

'Left-handed iron corkscrews' point the way to new weapon in battle against superbugs like MRSA

Scientists at the University of Warwick have taken inspiration from corkscrew structures found in nature to develop a new weapon in the fight against infections like E-coli and MRSA.

Researchers have created a new synthetic class of helix-shaped molecules which they believe could be a key tool in the worldwide battle against antibiotic resistance. By twisting molecules around iron atoms they have created what they term 'flexicates' which are active against MRSA and E-coli - but which also appear to have low toxicity, reducing the potential for side effects if used in treatment. The work is published in Nature Chemistry.

The new structures harness the phenomenon of 'chirality' or 'handedness' whereby the corkscrew molecules could be left-handed or right-handed. By making the most effective 'hand' to attack a specific disease, the University of Warwick research paves the way towards a more targeted approach to killing pathogens.

In the case of E-coli and MRSA, it is the left 'hand' which is most effective.

Professor Peter Scott of the University of Warwick's chemistry department said although this particular study concentrated on flexicates' activity against MRSA and E-coli, the new method of assembly could also result in new treatments for other diseases. "It's a whole new area of chemistry that really opens up the landscape to other practical uses. "These new molecules are synthetically flexible, which means that with a bit of tweaking they can be put to use against a whole host of different diseases, not just bugs like MRSA which are rapidly developing resistance to traditional antibiotics. "Flexicates are also easier to make and produce less waste than many current antibiotics."

Scientists have long been able to copy nature's corkscrew-shaped molecules in man-made structures known as helicates – but they have thus far not been able to use them in fighting diseases. One of the key issues is the problem of handedness. Sometimes 'left-handed' molecules in drugs are the most effective at combating some disease, while sometimes the 'right-handed' version works best.

Until now, scientists working with helicates have found it difficult to make samples containing just one type of corkscrew; either the right- or left-handed twist. But with flexicates, the University of Warwick scientists have succeeded in making samples containing just one type of twist – resulting in a more targeted approach which would allow the drug dosage to be halved. And flexicates solve other problems encountered by helicates, as they are easier to optimise for specific purposes, are better absorbed by the body and are also easier to mass-produce synthetically.

Professor Scott said: "Drugs often have this property of handedness - their molecules can exist in both right and left handed versions but the body prefers to use only one of them." "For this reason, drug companies have to go to the trouble of making many traditional molecules as one hand only. "What we have done is solve the 'handedness' problem for this new type of drug molecule. "By getting the correct hand we can halve the drug dose, which has the benefits of minimising side effects and reducing waste. "For patients, it's safer to swallow half the amount of a drug. "Our work means that we can now make whichever hand of the corkscrew we want, depending on the job we require it to do."

Notes to editors The study, entitled *Optically pure, water-stable metallo-helical 'flexicate' assemblies with antibiotic activity*, is published in *Nature Chemistry*. The research was also supported financially by EPSRC.

It is authored by Peter Scott, Suzanne Howson, Guy Clarkson and Alison Rodger from the University of Warwick, Albert Bolhuis from the University of Bath and Viktor Brabec and Jaroslav Malina from the Academy of Sciences of the Czech Republic. When the paper is published it can be retrieved at <http://dx.doi.org/10.1038/NCHEM.1206>

http://www.eurekalert.org/pub_releases/2011-11/wuso-dms112811.php

Drug may slow spread of deadly eye cancer

Uveal melanoma, the second most common form of melanoma, can be very aggressive and spread, or metastasize, from the eye to other organs, especially the liver.

A drug commonly used to treat seizures appears to make eye tumors less likely to grow if they spread to other parts of the body, according to researchers at Washington University School of Medicine in St. Louis. Their findings are available online in the journal *Clinical Cancer Research*.

"Melanoma in general, and uveal melanoma in particular, is notoriously difficult to treat once it has metastasized and grown in a distant organ," says principal investigator J. William Harbour, MD.

