestors' sexual partners, but they aren't the only ones.

Last month, a team at the Max Planck Institute for Evolutionary Anthropology in Leipzig Germany recovered hominin DNA in Mongolia from a 30-50,000-year-old finger bone that appears to be neither

Neanderthal nor human. Its ancestors, or another yet-to-be-discovered kind of archaic hominin, could have bred with humans.
Previous studies of small parts of the Neanderthal genome have found no evidence for interbreeding.

But with a complete Neanderthal genome due to be published any day now, and more DNA from the newly-discovered hominin in the works, scientists will have the best chance yet to determine whether our species shared a bed with any others.

Vitiligo 'cancer protection hope'

People with the skin disease vitiligo may have natural protection against skin cancer, a study suggests.

One in 200 people have vitiligo

The condition, affecting one in 200, causes pale skin patches that lack pigment and burn easily - leading to an assumed increased risk of skin cancer. But the University of London study of 4,300 people identified a common gene mutation that both increases the chance of vitiligo and cuts cancer risk. The findings are reported in the New England Journal of Medicine.
However, study author Professor Dot Bennett, from St George's, University of London, still warned: "Although this may provide some consolation for people with vitiligo, they should still be careful in the sun. As they know, they sunburn quickly, and a lower risk of cancer doesn't mean zero."

The findings, reported in the New England Journal of Medicine, emerged from genetic testing of 1,514 patients with vitiligo and 2,813 without. Seven genes in total were identified that were linked to vitiligo.

Some 70% of the general population had the combination that increases the risk of vitiligo while reducing the risk of malignant melanoma, the most serious form of skin cancer.

The remaining 30% had a different version that raises melanoma risk while lessening the chances of vitiligo.

Although everyone has one of the two variants, neither guarantees that either vitiligo or melanoma will actually develop. Likewise, neither guarantees protection, the study added.

The genes identified were already associated with auto-immune conditions such as type 1 diabetes, rheumatoid arthritis and lupus. This prompted suggestions the research may even lead to improvements in treatment for vitiligo.

There is currently no cure although the condition can be managed through steroid creams and treatment with ultraviolet light. But the study said future therapy may involve some element of "calming down immune response".

Bacterial mat the size of Greece found on Pacific floor

* 21 April 2010 **by Fred Pearce**

JUST off the coast of the world's driest desert, the lifeless Atacama in northern Chile, lies one of the largest and densest masses of life anywhere on Earth. The vast tangled mat of white "hair", which has an area of 128,000 square kilometres, roughly the size of Greece, was recently mapped as part of the first comprehensive Census of Marine Life.

The ghostly submarine prairie is made of wispy strings of giant bacteria, says Victor Gallardo, a marine biologist at Chile's University of Concepción. The bug thrives in water almost devoid of oxygen by extracting energy from hydrogen sulphide in sediments on the seabed, and feeds on nutrients dispersed by fish in the waters of the cold, fertile Humboldt current above.

Gallardo says the wispy bacteria resemble fossilised bacterial mats dating back 2.5 billion years. In total, he and his colleagues estimate that the mat contains hundreds of millions of tonnes of bacteria, and that the whole system regenerates every 10 weeks. Individual bacteria can reach 7 centimetres long.
The wispy bacteria resemble fossilised bacterial mats dating back 2.5 billion years

The decade-long census, whose aim is to catalogue all ocean life, is rapidly changing our ideas about how many species there are on Earth and where they are to be found. The Amazon rainforest has long been thought to contain the greatest biodiversity on the planet. In fact, the winner is more likely to be the "coral triangle", the region of coral reefs off south-east Asia, according to Ann Bucklin of the University of Connecticut - Avery Point.

Another, entirely unexpected hotspot is the deep ocean below 1000 metres. This huge ocean wilderness may be low in biomass volume, says Bucklin, but it is fabulously diverse.

Bacteria and other microbes may make up as much as 90 per cent of the oceans' biomass, and there could be up to a billion species on Earth, says John Baross of the University of Washington, Seattle, more than 10 times as many as previously suspected.

Self-starter: Life got going all on its own

* 21 April 2010 by **Catherine Brahic**

IN THE beginning there were Ida and Luca. The initial Darwinian ancestor - Ida - and the last universal common ancestor - Luca - assembled themselves from the spare parts sloshing around on the early Earth. Once all the ingredients were in place, it looks like life was all but inevitable.

The finding comes from recent discoveries about the behaviour of chemicals thought to have been present on the primordial Earth, relating to two key stages in the evolution of life. Ida was the first molecule that was able to self-replicate. Once it was around, busy making copies of itself, it somehow evolved the ability to store information in the form of the genetic code. That led to the life form from which we all descended: Luca.

Luca probably popped up about 4 billion years ago - some 500 million years after a spinning galactic cloud coalesced into planet Earth and a few hundred million years before complex life evolved and began to leave fossil traces. We can deduce Luca must have existed because all life forms that we know of - from bacteria and viruses to T. rex, bananas and humans - share the same genetic code, with a few small exceptions.

Luca is thought to have been based on RNA, the close cousin to DNA, because strands of RNA can act as enzymes. This means metabolism could operate before proteins evolved to take over.

The genetic code consists of triplets of genetic building blocks, or nucleotides, with each triplet coding for a particular amino acid or acting as an on/off switch for amino acid production. Amino acids are the building blocks of proteins and hence of organic life forms.

According to Michael Yarus of the University of Colorado at Boulder, Luca evolved the code as a result of natural chemical affinities between nucleotides and amino acids. Chemical bonding, he says, means that different amino acids naturally like to sit next to some triplets and not others.

In other words, the genetic code is the inevitable consequence of affinities between the molecular building blocks of RNA and those of the proteins they code for. If he's right, it will explain why individual triplets always code for the same amino acids, whether in a virus or a human.

Natural attraction

Yarus works with artificial RNA and has shown that these chemical affinities do exist. Mix strands of RNA with amino acids and the amino acids will more or less spontaneously nestle up to their corresponding triplets. "Yarus found that anticodons [a type of triplet found in some RNAs] were particularly good in this regard and bind the 'correct' amino acid with up to a millionfold greater affinity than other amino acids," says Nick Lane of University College London.

Now David Johnson and Lei Wang of the Salk Institute for Biological Sciences in La Jolla, California, have shown for the first time that these natural affinities occur in real organisms.

Johnson and Wang decided to look for evidence in ribosomes - key components of the cellular machinery that assemble proteins from amino acids. Ribosomes are made of a tangle of RNA and amino acid chains, so if there was natural attraction going on, it should be found there, they reasoned.

Sure enough, when the pair looked at where amino acids sat in the ribosome, they found that 11 of 20 standard amino acids were far more likely than not to be positioned next to the "right" triplet according to the genetic code (Proceedings of the National Academy of Sciences, DOI: 10.1073/pnas.1000704107).

"Not only is there a chemical reason for these affinities between amino acids and their triplets but you can see them in a natural, biological system," says Yarus. What's more, he adds, the ribosome is an evolutionarily ancient structure, supporting the idea that these affinities go way back. All this, he says, backs his theory that relatively simple chemical interactions allowed Luca to evolve the universal genetic code.

It also allows him to speculate about Ida. While the genetic code is central to life as we know it, there is no reason to think that other self-replicating life forms have to use it. However, since Ida gave rise to the RNA-based Luca, it is logical to assume Ida was also made of RNA or something very similar. But that creates a problem: how did RNA - made from a long chain of nucleotides - assemble itself?

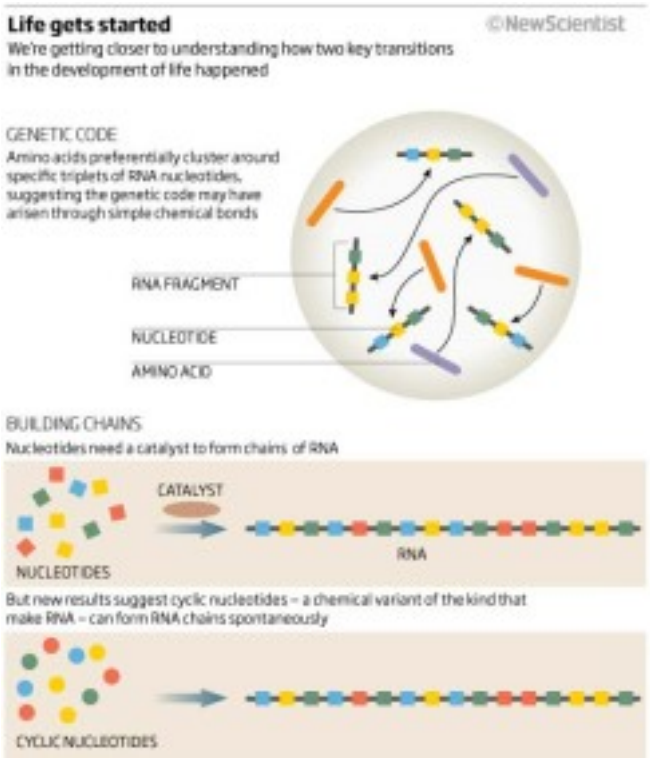
Nucleotides don't tend to form chains without catalysts to help them. In living cells, those catalysts are always proteins, yet the first proteins were made by Luca; they did not exist in the time of Ida. Something is needed that is like RNA but simple enough to replicate itself without a catalyst.

Yarus says that the answer lies in small-molecule enzymes called cofactors that help RNA and DNA do their jobs. "They're absolutely universal in biology today and therefore very old," he says. Because they are made of nucleotides, the cofactors could have started RNA chains (Cold Spring Harbor Perspectives in Biology, DOI: 10.1101/cshperspect.a003590).

The catalyst that allowed the first RNA chains to form is a missing link in the evolution of early life, says Lane. "There is kind of an assumption that it was there somehow, but no one has ever found it." While Lane

agrees that cofactors might have been involved in the early stages of life, he thinks there could be an even simpler way to explain how the first chains of RNA appeared.

That comes from a team led by Ernesto Di Mauro at Sapienza University of Rome, Italy. In their experiments, they have shown that cyclic nucleotides, which are a chemical variation of the nucleotides that make up RNA (see diagram), will spontaneously link to each other and form viable RNA chains (The Journal of Biological Chemistry, DOI: 10.1074/jbc.M109.041905).



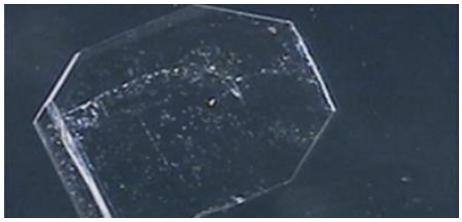
This suggests that if there were cyclic nucleotides in the primordial soup, there was no need for a catalyst, says Lane. Given the right ingredients, the first self-replicating life forms would have essentially booted themselves up. "Cyclic nucleotides are just as likely to occur in these primordial environments as any other nucleotides," he says.

For Lane, these reactions in all probability happened around the piping hot black smokers of the oceanic abyss, where the Earth's crust is wrenched apart by immense geological forces. "In environments like hydrothermal vents it is likely, but as yet experimentally unproven, that a range of amino acids and nucleotides would be formed by the laws of chemistry," he says. Local currents, he adds, would probably draw the molecules together, making it more likely that self-replicating chains of RNA could form and associate with amino acids.

Once that happened, the emergence of life was all but inevitable. "The Darwinian game was fully on," says Yarus.

'Ancestral Eve' crystal may explain origin of life's left-handedness

Scientists are reporting discovery of what may be the "ancestral Eve" crystal that billions of years ago gave life on Earth its curious and exclusive preference for so-called left-handed amino acids. Those building blocks of proteins come in two forms - left- and right-handed - that mirror each other like a pair of hands. Their study, which may help resolve one of the most perplexing mysteries about the origin of life, is in ACS' Crystal Growth & Design, a bi-monthly journal.



Tu Lee and Yu Kun Lin point out that conditions on the primordial Earth held an equal chance of forming the same amounts of left-handed and right-handed amino acids. Nevertheless, when the first forms of life emerged more than 3 billion years ago, all the amino acids in the proteins had the left-handed configuration. That pattern continued right up to modern plants and animals.

Molecules of aspartic acid with a left-handed orientation, shown in crystal form, could be the "ancestral Eve" of all amino acids -- the building blocks of proteins -- in life on Earth. **American Chemical Society**

The scientists used mixtures of both left- and right-handed aspartic acid (an amino acid) in laboratory experiments to see how temperature and other conditions affected formation of crystals of the material. They found that under conditions that could have existed on primitive Earth, left-handed aspartic acid crystals could have formed easily and on a large scale. "The aspartic acid crystal would then truly become a single mother crystal: an ancestral Eve for the whole left-handed population," the article notes.

"The Origin of Life and the Crystallization of Aspartic Acid in Water"

Fish oil supplements provide no benefit to brain power

The largest ever trial of fish oil supplements has found no evidence that they offer benefits for cognitive function in older people. The OPAL study investigated the effects of taking omega-3 long-chain polyunsaturated fatty acid supplements over a two year period on the cognitive function of participants aged 70-80 years.

The number of people with cognitive impairment is rising and it is estimated that by 2040, more than 81 million people globally will have dementia. Some studies have suggested that high intakes of omega-3 fatty acids, most commonly found in oily fish, are important for the maintenance of good cognitive health in later life.

The OPAL (Older People And omega-3 Long-chain polyunsaturated fatty acids) study, published today in the American Journal of Clinical Nutrition, was a randomised controlled trial led by Alan Dangour, Senior Lecturer at the London School of Hygiene & Tropical Medicine and colleagues.

The study enrolled 867 participants aged 70-80 years from General Practice clinics in England and Wales. Trial participants who all had good cognitive health at the start of the study were randomly assigned into two groups, one of which received fish oil capsules while the other group received a placebo for two years. Cognitive function was assessed at the start and end of the study by trained research nurses using a series of paper and pencil tests of memory and concentration.

After two years, those participants receiving fish oil capsules had significantly higher levels of omega-3 fatty acids in their blood than those participants receiving placebo capsules. However, cognitive function did not change over the course of the study in either group of participants and there was no evidence that the consumption of omega-3 fatty acids had a benefit for cognitive function in older people.

Dr. Alan Dangour urges caution in interpreting these results: "From the data we have collected in the OPAL study there is no evidence of an important benefit for memory or concentration of increased omega-3 fatty acid consumption over a two year period among older people with good cognitive health. However, it is important to keep in mind that poor cognitive function can take many years to develop and although this is the longest trial of its kind ever conducted, it may be that it was not long enough for any true beneficial effects to be detected among this healthy cohort of older people".

Miscarriage blamed on non-fussy uterus

* 21 April 2010 **by Linda Geddes**

FAR from being a passive container, the human uterus seems to be highly selective about which embryos it accepts. Women with less "fussy" uteruses may be at higher risk of miscarriage.

Miscarriage is the most common complication of pregnancy, with around 1 in 3 embryos lost before 6 weeks of pregnancy and a further 10 per cent before 12 weeks. For years, faulty embryos or problems such as abnormal clotting or immune responses have been blamed.

Jan Brosens at Imperial College London wondered if another process was at work. He had noted that many women who had repeated miscarriages claimed to have conceived incredibly quickly. "Each one of their pregnancies was conceived within one or two months of trying," he says. What's more, some studies have hinted that embryos implanting outside the normal window of uterine receptivity were more likely to miscarry.

To investigate further, he and his colleagues took cells from the uteruses of women who had undergone miscarriages and ones who hadn't. They measured the expression of a key regulator of uterine receptivity called PROK1 and levels of prolactin, a marker of decidualisation - the monthly process by which the uterus prepares to receive an embryo. Decidualisation involves a thickening of the uterine wall and the growth of new blood vessels.

Expression of PROK1 was higher in the women who had miscarried than in those who hadn't and this was maintained for longer, suggesting that their implantation window lasts longer. These women also produced far less prolactin, a sign that their cells don't decidualise properly.

Further studies indicated that this impaired decidualisation interfered with the signalling between the embryo and the uterus at the time of implantation. The researchers conclude that these uteruses are less picky, allowing abnormal embryos to implant, which later spontaneously abort (PLoS One, DOI: 10.1371/journal.pone.0010287).

Abnormal decidualisation may also interfere with placental formation - another reason such women are more likely to miscarry, says Brosens.

These are exciting findings says Anne Croy, a pregnancy researcher at Queen's University in Toronto, Canada. "We have invested huge effort in assessing the quality of the embryo. This [study] strongly suggests that we must be aware of the endometrial environment as well."

A test might be developed to predict whether a woman is at high risk of miscarriage before she tries for a baby. With a better understanding of decidualisation, drugs might be developed to reduce miscarriage.

A gassy mystery: Researchers discover surprising exoplanetary atmosphere

A Neptune-sized exoplanet orbiting a small star about 33 light years away could be a key stepping stone on the path to making sense of an Earth twin

A Neptune-sized exoplanet orbiting a small star about 33 light years away could be a key stepping stone on the path to making sense of an Earth twin. The finding is the latest advance in the quest to measure Earth-like planets that could possibly host signs of life, which researchers expect to find in the next few years.

"GJ 436b is the smallest exoplanet whose direct light we've been able to measure," said Kevin Stevenson, the University of Central Florida's first planetary sciences doctoral student and lead author of the study, which will be published Thursday, April 22, in Nature.

The results are surprising. Neptune-sized planets as hot as 800 Kelvin -- about 1,000 degrees Fahrenheit -- should contain high levels of methane and very little carbon monoxide, according to standard chemistry.

Instead, the researchers found 7,000 times less methane than expected and plenty of carbon monoxide, which suggests that scientists should be more flexible in their theories about the atmospheres of similar planets.

"This is unexpected," said UCF Physics Professor Joseph Harrington. "It's like dipping bread into beaten eggs, frying it and getting oatmeal." Stevenson and Harrington worked alongside colleagues from UCF, the Massachusetts Institute of Technology, Columbia University and NASA.

Using NASA's Spitzer Space Telescope, the UCF team measured the dimming of light as GJ 436b passed behind its star and re-emerged. The difference in the two light levels -- measured six times at different infrared wavelengths -- represents the light emitted by the planet itself.

The resulting data were used to figure out what molecules make up the planet's atmosphere. To do this, MIT Planetary Sciences Professor Sara Seager and postdoctoral researcher Nikku Madhusudhan simulated millions of chemical mixes under the planet's conditions to find the ones that best matched the UCF data.

The unexpected result puts GJ 436b in good company. "If you were looking at Earth from afar, you would be surprised to see oxygen gas in its atmosphere," Harrington said. "Oxygen reacts with surface materials and other gases, so you need something that continually produces it." That something is Earth's abundant plant life. Oxygen is a "biosignature," or an indicator of life, Harrington says.

Using similar techniques to that of the UCF study, astronomers will seek oxygen and other biosignatures on habitable worlds that they soon expect to discover.

"We'll keep pushing the frontier, and this is just one more step in that direction," Stevenson said.

To learn better, take a nap (and don't forget to dream)

Researchers reporting online on April 22nd in Current Biology, a Cell Press publication, offer more evidence that successful study habits should include plenty of napping. They found that people who take a nap and dream about a task they've just learned perform it better upon waking than either those who don't sleep at all or those who sleep but don't report any associated dreams.