"We previously identified an aggressive class 2 molecular type of uveal melanoma that, in most cases, already has metastasized by the time the eye cancer is diagnosed, even though imaging the body can't detect it

yet. This microscopic amount of cancer can remain dormant in the liver and elsewhere for several years before it begins to grow and becomes lethal."

Once this happens, the prospects for survival are poor, according to Harbour, the Paul A. Cibis Distinguished Professor of Ophthalmology and Visual Sciences and professor of cell biology and of molecular oncology. He also directs the Center for Ocular Oncology at the Siteman Cancer Center at Barnes-Jewish Hospital and Washington University School of Medicine.

Harbour's new study shows that drugs known as histone deacetylase (HDAC) inhibitors alter the conformation of the DNA of the aggressive form of uveal melanoma, which changes the way key genes are expressed, rendering the tumor cells less aggressive.

"We looked at uveal melanoma cells in the laboratory and in an animal model, and we found that HDAC inhibitors can block the growth and proliferation of tumor cells," he says. "HDAC inhibitors appear to reverse the aggressive molecular signature that we had identified several years ago as a marker for metastatic death. When we look at aggressive melanoma cells under the microscope after treatment with HDAC inhibitors, they look more like normal cells and less like tumor cells."

Because HDAC inhibitors already are on the market, Harbour says he thinks it may be possible to quickly begin testing the drugs in patients with aggressive forms of uveal melanoma.

The drugs have relatively mild side effects that are not as severe as those seen in patients undergoing chemotherapy. One HDAC inhibitor, for example, is the anti-seizure drug valproic acid. Its most common side effect is drowsiness, which is typical of all HDAC inhibitors.

Clinical trials of HDAC inhibitors could begin in the next six to 12 months, Harbour says. Already, other researchers have applied for funding to begin testing an HDAC inhibitor called SAHA (suberoylanilide hydroxamic acid) in patients with metastatic uveal melanoma.

"I think this is a reasonable place to start in the challenging effort to improve survival in patients with metastatic uveal melanoma," Harbour says. "I suspect that the best role for HDAC inhibitors will be to slow or prevent the growth of tumor cells that have spread out of the eye but cannot yet be detected. This might lengthen the time between the original eye treatment and the appearance of detectable cancer in the liver and elsewhere."

Like the chicken pox virus that lives for years in nerve cells without affecting health, Harbour says treatment with HDAC inhibitors may allow patients with aggressive melanomas to live for many years without any detectable spread of their disease.

Harbour and his colleagues previously developed a screening test to predict whether the cancer would be likely to spread to the liver and other parts of the body. The test is helpful because although less than 4 percent of patients with uveal melanoma have detectable metastatic disease, up to half will eventually die of metastasis even after successful treatment of the tumor with radiation, surgery, or, in the worst cases, removal of the eye.

Tumors that tend to remain contained within the eye are called class 1 uveal melanomas. With a needle biopsy, doctors can quickly determine whether a tumor is likely to be a class 1 cancer or whether it carries a molecular signature that identifies it as a high-risk, class 2 melanoma. Harbour's team developed a test to identify the class 2 molecular signature, and that test is now being used around the world to detect the aggressive form of uveal melanoma.

In addition, Harbour's team published a paper last year in the journal *Science* identifying a mutation in a gene called BAP-1 that helped further explain why some eye tumors develop the class 2 signature and acquire the ability to spread. Harbour explains that HDAC inhibitors appear to reverse some of the effects of BAP-1 mutations on the melanoma cell.

Landreville S, Agapova OA, Matatall KA, Kneass ZT, Onken MD, Lee RS, Bowcock AM, Harbour JW. Histone deacetylase inhibitors induce growth arrest and differentiation in uveal melanoma. Clinical Cancer Research, available online at: doi:10.1158/1078-0432.CCR-11-0946

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Study debunks stereotype that men think about sex all day long

Men may think about sex more often than women do, but a new study suggests that men also think about other biological needs, such as eating and sleep, more frequently than women do, as well.