The learners in the study were asked to sit in front of a computer screen and learn the layout of a three-dimensional maze so that they could find their way to a landmark (a tree) when they were plopped down at a random location within the virtual space five hours later. Those who were allowed to take a nap and also remembered dreaming of the task found the tree in less time.

"We at first thought that dreaming must reflect the memory process that's improving performance," said Robert Stickgold of Harvard Medical School. "But when you look at the content of the dreams, it was hard to argue that." In a couple of cases, the dreamers said they recalled just the music from the computer maze. One subject said they were dreaming that there were people at particular checkpoints in the maze, even though the real maze didn't have any people or checkpoints. Another said they dreamt about an experience they'd had tromping through bat caves and thinking that the caves were like mazes.

"We think that the dreams are a marker that the brain is working on the same problem at many levels," Stickgold said. "The dreams might reflect the brain's attempt to find associations for the memories that could make them more useful in the future." In other words, it's not that the dreams led to better memory, but rather that they are a sign that other, unconscious parts of the brain were working hard to remember how to get through the virtual maze. The dreams are essentially a side effect of that memory process.

Stickgold said that there may still be ways to take advantage of this phenomenon for improving learning and memory. For instance, it may be better to study hard right before you go to sleep than in the afternoon, or to take a nap after a period of intense afternoon study. More generally, people might take notice of the study habits or mental processes while awake that lead them to dream about something they need to remember. Perhaps other more directed ways to guide dreams could even prove useful to make your brain work on what you want it to at night.

But, Stickgold said, the most exciting thing to him is the notion that this line of evidence might elucidate a deeper question that has seemed almost impossible to tackle: Why do we dream? What is its function?

"Some have viewed dreaming as entertainment, but this study suggests it is a by-product of memory processing," he said. Whether you have to remember your dreams to get the benefits isn't yet entirely clear, but Stickgold suspects not. After all, he said, people generally remember only a small fraction, no more than 10 to 15 percent, of their dreams.

The researchers hope to follow up their study by manipulating the learning environment in ways that boost incorporation into dreams. They also plan to study the same phenomenon following a full night of sleep as opposed to a nap.

New strain of virulent airborne fungi, unique to Oregon, is set to spread

DURHAM, N.C. – A newly discovered strain of an airborne fungus has caused several deaths in Oregon and seems poised to move into California and other adjacent areas, according to scientists at Duke University Medical Center.

"This novel fungus is worrisome because it appears to be a threat to otherwise healthy people," said Edmond Byrnes III, a graduate student in the Duke Department of Molecular Genetics and Microbiology. "Typically, we see this fungal disease associated with transplant recipients and HIV-infected patients, but that is not what we are seeing." Byrnes and other Duke co-authors work in the laboratory of senior author Joseph Heitman, M.D., Ph.D., and chair of the Department of Molecular Genetics and Microbiology.

Their new work on the emergence and virulence of the new genotypes of Cryptococcus gattii fungi in the United States was published online in PLoS Pathogens on April 22.

The mortality rate for recent C. gattii cases in the Pacific Northwest is running at approximately 25 percent out of 21 cases analyzed in the United States, compared to a mortality rate of 8.7 percent out of 218 cases in British Columbia, Canada, the researchers said. Most have a more complicated clinical course than people infected with the more common Cryptococcus neoformans.

Because the strain is so virulent when it infects some humans and animals, the researchers are calling for greater awareness and vigilance. Testing involves culturing the fungus and then sequencing its DNA to learn whether it is the virulent or more benign strain, which could affect treatment plans.

Some strains of C. gattii are not more virulent than C. neoformans, for example, but doctors need to know what type they are dealing with, Byrnes said. Using molecular techniques, the geneticists uncovered clues that showed the Oregon-only fungal type most likely arose recently, in addition to an outbreak of C. gattii that began in Canada in 1999 that has now spread into Washington and Oregon.

Symptoms can appear two to several months after exposure, and may include a cough lasting weeks, sharp chest pain, shortness of breath, headache (related to meningitis), fever, nighttime sweats and weight loss. In animals the symptoms are a runny nose, breathing problems, nervous system problems and raised bumps under the skin. While C. gattii can be treated, it cannot be prevented; there is no vaccine.

The new type of Cryptococcus gattii reproduces both sexually and asexually. The more virulent strain may have genetically recombined with related but less harmful strains. This novel genotype is highly virulent compared with similar isolates of Cryptococcus that are not causing disease outbreaks.

The researchers found that the novel genotype (VGIIc) is now a major source of Cryptococcus gattii illness in Oregon. Because C. gattii types had been found in tropical areas before, co-lead author Wenjun Li, M.D., Ph.D., of Duke Molecular Genetics and Microbiology, speculates that environmental changes may be responsible for the evolution and emergence of this pathogen. Determining the exact origin of the VGIIc type is difficult, and sampling thus far has failed to turn up isolates in Oregon soil, water or trees.

"We are trying to put together the evolutionary story of where these types come from by closely studying the genetics of all samples possible," said Yonathan Lewit, a research associate also in Duke Molecular Genetics and Microbiology. He said that cell components called mitochondria may play a role in the increased virulence of certain types.

VGIIc, the new Oregon strain, has yielded dozens of isolates in many specimens, including from domesticated animals: cats, dogs, an alpaca and a sheep. "Most of those are nonmigratory animals," Byrnes said, explaining that the animals probably didn't bring the pathogen from some other region, and most likely acquired it locally.

Other authors include Hansong Ma, Kerstin Voelz and Robin May of the Department of Molecular Pathobiology at the University of Birmingham, United Kingdom; Ping Ren and Vishnu Chaturvedi of the Mycology Laboratory at Wadsworth Center in Albany, N.Y.; Dee Carter of the Department of Molecular and Microbial Biosciences, the University of Sydney, Australia; and Robert Bildfell of the Department of Biomedical Sciences, Oregon State University, Corvallis.

This work was supported by National Institutes of Health/National Institute of Allergy and Infectious Diseases grants.

Revealed: Pfizer's payments to censured doctors

* 16:18 22 April 2010 **by Peter Aldhous and Jim Giles**

They are billed as "healthcare professionals who spend years building expertise in their fields". Using materials firmly grounded in science, they educate their peers in the risks and benefits of drugs.

This is how Pfizer, the pharmaceuticals giant, describes the experts it hires to lead educational forums in which doctors are lectured on the use of its products.

Yet New Scientist has found that some of Pfizer's experts have been disciplined for deficiencies in patient care, while others have been reprimanded for how they conducted drug research trials.

The findings add to a growing controversy surrounding the pharmaceutical industry's efforts to market drugs by influencing patterns of prescribing.

Unknown influence

Doctors paid to educate peers are a particular worry, argues Sidney Wolfe of consumer advocacy group Public Citizen in Washington DC. "They are doing things that may be influencing your doctor and you have no way of knowing about it," he says. "It's made worse by the fact that some of them have been disciplined."

Many drug companies sponsor educational events for doctors. They range from informal evenings with a slide presentation to workshops at multiple venues dedicated to the use of a particular drug. The talks may include research results, advice on identifying patients suitable for treatment and guidance on doses that should be prescribed.

New Scientist matched doctors licensed to practice in the four most populous US states – California, Texas, New York and Florida – against Pfizer's records of payments to doctors and medical researchers in the second half of 2009. These were published on 31 March as a condition of Pfizer's record $2.3-billion settlement with the US government over charges of illegal drug marketing.

Warning signs

Our search revealed 26 doctors paid to lecture on the company's drugs whose records include disciplinary actions related to problems with patient care or drug prescribing. We also cross-referenced Pfizer's expert lecturers against US Food and Drug Administration (FDA) records and found another four who have received warning letters over problems with how they conducted drug research.

The censured doctors we found are a small minority of the doctors paid by Pfizer to speak at educational forums – within the four largest states, about 1 in 50 of Pfizer's experts had disciplinary records for problems with patient care or drug prescribing.

However, campaigners for patients' rights say that the number could be close to zero if drug companies screened experts using medical-license verification websites provided by most US states. Only a small proportion of doctors are disciplined by state medical boards for problems involving patient care.

Thought-leaders

Elizabeth Woeckner, president of Citizens for Responsible Care and Research, based in Philadelphia, Pennsylvania, believes doctors with disciplinary records should not be educating their peers. "If it's Pfizer's position that these are respected thought-leaders, they should have clean records," she says.

Some of the 26 doctors were under probation from their state medical boards as they lectured about the company's products. They include Joseph Altieri, a psychiatrist in Vero Beach, Florida, who was paid $1000 to speak about the anti-psychotic drug Geodon. In 2008, Altieri was fined $30,000 and ordered to take courses in prescribing controlled drugs and medical ethics, for problems that included prescribing methadone to a patient who had admitted using another narcotic bought on the street.

Psychiatrist Mark Kosins of San Clemente, California, was paid $2500 to lecture on Geodon while on probation. His disciplinary action concerned a patient who was taken into intensive care after Kosins prescribed a combination of drugs that the medical board said "significantly increased" the chance of an adverse drug reaction.

Other Pfizer experts ran into trouble during their research. Among them is Thomas Gazda of Scottsdale, Arizona, who was paid to lecture about Geodon after being reprimanded by the FDA over irregularities in his conduct of a trial of the same drug's use in children and adolescents with bipolar disorder – one of whom was given more than the maximum allowable dose for five days. The FDA had earlier told Pfizer to exclude Gazda's data from the results submitted by Pfizer during its efforts to win approval to use the drug for this purpose.

Doctors' defence

These three Pfizer speakers deny that their records make them unsuitable to educate other doctors. "One learns from mistakes," says Gazda, who adds that he has extensive clinical experience outside of research trials.

Altieri and Kosins both argue that their disciplinary actions have no bearing on their lectures for Pfizer, because they concerned the prescription of drugs other than Geodon.

Pfizer is not alone in hiring doctors who have been disciplined over problems with patient care. Other drug companies have released doctor-payment records, but mostly in formats that are hard to search systematically against other records. Of the 26 we found speaking on Pfizer's behalf, four were also paid to speak for GlaxoSmithKline in 2009.

Return on investment

The influence of pharmaceutical industry educational events is unclear, says Joel Lexchin of York University in Toronto, Canada, who studies doctors' prescribing habits. "But given the amount of money spent on this, it's clear that they must be getting a return on their investment." Pfizer's records indicate that the company paid more than $9.6 million to its lecturers in the US in the second half of 2009.

Pfizer says that it already excludes those who are debarred from US government healthcare schemes.

"We are continually refining our review process to ensure we are selecting the most appropriate healthcare providers to partner with to educate the medical community," says company spokeswoman Kristen Neese.

Additional reporting by Brad Stenger

Whale poop is vital to ocean's carbon cycle

* 16:37 22 April 2010 **by Wendy Zukerman**

Saving endangered baleen whales could boost the carbon storage capacity of the Southern Ocean, suggests a new study of whale faeces. Whale faeces once provided huge quantities of iron to a now anaemic Southern Ocean, boosting the growth of carbon-sequestering phytoplankton.

So says Stephen Nicol of the Australian Antarctic Division, based in Kingston, Tasmania, who has found "huge amounts of iron in whale poo".

He believes that before commercial whaling, baleen whale faeces may have accounted for some 12 per cent of the iron on the surface of the Southern Ocean.

The high iron content of whale faeces feeds Antarctic krill in the Southern Ocean and elsewhere **Image: J Brokowski**

Previous studies have shown that iron is crucial to ocean health because plankton need it to grow.

"If you add soluble iron to the ocean, you get instant phytoplankton growth," says Nicol. The amount of iron in whale faeces means that protecting Antarctic whales could swell populations of phytoplankton, which absorb carbon dioxide. Antarctic krill (Euphausia superba) feed on the phytoplankton, concentrating the iron in their tissue. And in turn, baleen whales eat the krill.

Iron rations

It had already been suggested that whales recycled iron in the ocean by eating it in krill and making it available to phytoplankton in faeces. But until this study, no one had analysed whale faeces to confirm if it indeed contained significant quantities of iron.

Nicol's team analysed 27 samples of faeces from four species of baleen whales. He found that on average whale faeces had 10 million times as much iron as Antarctic seawater. The team confirmed the iron came from krill by analysing the iron content in whole krill and sampling genetic material from the whale faeces for krill DNA. "We confirmed the vast majority of the iron in the poo came from krill," says Nicol.

Big eaters

Using estimates of the whale population before commercial whaling in the Southern Ocean began early last century, Nicol predicts that baleen whales – now endangered – once consumed about 190 million tonnes of krill every year and produced 7600 tonnes of iron-rich faeces.

Larger populations of whales would have produced more of this "bio-available" iron, leading to bigger phytoplankton and krill populations in turn, says Nicol.

"Allowing the great whales to recover will allow the system to slowly reset itself," he says. And this will ultimately increase the amount of CO2 that the Southern Ocean can sequester.

David Raubenheimer, who researches marine nutritional ecology at Massey University in Auckland, New Zealand, says the findings are convincing and important. They highlight a specific ecological role for whales in the oceans "other than their charisma", he says.

Peter Gill, a whale ecologist at Deakin University in Warrnambool, Victoria, Australia, calls the research "exciting stuff". "So many whales were moved from the ocean before we could understand the ocean ecology," says Gill. "It's exciting when we can reconstruct the past, and all these bits fall into place."

Journal reference: Fish and Fisheries, DOI: 10.1111/j.1467-2979.2010.00356.x

Coma Victim's Language Ability Explained

How could a Croatian girl speak German but forget her native language after coming out of a coma?

By Emily Sohn

THE GIST:

**** A coma left a teenager only able to speak a language that she had just begun to learn.***

**** Different parts of the brain become involved when a person learns a second language.***

**** There is still a lot we don't know about language in the brain.***

After 24 hours in a coma, a Croatian girl woke up speaking only German, according to reports that spread across the Internet last week. The 13-year-old had been studying German in school and watching German television shows on her own, according to various versions of the story, but she was not fluent until after the incident. Meanwhile, she lost the ability to speak her native language.

Discovery News did not confirm the report with the girl's doctors or parents, but experts say the story is plausible -- to some extent.

In a condition called bilingual aphasia, people often lose one of their two languages because different parts of the brain are involved in remembering each one, explained Michael Paradis, a neurolinguist at McGill University in Montreal. Even if a brain injury affected the Croatian teenager's memory of her native language, the brain areas that were learning German could have remained untouched. "This has been observed thousands of times," Paradis said. "It's not surprising at all. I'd like to know all the facts, but it's quite possible that after a coma, you'd have problems which might be located in such a way in the brain that they affect one language but not another."

What can't be true, though, is the claim that the coma gave the girl fluency that she didn't have before.

"I looked on the web and saw comments that she recovered perfect German," Paradis said. "This cannot be the case. If she recovered German to the point that she could communicate well, that's fine. That's the kind of thing you would expect."

Bilingual aphasia is possible because different types of memory are involved in learning first and second languages. As toddlers start to talk, their brains treat language like walking, jumping or any other motor skill. Those abilities belong to a realm called procedural memory; we do them without consciously thinking about them.

When an adult or older child learns a new language, on the other hand, something called declarative memory takes charge. As if the language were history, geography or math, the brain learns rules and memorizes facts. After years or decades of developing fluency, some of that knowledge gets transferred into the subconscious procedural memory. However, declarative, or conscious, memory will always hang on to it in some way. (Children who grow up multilingual can store more than one language within the subconscious memory system.)

Multiple areas of the brain intersect to encode both types of memory, but the two systems are generally distinct from each other. That makes it possible for a localized lesion, tumor or traumatic injury to wipe out one language but not another.

Paradis suspects that the Croatian teenager suffered from edema, or swelling, that interfered with her ability to speak Croatian but not German. In cases like hers, he said, the native language usually returns when swelling goes down after a few weeks or months.

Whether true or not, the case points out how much scientists still don't know about language and the brain.

"The bilingual neuroimaging literature is quite messy, and we're really only beginning to understand how the brain is capable of sustaining multiple languages," said Matt Leonard, a doctoral student in cognitive science at the University of California, San Diego.

Along with neuroscientist Eric Halgren and colleagues, his group is using new, magnetic field-based technology to zero in -- in more detail than ever -- on which parts of the brain process language and in what order. "Second-language learning is a controversial field," Halgren added, with ongoing debate about which brain areas are involved. "The amount we don't know is far greater than the amount we know. That is going to be true for a long time."

Useful stroke trials left unpublished

An investigation into unpublished stroke research data has revealed that 19.6% of completed clinical trials, which could potentially influence patient care, are not published in full. Researchers writing in BioMed Central's open access journal Trials describe how these unpublished studies included more than 16,000 participants and tested 89 different interventions.

Peter Sandercock and his colleague Lorna Gibson worked with a team of researchers from the University of Edinburgh, UK, to search the Cochrane Stroke Group's Specialised Register of Trials for completed trials of pharmacological interventions for acute ischemic stroke, and to determine how many of these were ultimately published. He said, "Failure to publish trial data is to be deprecated as it sets aside the altruism of participants' consent to be exposed to the risks of experimental interventions, potentially biases the assessment of the effects of therapies, and may lead to premature discontinuation of research into promising treatments".

The researchers identified 940 trials, of which 125 were not published in full. The largest trial included 856 patients, while two unpublished trials included fewer than 10 patients each. According to Sandercock, "Several of the trials we identified may have been large enough to influence clinical practice and the findings of systematic reviews and meta-analyses".

Sandercock concludes, "Well designed clinical trials should be published because their results can benefit patients, justifying the risk to trial participants from experimental treatments. We found 22 unpublished trials that reported the number of deaths. In these trials, 636 people died, but no information was available on whether the experimental drug had contributed to any of those deaths".

551 different researchers were involved in conducting these studies and of these, 72 had been involved in more than one trial that remained unpublished.

Notes to Editors *1. A systematic review of clinical trials of pharmacological interventions for acute ischaemic stroke (1955-2008) that were completed, but not published in full Lorna M Gibson, Miriam Brazzelli, Brenda M Thomas and Peter AG Sandercock Trials 2010, 11:43 doi:10.1186/1745-6215-11-43*

Singapore scientists develop zebrafish model for studying Parkinson's disease

Useful model may aid drug development for the disease

Scientists at the Genome Institute of Singapore (GIS), a biomedical research institute of the Agency for Science, Technology and Research (A*STAR), have recently developed a zebrafish model for Parkinson's disease that can be used for understanding the mechanism underlying its development. The knowledge gained will be helpful for future screening of new drugs to treat Parkinson's disease (PD).

This study describes the first zebrafish model for LRRK2 mutation-related PD. It is able to overcome some limitations of other animal models of LRRK2 and demonstrates that zebrafish, a tropical freshwater fish that can often be found in aquariums, can be used to study the development of human diseases. Led by GIS Group Leader Dr Liu Jianjun, the finding was published in PLoS Genetics on April 22, 2010.

To explore the biological functions of LRRK2, the scientists studied this gene in zebrafish by blocking its normal function. This resulted in Parkinsonism-like phenotypes in zebrafish, including locomotive defects and loss of neurons, similar to those of PD patients. It was found from the study that the defects of the fish can be rescued by expressing the normal protein of LRRK2. Significantly, the administration of Levo-dopa (L-dopa), a compound that is widely used to treat PD, can also rescue the locomotive defects caused by the modification of the zebrafish LRRK2 protein.