COLUMBUS, Ohio – And the research discredits the persistent stereotype that men think about sex every seven seconds, which would amount to more than 8,000 thoughts about sex in 16 waking hours. In the study, the median number of young men's thought about sex stood at almost 19 times per day. Young women in the study reported a median of nearly 10 thoughts about sex per day. As a group, the men also thought about food almost 18 times per day and sleep almost 11 times per day, compared to women's median number of thoughts about eating and sleep, at nearly 15 times and about 8 1/2 times, respectively.

The college-student participants carried a golf tally counter to track their thoughts about either eating, sleep or sex every day for a week. Each student was assigned to just one type of thought to record. Before receiving the tally counter, they had completed a number of questionnaires and were asked to estimate how often they had daily thoughts about eating, sleeping and sex. Overall, a participant's comfort with sexuality was the best predictor for which person would have the most frequent daily thoughts about sex.

"If you had to know one thing about a person to best predict how often they would be thinking about sex, you'd be better off knowing their emotional orientation toward sexuality, as opposed to knowing whether they were male or female," said Terri Fisher, professor of psychology at Ohio State University's Mansfield campus and lead author of the study. "Frequency of thinking about sex is related to variables beyond one's biological sex."

Correcting this stereotype about men's sexual thoughts is important, Fisher noted.

"It's amazing the way people will spout off these fake statistics that men think about sex nearly constantly and so much more often than women do," she said. "When a man hears a statement like that, he might think there's something wrong with him because he's not spending that much time thinking about sexuality, and when women hear about this, if they spend significant time thinking about sex they might think there's something wrong with them."

The study appears online and is scheduled for publication in the January issue of the Journal of Sex Research.

The study involved 163 female and 120 male college students between the ages of 18 and 25 who were enrolled in a psychology research participation program. Of those, 59 were randomly assigned to track thoughts about food, 61 about sleep and 163 about sex. Most students were white and self-identified as heterosexual. The college-student sample made it comparable to previous research and involved an age group at which gender differences in sexuality are likely at their peak.

Before the thought-tracking began, the participants completed a number of questionnaires. These included a sexual opinion survey to measure a positive or negative emotional orientation toward sexuality (erotophilia vs. erotophobia); a sociosexual orientation inventory measuring attitudes about sex and tracking sexual behavior and levels of desire; a social desirability scale to measure respondents' tendency to try to appear socially acceptable; and an eating habits questionnaire and sleepiness scale. They also were asked to estimate how many times in an average day that they thought about sleeping, eating and sex.

Researchers then gave each student a tally counter device and told those assigned to the sexual thoughts condition to click the device to maintain a count their of thoughts about sex. They were told to count a thought about any aspect of sex: sexual activity of any kind, fantasies and erotic images, sexual memories and any arousing stimuli. Others were instructed to use the device to record thoughts about eating that included food, hunger, cravings, snacking or cooking, and thoughts about sleep that included dreaming, sleeping, napping, going to bed or needing rest.

The questions about food and sleep were designed to mask the true intent of the study's focus on thoughts about sex, Fisher said. However, the results about these additional thoughts provided important information about differences in thinking among males and females.

"Since we looked at those other types of need-related thoughts, we found that it appears that there's not just a sex difference with regard to thoughts about sex, but also with regard to thoughts about sleep and food," she said. "That's very significant. This suggests males might be having more of these thoughts than women are or they have an easier time identifying the thoughts. It's difficult to know, but what is clear is it's not uniquely sex that they're spending more time thinking about, but other issues related to their biological needs, as well."

And when all of those thoughts were taken into account in the statistical analysis, the difference between men and women in their average number of daily thoughts about sex wasn't considered any larger than the gender differences between thoughts about sleep or thoughts about food.

In raw numbers, male participants recorded between one and 388 daily thoughts about sex, compared to the range of female thoughts about sex of between one and 140 times per day.

"For women, that's a broader range than many people would have expected. And there were no women who reported zero thoughts per day. So women are also thinking about sexuality," Fisher said.