Parkinson's disease (PD) is a degenerative disease of the brain that often impairs motor skills, speech and other functions. The discovery of several gene mutations in affected patients clearly demonstrated the involvement of genetic factors in the development of PD. LRRK2 was discovered from previous studies by the same team of researchers to be one of the most important genetic causes of PD in the Asian population.

"This work shows how the use of a simple model system in fish can help decipher the root causes of a serious human disorder like Parkinson's disease, " said Professor Edison Liu, Executive Director of the GIS.

Dr Lim Kah Leong, Associate Professor of the National Neuroscience Institute and Duke-NUS Graduate Medical School, added "This novel and elegant study has illuminated the role of an otherwise poorly understood but important domain of LRRK2 that is associated with an increased risk for Parkinson's disease amongst Asian populations. The use of zebrafish as a disease model is a clever approach. I am definitely pleased to note that our arsenal of experimental organisms for drug screening has expanded with this study."

The zebrafish model derived from this study serves as a vertebrate model suitable for large-scale drug screening and provides a good disease model for PD. Using a novel technology known as the Zinc-finger nucleases (ZFNs), further research is being carried out to generate additional mutations of zebrafish LRRK2 gene. Such mutated zebrafishes can be used for advancing investigation for the biological mechanism of PD and screening of new drugs for PD treatment.

Notes to the Editor:

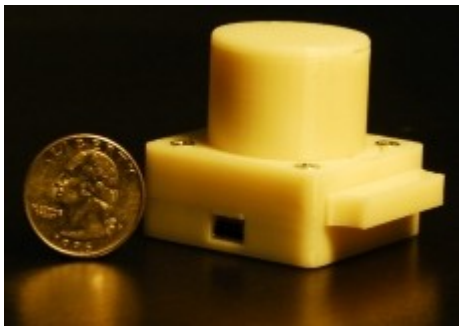
Research publication: The research findings described in the press release can be found in the April 22, 2010 print issue of PLoS GENETICS under the title "Deletion of the WD40 Domain of LRRK2 in Zebrafish Causes Parkinsonism-Like Loss of Neurons and Locomotive Defect".

UCLA engineer invents world's smallest, lightest telemedicine microscope

Portable, lensless device can deliver health care in resource-limited settings

By Jennifer Marcus and Mike Rodewald

Aydogan Ozcan, whose invention of a novel lensless imaging technology for use in telemedicine could radically transform global health care, has now taken his work a step further — or tinier: The UCLA engineer has created a miniature microscope, the world's smallest and lightest for telemedicine applications.



Prototype for Ozcan's lensless microscope

The microscope, unveiled in a paper published online in the journal Lab on a Chip, builds on imaging technology known as LUCAS (Lensless Ultra-wide-field Cell Monitoring Array platform based on Shadow imaging), which was developed by Ozcan, an assistant professor of electrical engineering at the UCLA Henry Samueli School of Engineering and Applied Science and a researcher at UCLA's California NanoSystems Institute.

Instead of using a lens to magnify objects, LUCAS generates holographic images of microparticles or cells by employing a light-emitting diode to illuminate the objects and a digital sensor array to capture their images. The technology can be used to image blood samples or other fluids, even in Third World countries.

"This is a very capable and yet cost-effective microscope, shrunk into a very small package," Ozcan said. "Our goal with this project was to develop a device that can be used to improve health outcomes in resource-limited settings."

The lensless microscope, in addition to being far more compact and lightweight than conventional microscopes, also obviates the need for trained technicians to analyze the images produced — images are analyzed by computer so that results are available instantaneously.

Weighing 46 grams — approximately as much as a large egg — the microscope is a self-contained imaging device. The only external attachments necessary are a USB connection to a smart-phone, PDA or computer, which supplies the microscope with power and allows images to be uploaded for conversion into results and then sent to a hospital.

Samples are loaded using a small chip that can be filled with saliva or a blood smear for health monitoring. With blood smears, the lensless microscope is capable of accurately identifying cells and particles, including red blood cells, white blood cells and platelets. The technology has the potential to help monitor diseases like malaria, HIV and tuberculosis in areas where there are great distances between people in need of health care and the facilities capable of providing it, Ozcan said. It can even be used to test water quality in the field following a disaster like a hurricane or earthquake.

Using a couple of inexpensive add-on parts, the lensless microscope can also be converted into a differential interference contrast (DIC) microscope, also known as a Nomarski microscope. DIC microscopes are used to gain information on the density of a sample, giving the appearance of a 3-D image by putting lines and edges in stark contrast. The additional parts for conversion to a DIC microscope cost approximately $1 to $2.

A number of design elements lead Ozcan to believe his lensless microscope will be a useful medical tool in resource-limited settings, such as some countries in Africa. Two key requirements for such settings are ease of use and durability. The microscope requires minimal training; because of its large imaging field of view, the sample does not need to be scanned or perfectly aligned in the microscope. And operating the microscope is as simple as filling a chip with a sample and sliding the chip into a slot on the side of the microscope. Because of its large aperture, the lensless microscope is also resistant to problems caused by debris clogging the light source. In addition, there are few moving parts, making the microscope fairly robust.

The lensless microscope is also an example of a type of medicine known as telemedicine. In resource-limited settings, tools that are portable enough to do medical tests in the field are vital. Tools like the lensless microscope could be digitally integrated as part of a telemedicine network that connects various mobile health-care providers to a central lab or hospital, filling gaps in physical infrastructure with mobile tools. The transmission connections for such networks already exist in cellular networks, which have penetrated even the most remote corners of the globe.

"Making things user-friendly is what I love about being an engineer," Ozcan said. "It is very rewarding to create something that to the end-user is very simple, when in reality years of research and work went into the technology and product development."

Study of Williams syndrome patients reveals specific gene's role in intelligence

University of Utah Brain Institute researcher leads multi-institution team in groundbreaking study

SALT LAKE CITY, UT – Although genetics is the most significant known determinant of human intelligence, how specific genes affect intelligence remains largely unknown. A multi-institution team led by a University of Utah (U of U) USTAR researcher has found that the brain gene STX1A plays a significant role in the level of intelligence displayed by patients with Williams Syndrome (WS). The study may have implications for the understanding of intelligence and treatment of neurological disease in the general population.

Researchers at UCLA, Cedars-Sinai Medical Center, Salk Institute, and the U of U found that variations in the expression of STX1A could account for 15.6 percent of cognitive variation in a group of 65 WS patients, a very high level of confidence in comparison to prior genetic studies. STX1A is involved in the electrochemical processes that occur at the brain's synapses.

The research team is under the direction of Julie R. Korenberg, Ph.D., M.D., Brain Institute USTAR investigator and professor of pediatrics at the U of U School of Medicine. The team published the study on April 21, 2010 in the open access / online scientific jounal PLoS ONE.

The study describes a new approach in determining the relationship between gene expression and intelligence in patients with WS, a neurodevelopmental disorder caused by the deletion of only two dozen genes from chromosome 7, a tiny fraction of the almost 30,000 genes found in humans. WS patients have one less copy each of the genes in question than does the general population. WS patients typically exhibit an IQ of 60, compared to an average of 100 for the general population. WS patients tend to be highly verbal and social, but have difficulty with numbers, visual-spatial perception and memory.

"Williams Syndrome patients are missing a very, very small amount of genetic material," said Korenberg. "In almost all other respects, their make-up is the same as the general population, so we knew to take a very close look at a small number of genes. We analyzed ten different genes, but the data spoke, and STX1A clearly stood out in relation to the different patients' intelligence levels," Korenberg said.

STX1A has a fundamental role in the brain's neurotransmission machinery. It supports the process by which electrical signals speed from one neuron to the next. "In terms of the brain, we're talking about a basic utility when we look at STX1A," Korenberg said.

The study points the way to further research that may have long-range benefits for WS patients as well as the general population. "This study shows in part how Nature's hand shapes intelligence at the synapse. Monitoring gene expression may provide unique insights into the neurobiology and genetics of intelligence in WS subjects and possibly the general population," Korenberg said.

Korenberg suggested there may be pharmaceutical treatments in the future that could help enhance synaptic function. "New studies could suggest ways to help people whose brain function is lacking, such as in Williams Syndrome, or people who are losing brain function, such as in Alzheimer's Disease," she said.

The research team overcame obstacles with some creative problem solving, Korenberg said. Since brain cells from live patients were unavailable for study, lymphoblastoid cells from the lymph system grown in culture provided the genetic material to analyze.

In addition, the researchers developed a more precise measure of WS intelligence test data, using a technique called Principal Component Analysis (PCA). In comparison to standardized IQ tests best suited for the general population, the PCA approach was able to better represent a baseline pattern of intelligence in WS patients. The WS baseline adjusted for relative strengths and weaknesses in the study group, and was able to illuminate the impact of specific genes like STX1A more accurately.

The full text of the paper, "Intelligence in Williams Syndrome is related to STX1A, which encodes a component of the presynaptic SNARE complex," is at http://tinyurl.com/237fdvp.

Parkinson's protection without caffeine or nicotine

* 16:06 23 April 2010 **by Ewen Callaway**

Decaf coffee and nicotine-free tobacco aren't just for the health-conscious. Giving them to flies with a form of Parkinson's disease has revealed that although coffee and cigarettes protect the brain, caffeine and nicotine aren't responsible for the benefit. If the compounds that put up this brain defence can be identified, they may offer a preventive Parkinson's treatment where none currently exists, says Leo Pallanck, a neuroscientist at the University of Washington in Seattle, whose team led the new study.