The questionnaire data offered some additional clues about the influences on sexual thoughts. When all participants were analyzed together, those measuring the highest in erotophilia – or comfort with their sexuality – were the most likely to think more frequently about sex. But when the analysis considered males and females separately, no single variable – erotophilia score, unrestrictive attitudes about sex or a lack of desire to be socially acceptable – could be defined as a predictor of how often men think about sex. But for women, the erotophilia score remained a good predictor of more frequent sexual thoughts. On the other hand, women who scored high on the desire to be socially acceptable were more likely to think less frequently about sex.

"People who always give socially desirable responses to questions are perhaps holding back and trying to manage the impression they make on others," Fisher explained. "In this case, we're seeing that women who are more concerned with the impression they're making tend to report fewer sexual thoughts, and that's because thinking about sexuality is not consistent with typical expectations for women."

The participants' estimates about how often they thought each day about eating, sleeping and sex were all much lower than the actual number of thoughts they recorded. This suggested to Fisher that previous research in this area – especially on thoughts about sex – was weak because almost all previous studies were based on participants' retrospective estimates about how often they thought about sex. "There's really no good reason that our society should have believed that men are thinking so much more about sex than women. Even the research that had been done previously doesn't support the stereotype that men are thinking about sex every seven seconds," she said.

Fisher conducted the research with undergraduate Ohio State-Mansfield students Zachary Moore and Mary-Jo Pittenger. Both have since graduated.

<http://www.sciencedaily.com/releases/2011/11/111128120544.htm>

Immune System Has Protective Memory Cells, Researchers Discover

The immune system possesses a type of cell that can be activated by tissues within the body to remind the immune system not to attack our own molecules, cells and organs

ScienceDaily - The immune system possesses a type of cell that can be activated by tissues within the body to remind the immune system not to attack our own molecules, cells and organs, UCSF researchers have discovered. The discovery is likely to lead to new strategies for fighting a range of autoimmune diseases - in which the immune system attacks and harms specific molecules and cells within us - as well as for preventing transplant rejection, according to UCSF researchers who report their findings in the November 27 online edition of the journal Nature.

The cells tracked by the UCSF researchers circulate in the blood and are counterparts of the memory cells that help ward off microbial foes following vaccination or repeated exposure to the same pathogen.

UCSF immunologist and chair of the Department of Pathology Abul Abbas, MBBS; Michael Rosenblum, MD, PhD, an assistant professor with the UCSF Department of Dermatology; and UCSF postdoctoral fellow Iris Gratz, PhD, used a mouse model of autoimmune disease to discover a role in immune system memory for cells called activated T regulatory cells. They found that over time a tissue within the body - in this case, skin - defends itself from autoimmune attack by protectively activating a small fraction of T regulatory cells.

"It's a novel concept -- that tissues remember," Abbas said. "Subsequent exposure to the same protein that elicited autoimmunity in that tissue may lead to less severe inflammatory disease."

Autoimmune diseases, ranging from minor to severe, affect an estimated 50 million Americans. Immunologists had for decades blamed these diseases on faulty functioning of immune cells known as lymphocytes, including the cells that make antibodies that normally target foreign proteins found on infectious disease pathogens.

In autoimmune disease, lymphocytes may be directed against "self" proteins. In multiple sclerosis, for example, lymphocytes make antibodies that attack proteins in the insulating sheath that surrounds nerves. In lupus, antibodies attack DNA. But in many cases autoimmune disease may involve abnormal responses by T regulatory cells, the UCSF researchers said. In recent years immunologists have come to recognize the important role that T regulatory cells normally play not only in ramping down an immune response during recovery from infection, but also in preventing autoimmune responses.

"Instead of an immune response that attacks, it's an immune response that suppresses attack," Rosenblum said. The two types of cells exist in a balance, and the balance is disrupted in autoimmune disease.

The UCSF researchers wanted to explore how autoimmunity may become self-limiting or wane over time. Physicians have observed that in many cases an autoimmune disease that attacks a single organ is worst when it first arises, with later flare-ups becoming less severe.

Similarly, Abbas, Rosenblum and Gratz were curious about the success of desensitization - "allergy shots" - for some allergy patients. Like our own self proteins, allergens such as certain pollens pose no disease threat. But in people with allergies the immune system goes on the attack anyway. However, with repeated injections, with gradually increased doses of the same allergen, even evil ragweed-induced sneezing, itching and stuffiness can be relieved.

The UCSF scientists genetically engineered a strain of mice in which they could switch on or off the production of a particular self protein, called ovalbumin, in the skin. The mice were triggered to make an overabundance of the protein, which provoked an autoimmune response.

However, the presence of the protein also stimulated the activation of T regulatory cells. The activated T regulatory cells proliferated and transformed into a more potent form that better suppresses autoimmunity.

When the researchers again boosted ovalbumin production in the mice it provoked a weaker autoimmune response, due to the presence of already activated T regulatory cells. T regulatory cells already are being explored in therapies aimed at preventing the rejection of transplanted organs, including treatment developed by a team led by Jeffrey Bluestone, PhD, now UCSF executive vice chancellor and provost.

But the discovery of long-lived memory cells among the T regulatory cell population highlights the potential for using specialized memory cells in treatment to help prevent attack on specific molecular targets, which immunologists call "antigens." It may be possible to raise such specialized memory cells outside the body and return the bolstered ranks of protective cells to the patient, Rosenblum said.

Although the role of activated T regulatory memory cells had not previously been recognized, "It's the generally accepted success of what the allergists call specific immunotherapy that has led to recent clinical trials of antigen administration in multiple sclerosis and in type 1 diabetes," Abbas said.

<http://www.sciencedaily.com/releases/2011/11/111128121356.htm>

Closer to Finding Treatment for Duchenne Muscular Dystrophy

An important breakthrough has been made in the development of a treatment for Duchenne muscular dystrophy

ScienceDaily - Academics from Royal Holloway, University of London and a team lead by scientists at the UCL Institute of Child Health (ICH), have made an important breakthrough in the development of a treatment for Duchenne muscular dystrophy (DMD) which in the future could help the likes of the Lloyd family who were featured on a recent X-Factor TV show in the U.K.

The family's story was shown before the X Factor stars performed the show's charity song in aid of sick children. In a moving interview the boys' parents Helen and Chris Lloyd spoke about when their identical twins Dan and Sam, 16, were first diagnosed with the genetic disease DMD when they started showing signs of struggling to move.

But the family's ordeal got worse when younger brother Tom, 13, was also diagnosed with the life-limiting condition that affects one in 3,000 male births in the general population, with around 100 cases diagnosed in the UK each year.

Together with the MDEX Consortium, Professor George Dickson from the School of Biological Sciences at Royal Holloway showed that a gene-based drug treatment was effective in restoring the dystrophin protein that is missing in sufferers of DMD, in seven out of 19 trial participants.

DMD causes progressive muscle weakness due to the breakdown and loss of muscle cells. Patients lack a single important protein in their muscle fibres called dystrophin. By the ages of eight to 12, boys become unable to walk and by their late teens or early twenties the condition can become severe enough to limit life expectancy.

In this clinical trial of 19 patients, study participants aged five to 15 at Great Ormond Street Hospital and the Royal Victoria Infirmary, Newcastle, were given weekly doses of the drug, AVI-4658. The drug had already been tested for safety and efficacy by the MDEX Consortium and AVI Biopharma in an earlier phase of the study (Kinali et al, Lancet Neurol 2009).

Professor Dickson said: "Duchenne dystrophy is a very serious inherited disorder which affects 1 in 3,000 boys from age four onwards so to have all three brothers affected by the disease is very rare indeed. It is a progressive and severe muscle wasting disease which is currently untreatable. But our ongoing clinical trials have great promise as a long-term treatment and we hope in future to be able to help transform the lives of families like the Lloyds who have to go through this terrible ordeal."