"We think that there's something else in coffee and tobacco that's really important," he says.

Bad for body, good for brain?

Evidence for the protective effect of coffee and tobacco comes mostly from epidemiological studies which suggest that coffee-drinkers and smokers are less likely to develop Parkinson's than abstainers.

"A lot of the field has gravitated to the idea that it's caffeine and nicotine [that protects their brains]," says Pallanck. But because these drugs are harmful in large amounts, it would be tough to find a way of using them as therapies. To see if ingredients other than caffeine and nicotine might be providing the benefit, Pallanck's team turned to fruit flies with a condition similar to Parkinson's disease.

Mutant flies

The flies have mutations that kill off dopamine-producing neurons, which causes them to develop movement and cognitive problems like those characteristic of Parkinson's in people. The same mutations are linked to hereditary forms of Parkinson's in humans.

Pallanck's team prepared several fly foods spiced up with normal coffee, decaffeinated coffee, smokeless "dipping" tobacco designed to allow nicotine absorption via the mouth, or a commercial nicotine-free tobacco. Then the researchers raised groups of flies on the various diets.

Normally, dopamine-producing neurons in the mutant flies die off as they age. But a diet featuring coffee and tobacco kept the neurons alive in all the flies tested at 20 days old, whether or not their food contained caffeine or nicotine. What's more, when pure caffeine or nicotine were added to the meals of other groups of flies, their dopamine neurons died off – just like those of flies whose food had no additive at all. "We didn't see any protective effects at all of caffeine and nicotine," Pallanck says.

Protective pathways

His team went on to identify a compound found in both decaf and normal coffee called cafestol that seems partially responsible for its neuro-protective effects. Cafestol activates a protein produced by flies called Nrf2, and the team found that blocking Nrf2 diminished coffee's protective effect on dopamine neurons.

Blocking Nrf2 in flies fed tobacco also reduced its protective effects. Pallanck's team is now searching for tobacco ingredients that activate Nrf2 – and other ones that do the same in coffee. These compounds might one day be given to people to protect against Parkinson's.

Alternatively, new drugs could mimic the protective neural processes triggered by coffee and cigarettes.

Journal reference: Journal of Neuroscience, DOI: 10.1523/jneurosci.4777-09.2010

Decaying beauty spied for first time by LHC

* 16:50 23 April 2010 **by Kate McAlpine**

A rare, fleeting "beauty" particle has been spotted in the first run of the Large Hadron Collider (LHC). The LHC started work on 30 March, and one of its four large detectors detected evidence of a beauty quark – also, less poetically, known as a bottom quark – on 5 April. The find should be the first of many beauty decays that LHCb, the LHC's beauty experiment, will observe, and demonstrates the detector is working as planned.

This first recorded particle is a meson composed of an anti-beauty quark – the beauty quark's antiparticle – and an up quark – one of the two common quarks that make up protons and neutrons. While up quarks last for billions of years, the large beauty quarks swiftly decay into lower-energy particles in about 1.5 x 10-12 seconds.

After travelling only 2 millimetres in the accelerator, the beauty quark decayed to a lighter quark – still paired with the original up quark – and the extra energy was carried off in the form of electron-like particles called muons.

Extremely rare

"It's a very rare event – it's like a needle in a haystack," says Andreas Schopper, a spokesperson for LHCb. "In these 10 million data or so we find this one event."

The particle was detected by LHCb's automatic trigger system, which is designed to recognise unusual events or particles but to ignore the vast majority of proton collisions. Less than 1 per cent of the collisions will be of interest to LHCb scientists.

Once an event is recorded, the details of detector signals are sent out to computing centres on five continents, where over a few days software reconstructs particle tracks. "It is the teamwork of the collaboration," says Schopper. "This is the first time we have really detected and reconstructed such a big particle."

Back to the big bang

LHCb will look at many such decays in order to shed light on what happened to the antimatter that should have been created alongside the matter that makes up our universe.

The experiment is designed to examine what happens to beauty quarks, which form in high-energy explosions – not least the big bang. By comparing the decay products of beauty quarks, LHC researchers hope to find clues as to why our universe seems to favour matter over antimatter.

"While precision measurements will need many millions of beauty particles, as with kisses, the first is always very special," says Jürgen Schukraft, spokesperson for the LHC's ALICE experiment. "It shows that the detector is up to its task, performing very well in identifying the complex decay pattern."

Scheme to save ancient orchards

Dozens of orchards have been created and cultivated in a bid to protect traditional fruit trees and the habitat they offer to wildlife.

The National Trust and Natural England effort follows a 60% decline in ancient orchards in England since the 1950s. Some 27 orchards have been restored and replanted and 12 new ones created, with some 2,200 trees planted. The National Trust is celebrating the first year of the project with a "full bloom festival" starting on Sunday.

The major decline in ancient orchards has been the result of urban development, conversion to other uses and the pressure on small-scale producers from commercial fruit growing.

The project aims to help orchards of apples, plums, pears and damsons

Wildlife habitat

The UK biodiversity action plan now lists traditional orchards as a conservation priority as they are home to local varieties of apples, plums, pears and damsons, and provide an important habitat for wildlife.

A series of wildlife surveys have been undertaken at the new and restored sites, with one location found to be home to 37 different bird species, including mistle thrush, bullfinch, green woodpecker and kestrel.

The project's orchard officer, Kate Merry, said: "You can't fail to appreciate what they add to our landscape.

"We would lose that and lose their historic importance. We would also lose valuable wildlife habitat, and all the old heritage and fruit varieties we have found. "And we would lose a lot of community opportunities to use this space to come together and have events. "They do so much for us, it's imperative that we try and save what's left," she said.

The project also aims to find ways to help orchards pay their own way, including repairing and using old equipment such as harvesting ladders and cider presses. The project is also training people in traditional orchard management skills in order to ensure the orchards are maintained beyond the scheme's two-and-a-half year lifespan.

Briefing: The man who's got a whole new face

18:16 23 April 2010 by **Andy Coghlan**

Yesterday it emerged that a farmer in his thirties in Spain who accidentally shot away the lower part of his face has become the first person to receive an entire face transplant. According to yesterday's press conference, he is already recovering well. Previously, he could only breathe and eat through tubes. Now he is expected to begin relearning how to talk, eat, smile and laugh within weeks. Read *New Scientist*'s guide to the intricate operation – and what challenges remain to making face transplants more common

How was the patient's face repaired?

In a 24-hour operation, a team of 30 surgeons at the Vall d'Hebron University Hospital in Barcelona, Spain, led by surgeon Joan Pere Barret, started by removing what remained of the man's face – skin, veins and arteries – leaving just his eyeballs and tongue.

The team then replaced this with practically the entire face of a dead donor, including all the skin, muscles and nerves, the entire nose, the lips, palate, all the teeth, the cheekbones and the entire lower jaw. These were grafted by microsurgery to what remained of the patient's own face, and the blood supply reconnected. In the final part of the operation, the surgeons transplanted bones and connecting nerves to the patient's own face.

In what ways does this break new ground?

Since Isabelle Dinoire received the world's first face transplant in France in 2005, the procedure has been repeated successfully in 10 others.

But this latest is the most extensive facial graft yet, says Maria Siemionow of the Cleveland Clinic Foundation in Ohio. She came close to replacing an entire face in December 2008, but says that the Spanish team is the first to transplant both the upper and lower jaw, and both eyelids. Her team, which repaired the face of a woman who'd been shot by her husband, restored upper but not lower jawbones, and lower eyelids.

Is a whole face in any way preferable to replacing just sections because then it works as a whole?

No – and it would be risky to take away surviving parts of the face unnecessarily, in case the transplant doesn't take, says Siemionow. As a result, she says it's unlikely that a full transplant will be performed except when absolutely necessary.

How are the other patients doing?

One of those treated in France died last year, but from a bacterial infection not related to the transplant. Dinoire is still reportedly doing well five years on, despite two rejection episodes in which the immune system started to attack her transplant. Heavier immunosuppressive drugs were needed to deal with these.

Siemionow says her own patient is progressing remarkably well some 18 months after her operation. "We included very extensive rehabilitation, physical and speech therapy in her recovery programme," says Siemionow. "She's now smiling, can say all her vowels and has such normal sensation in her face that she can feel a kiss."

What are the benefits of a face transplant rather than conventional repair with skin grafts?

The major benefit is that the transplant is much more than simply a mask to cover a deformity. Because donor nerves and blood vessels plug the transplant into the patient's own tissue, the graft comes to life fully, providing function as well as cosmetic improvement.

It means people can smile, talk and eat because they can move their new lips. Likewise, they can make facial expressions and open and close their eyes. "It's not just technical coverage of missing parts, but functional restoration," says Siemionow.

What hurdles remain to be overcome now?

Siemionow says milder immunosuppression regimes are required to stop donated tissue being rejected. Because current regimes dampen the immune system, it puts recipients at abnormally high risk of infection and cancer. Siemionow says she's hoping within months to test a novel, mild regime that is based on antibodies, initially with people having kidney transplants.

The Rise of the Mind

When and where did the cognitive abilities of modern humans arise? It's a big question -- one debated by anthropologists for decades. It's an even bigger question for an undergraduate thesis, but senior Logan Bartram has a leg up on this ambitious project: he helped unearth artifacts that are playing a critical role in shaping our knowledge about human origins.

In the summer of 2009, Bartram and fellow UVM student Kristina Bauman were accepted to join a team of archaeologists at a pivotal dig site on the coast of South Africa. It's the shells, ochre and tools at this site -- and not the paintings in the caves of Europe -- that many anthropologists today cite as the first signs of higher human cognitive power.

Ochre found in this cave at the tip of Pinnacle Point in South Africa has offered up key evidence that early humans were engaging in symbolic behavior long before anthropologists previously surmised. **Photo courtesy of Logan Bartram**

Signs of (intelligent) life

One such scientist -- and principal investigator for this National Science Foundation-funded excavation -- is paleoanthropologist Curtis Marean, a professor at Arizona State University's Institute of Human Origins. Marean's research, which is highly transdisciplinary in nature, drawing on expertise from geologists, plant biologists, geneticists, nutritionists, and others, pinpoints caves along the coast of South Africa as a likely habitat of the small population of Homo sapiens we're directly descended from today.

Marean's work shows that the migration of hominids to the coast of Africa may have helped develop -- or at least coincided with -- a boost in brain function. The ochre at the cave sites along the Indian Ocean is a sign of symbolic behavior, whether it was used for self adornment or markings on stone. Small blades that would have been affixed to stone or wood, instead of just held in hand, are evidence of complex tools. And an appetite for seafood, as evidenced by burned shells in ash pits, means that these early humans were able to use tides and lunar schedules to successfully harvest shellfish as a dietary staple.

The work at these sites, which was recently featured in the three-part Nova special "Becoming Human" (in which Bartram and Bauman have cameo appearances), has extended the origin of modern cognitive abilities further back in time, to roughly 170,000 years ago.

Since this was not a field school designed to teach archaeological skills to newcomers, Bartram -- a novice -- had to learn the techniques on the job. His training ground was an embankment in a rock shelter, where he cleared away sand deposits in search of the landscape surface inhabited by early humans.

The digging was slow and methodical. Electronic distance measurement tools collected data to document the precise location in space for each artifact, which allows researchers back in the lab to reconstruct three-dimensional maps of the site.

"You're digging down, and you can see right in the strata what's going on," Bartram says while pointing to an image he took of a cross-section view of the ledge. A black line bisecting the beige sand is the remains of a hearth -- concreted ash and burned shells are what's left behind from an ancient seafood dinner.

Brain food

Why did our ancestors move to the coasts? Climate change and drought throughout Africa meant fewer resources on land just shy of 200,000 years ago. The nutrition offered up by the sea was life sustaining -- a point driven home for Bartram when the site director foraged for mussels at lunchtime on a rock formation just below the caves.

For a pre-med student like Bartram, the idea that higher cognitive function may have been aided by the brain-building omega-3 fatty acids that seafood provides is an intriguing one. The southern coast of Africa is also known for amazing biodiversity and an abundance of tuberous plants, which are high in carbohydrates. "You couple that with shellfish, and you've got a really nice nutritional package going on," Bartram says. "Is it the reason we evolved, just because we had access to this nutrient? Probably not. But the ability to have that available to you and raise kids who are getting complete brain food -- there's no way that could have hurt."

Back at UVM, Bartram's wrapping up his thesis: "Evidence for Modern Human Behavioral Origins on the Southern African Coast." While based on his time in Africa, where he unearthed his own share of stone tools and looked out at the sea from the same cave shelters our ancestors once shared, he says that his thesis work is really about reviewing the published research. "It's certainly a library project...There's been so much literature published on these issues, and from this site," Bartram says. "If nothing else, my thesis is helping me reaffirm the experience I had, not just for others, but for myself." ***Provided by University of Vermont***

Follicle-stimulating hormone may affect bone loss in menopausal women

Diminished bone density is common among menopausal women and raises their risk of osteoporosis, bone fractures and subsequent complications. Research has traditionally focused on therapies that seek to maintain the level of estrogen in the body. This hormone seems to sustain bone health, but it drops to an extremely low level during and after menopause.

However, research conducted by a team at the Medical College of Georgia in Augusta, GA suggests that another hormone, follicle-stimulating hormone (FSH) may also be involved in decreasing bone mineral density during menopause. Dr. Joseph Cannon, Kellett Chair in Allied Health Sciences, will present his team's research at the American Physiological Society's Experimental Biology 2010 conference in Anaheim on April 24-28, 2010.

Increasing FSH Correlates to Decreasing Bone Density

The level of FSH gradually increases in the five years leading up to menopause, when it reaches its peak and estradiol bottoms out. Research has indicated that bone density begins to decrease over the same period of time. Also, data from animal studies indicated a link between FSH and bone density. This led Cannon and his colleagues to probe whether the increase of FSH has an effect on bone density in humans.

Bone mineral density is a balancing act between bone loss and bone growth involving two types of cells in the body: osteoclasts that break down bone, and osteoblasts that regenerate it. During menopausal bone loss, the osteoclasts' destructive activity outweighs the osteoblasts' rebuilding activity, resulting in an overall weakening of the bone.

Cytokines, which are secreted by white blood cells such as monocytes, are thought to play a role in this imbalance. One cytokine in particular, interleukin-1 beta (IL-1β), is known to activate osteoclasts. "Our hypothesis was that [FSH] was decreasing bone mineral density by influencing the production or action of cytokines," said Dr. Cannon.

Data in Cells Confirms Hormone's Effect in Women

To test their hypothesis, the researchers conducted a study of 36 women from 20 to 50 years old. By measuring each woman's level of FSH and then using a low-energy x-ray to analyze her bone density, the researchers saw that higher levels of FSH among the women were indeed associated with lower bone density.

These results prompted Cannon and his team to determine the effects of FSH on a cellular level. They collected blood samples from the study participants and isolated the monocytes to investigate the effect of FSH on cells outside of the body.

They discovered that the monocytes that make IL-1β have receptors for FSH. Receptors act like a lock for a key: when the key (FSH) enters the lock (receptor), the cell performs the activity coded by that key. In this case, the researchers determined that FSH stimulates the production of IL-1β if the monocytes have a sufficient number of FSH receptors.

Through further analysis, the researchers were able to confirm that blood FSH levels corresponded to blood levels of IL-1β. This suggests that both inside and outside the body, FSH stimulation of monocytes results in the production of IL-1β. The team also compared the amount of IL-1β in the participants' blood to their bone density and saw that the higher the level of IL-1β, the lower the bone density, when other factors that control IL-1β activity were taken into account.

"Our current data suggest that if there was a way to modulate FSH receptors on cells, or some other way to modulate the ability of FSH to influence cells, the result might be a new way of treating or preventing osteoporosis," said Dr. Cannon. "These data support the possibility that controlling the actions of FSH may be a therapeutic way of dealing with osteoporosis that will work beyond the scope of treatments that have been used in the past."

Targeting a waterborne foe

A Brandeis biochemist's pioneering research on cryptosporidium could lead to the first effective treatment

ANAHEIM, CA – Discovered in 1976, cryptosporidium lurks worldwide in water, contaminating swimming pools, water parks, and drinking water supplies. Although it has even been featured on the comedy show The Colbert Report, it is no laughing matter - this microscopic pathogen is a leading cause of diarrhea and malnutrition and the most common source of infection in immune-weakened people such as AIDS patients. It is also a potential bioterrorism agent.

"All you need is a cow and a centrifuge to harvest enough oocysts to infect a small city," says Brandeis University biochemist Liz Hedstrom. Roughly 20 percent of calves are infected by cryptosporidium oocysts, which are found in their feces. In 1993, in the largest waterborne disease outbreak in U.S. history, this nasty protozoan parasite infiltrated Milwaukee's municipal water supply, killing more than 100 people and sickening some 400,000.

Cryptosporidium invades the small intestine, where it opens fire, typically causing severe gastrointestinal distress and even death in people with weakened immune systems. Cryptosporidium is a hardy foe whose oocysts - a spore-like phase in the parasite life cycle - remain stable outside a host for long periods and are resistant to conventional water treatment such as chlorine disinfection.

The latest research news on this waterborne foe will be the focus of Hedstrom's talk, titled "Targeting a prokaryotic protein in a eukaryotic parasite," at the American Society for Biochemistry and Molecular Biology's annual meeting. The talk will be held in the Anaheim Convention Center, Room 304C, on Sunday April 25 at 9:55 am PST. Hedstrom's promising research could lead to an effective treatment to prevent cryptosporidiosis.

Hedstrom and her collaborators made a critical breakthrough in eroding cryptosporidium defenses when they identified IMPDH, a key enzyme involved in the biosynthesis of RNA and DNA, as a potential drug target. Her research has shown that IMPDH inhibitors block the parasite from proliferating in vitro. Importantly, the Cryptosporidium IMPDH has very different properties from those of the human enzyme counterpart.

Next, Hedstrom and her colleagues identified compounds that blocked the action of the Cryptosporidium IMPDH, but spared human IMPDH. Leading a large-scale screen of a commercial library containing 129,000 compounds, Hedstrom discovered more than fifty compounds that specifically inhibit the parasite enzyme. A number of these compounds display antiparasitic activity. Hedstrom is now working on improving the compounds' potency, bioavailability and metabolic stability, a first step in the drug development process.

"It's a difficult problem, but we think that we have some very promising compounds," says Hedstrom.

Putting bacterial antibiotic resistance into reverse

ANAHEIM, CA – The use of antibiotics to treat bacterial infections causes a continual and vicious cycle in which antibiotic treatment leads to the emergence and spread of resistant strains, forcing the use of additional drugs leading to further multi-drug resistance.

But what if it doesn't have to be that way?

In a presentation at the American Society for Biochemistry and Molecular Biology's annual meeting, titled "Driving backwards the evolution of antibiotic resistance," Harvard researcher Roy Kishony will discuss his recent work showing that some drug combinations can stop or even reverse the normal trend, favoring bacteria that do not develop resistance. The talk will be in Anaheim Convention Center Room 304D, on Sunday April 25 at 3:30 pm PST.

"Normally, when clinicians administer a multi-drug regimen, they do so because the drugs act synergistically and speed up bacterial killing," Kishony explains. However, Kishony's laboratory has focused on the opposite phenomenon: antibiotic interactions that have a suppressive effect, namely when the combined inhibitory effect of using the two drugs together is weaker than that of one of the drugs alone.

Kishony and his team identified the suppressive interaction in E. coli, discovering that a combination of tetracycline – which prevents bacteria from making proteins – and ciprofloxacin – which prevents them from copying their DNA – was not as good as slowing down bacterial growth as one of the antibiotics (ciprofloxacin) by itself.

Kishony notes that this suppressive interaction can halt bacterial evolution, because any bacteria that develop a resistance to tetracycline will lose its suppressive effect against ciprofloxacin and die off; therefore, in a population the bacteria that remain non-resistant become the dominant strain.

While such a weakened antibiotic combination is not great from a clinical standpoint, the Kishony lab is using this discovery to set up a drug screening system that could identify novel drug combinations that could hinder the development of resistance but still act highly effectively. "Typical drug searches look for absolute killing effects, and choose the strongest candidates," he says. "Our approach is going to ask how these drugs affect the competition between resistant versus sensitive bacterial strains."

To develop such a screen, Kishony and his group first had to figure how this unusual interaction works.

"Fast growing bacteria like E. coli are optimized to balance their protein and DNA activity to grow and divide as quickly as the surrounding environment allows," Kishony explains. "However, when we exposed E. coli to the ciprofloxacin, we found that their optimization disappeared."

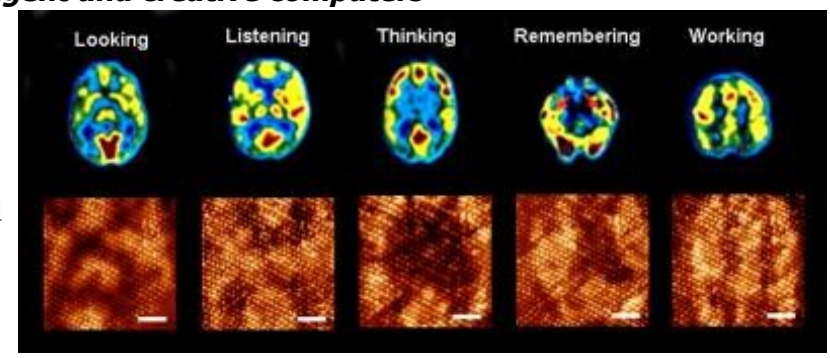
"We expected that since the bacteria would have more difficulty copying DNA, they would slow down their protein synthesis, too," Kishony continues. "But they didn't; they kept churning out proteins, which only added to their stress." However, once they added the tetracycline and protein synthesis was also reduced in the E. coli, they actually grew better than before. They then confirmed the idea that production of ribosomes - the cell components that make proteins - is too high under DNA stress by engineering E. coli strains that have fewer ribosomes than regular bacteria. While these mutants grew a more slowly in normal conditions, they grew faster under ciprofloxacin inhibition of DNA synthesis.

Kishony notes that their preliminary work on the development of a screen for drugs that put resistance in a disadvantage looks promising, and hopes that it would lead to the identification of novel drugs that select against resistance.

Brain-like computing on an organic molecular layer

Toward intelligent and creative computers

Information processing circuits in digital computers are static. In our brains, information processing circuits - neurons - evolve continuously to solve complex problems. Now, an international research team from Japan and Michigan Technological University has created a similar process of circuit evolution in an organic molecular layer that can solve complex problems. This is the first time a brain-like "evolutionary circuit" has been realized.



Magnetic resonance images of human brain during different functions appear on top. Similar evolving patterns have been generated on the molecular monolayer one after another (bottom). A snapshot of the evolving pattern for a particular brain function is captured using Scanning Tunneling Microscope at 0.68 V tip bias (scale bar is 6 nm). The input pattern to mimic particular brain function is distinct, and the dynamics of pattern evolution is also typical for a particular brain operation. **Anirban Bandyopadhyay**

This computer is massively parallel: The world's fastest supercomputers can only process bits one at a time in each of their channels. Their circuit allows instantaneous changes of ~300 bits.

Their processor can produce solutions to problems for which algorithms on computers are unknown, like predictions of natural calamities and outbreaks of disease. To prove this unique feature, they have mimicked two natural phenomena in the molecular layer: heat diffusion and the evolution of cancer cells.

The monolayer has intelligence; it can solve many problems on the same grid.

Their molecular processor heals itself if there is a defect. This remarkable self-healing property comes from the self-organizing ability of the molecular monolayer. No existing man-made computer has this property, but our brain does: if a neuron dies, another neuron takes over its function.

The work is described in the Nature Physics paper "Massively parallel computing on an organic molecular layer." It is coauthored by Ranjit Pati, of the Michigan Technological University Department of Physics. Lead author is Anirban Bandyopadhyay, National Institute for Materials Science, National Institute of Information and Communication Technology, Japan.

Research in Antarctica reveals non-organic mechanism for production of important greenhouse gas

Athens, Ga. – In so many ways, Don Juan Pond in the Dry Valleys of Antarctica is one of the most unearthly places on the planet. An ankle-deep mirror between mountain peaks and rubbled moraine, the pond is an astonishing 18 times saltier than the Earth's oceans and virtually never freezes, even in temperatures of more than 40 degrees below zero Fahrenheit.

Now, a research team led by biogeochemists from the University of Georgia has discovered at the site a previously unreported chemical mechanism for the production of nitrous oxide, an important greenhouse gas. Possibly even more important, the discovery could help space scientists understand the meaning of similar brine pools in a place whose ecosystem most closely resembles that of Don Juan Pond: Mars.

The research, published April 25 in the journal Nature Geoscience, adds an intriguing new variable to growing evidence that there has been - and may still be - liquid water on Mars, a usual prerequisite for the formation of life. In fact, the new findings could help space scientists develop sensors for detecting such brines on Mars - thus narrowing the search for places where life may exist.

"The pond's soils and brines and the surrounding rock types are similar to those found on Mars," said Samantha Joye, a faculty member in the department of marine sciences in the Franklin College of Arts and Sciences and lead author on the paper. "So it provides an ideal location to assess microbial activity in extreme environments. While we did not detect any 'bio-gases' such as hydrogen sulfide and methane, we did, surprisingly, measure high concentrations of nitrous oxide, which is normally an indicator of microbial activity. We needed to find out whether a non-organic process could account for this nitrous oxide production."

Other authors on the paper include Vladimir Samarkin, a research scientist, and Marshall Bowles, a graduate student, also of the department of marine sciences at UGA; Michael Madigan of Southern Illinois University; Karen Casciotti of the Woods Hole Oceanographic Institution; John Priscu of Montana State University; and Christopher McKay of the Ames Research Center of NASA.

The research was supported by grants from the National Science Foundation's Antarctic Organisms and Ecosystems Program and the McMurdo Microbial Observatory Program.

Scientists have been fascinated with Don Juan Pond since its discovery in 1961. (While the site is lovely, there's nothing romantic about the name, which comes from the helicopter pilots who first found it, Don Roe and John Hickey.) From the time of its discovery, researchers realized they had found a place like nowhere else on Earth.

The pond, which is a roughly 1,000- by 400-meter basin, is the saltiest body of water on Earth by far, some eight times saltier than the Dead Sea. While researchers more than 30 years ago reported finding abundant and varied microflora of fungi, bacteria, blue-green algae and yeasts, since then and during the Joye team's work, such life has been non-existent. Since the depth level and area covered by the pond (which is fed by hypersaline groundwater) have demonstrably varied over the years, this wasn't unexpected. What did surprise the team was that even with no life-forms present, they were able to measure nitrous oxide, perhaps best known to most people as the "laughing gas" used in dental procedures. (The amounts measured in the air were beneath a level that could make a person light-headed or giddy, as "laughing gas" can.)

"What we found was a suite of brine-rock reactions that generates a variety of products, including nitrous oxide and hydrogen," said Joye. "In addition to Don Juan Pond, this novel mechanism may occur in other environments on Earth as well and could serve as both an important component of the Martian nitrogen cycle and a source of fuel [hydrogen] to support microbial chemosynthesis."

Even more interesting, perhaps, is that the results suggest that an additional mechanism - the reaction of brine-derived nitrates with basaltic rock - could be a "previously unrecognized means for mobilizing nitrate from the surface soils . . . and returning it to the Martian atmosphere as nitrous oxide," Joye said.

The discovery of water has been the holy grail of numerous Mars missions over the years, and in 2009 the Mars Phoenix mission's cameras photographed on the legs of the lander what appeared to be liquid water. If ultimately confirmed - and growing evidence appears to be solidifying in favor of such an analysis - it would be the first time liquid water was detected and photographed outside the Earth.

Working in such a beautiful but unearthly area presents stern challenges to researchers, Joye said.

"It's a 40-minute helicopter ride over the McMurdo Sound just to get there," she said. "Once in the Wright Valley, we enter a tight enclosure with steep, rocky cliffs on both sides, and between them is Don Juan Pond. I believe it must be one of the most beautiful places in Antarctica."

Samarkin agreed.

"It has the kind of beauty that rock parks in Japan have," he said, "except this is made by nature."

Beauty aside, though, the team had to dress in sterile suits and masks and use sterile instruments for sampling to avoid possible contamination. They also collected the minimal amount of material necessary to achieve their research goals.

The discovery of the new mechanism opens numerous questions that must be studied, including the possibility that the process is taking place in other extreme Antarctic habitats or that it might contribute to nitrous oxide in temperate soils - a possible new clue to understanding greenhouse gases involved in global warming.

The most crucial result, however, may be in understanding how similar brine pools on Mars might work and whether they could support life.