Four reasons why the quantum vacuum may explain dark matter

Gravitational polarization of the quantum vacuum can explain four cosmological observations, only some of which can be explained by dark matter models or theories of modified gravity

PhysOrg.com - Earlier this year, PhysOrg reported on a new idea that suggested that gravitational charges in the quantum vacuum could provide an alternative to dark matter. The idea rests on the hypothesis that particles and antiparticles have gravitational charges of opposite sign. As a consequence, virtual particle-antiparticle pairs in the quantum vacuum form gravitational dipoles (having both a positive and negative gravitational charge) that can interact with baryonic matter to produce phenomena usually attributed to dark matter. Although CERN physicist Dragan Slavkov Hajdukovic, who proposed the idea, mathematically demonstrated that these gravitational dipoles could explain the observed rotational curves of galaxies without dark matter in his initial study, he noted that much more work needed to be done.

Now with a new analysis, Hajdukovic has taken another step toward demonstrating the credibility of this idea by showing that the gravitational polarization of the quantum vacuum can explain four cosmological observations, only some of which can be explained by dark matter models or theories of modified gravity. In his paper, which was recently published in *Astrophysics and Space Science*, he starts off with some background information.

Background

“Contemporary physics has two cornerstones: General Relativity and the Standard Model of Particle Physics,” he writes. “General Relativity is our best theory of gravitation. The Standard Model is a collection of Quantum Field Theories; according to the Standard Model, everything in the Universe is made from six quarks and six leptons (and their antiparticles) which interact through exchange of gauge bosons (photon for electromagnetic interactions, W and Z for weak interactions and eight gluons for strong interactions).”

He goes on to explain that these two theories do not fit with certain observations, one of which is that the gravitational field in the universe appears much stronger than it should be according to General Relativity and the existing amount of baryonic matter, which is composed of Standard Model particles. While thousands of scientists around the world are trying to figure out whether one of the two cornerstone theories needs modification, Hajdukovic’s idea does not require modifying gravity or invoking new matter. He summarizes it this way:

“In simple words, according to the Quantum Field Theory, all baryonic matter in the Universe is immersed in the quantum vacuum; popularly speaking, a ‘sea’ of short-living virtual particle-antiparticle pairs (like electron-positron pairs with the lifetime of about 10⁻²² seconds, or neutrino-antineutrino pairs with a lifetime of about 10⁻¹⁵ seconds, which is a record lifetime in the quantum vacuum). It is difficult to believe that the quantum vacuum does not interact gravitationally with the baryonic matter immersed in it. In spite of it, the quantum vacuum is ignored in astrophysics and cosmology; not because we are not aware of its importance but because no one has any idea what the gravitational properties of the quantum vacuum are. In absence of any knowledge, as a starting point, we have conjectured that particles and antiparticles have the gravitational charge of opposite sign. An immediate consequence is the existence of the gravitational dipoles; a virtual pair is a gravitational dipole (in the same way as a virtual electron-positron pair is an electric dipole), that allows the gravitational polarization of the quantum vacuum. The initial study has revealed the surprising possibility that the gravitational polarization of the quantum vacuum can produce phenomena usually attributed to dark matter.”

He said that the idea is not a full theory yet, and acknowledges that it conflicts with many of our basic human assumptions.

“I would say a theory in the early stage,” he told PhysOrg.com. “Thousands of scientists work on the development of the cold dark matter theory and the theories of modified gravity; I am working alone in this third direction. The involvement of the other scientists in the research is crucial but still uncertain. On one side I have obtained a few results in striking agreement with the measurements, but on the other side a huge majority of physicists is ‘allergic’ to the idea of the gravitational repulsion between matter and antimatter; the most common experience of all humans is that everything falls down, and it is not easy to swallow the idea that antimatter may ‘fall up.’”

Four phenomena

In this study, Hajdukovic focuses on four other phenomena, all of which have been established by observations of galaxies. Neither the cold dark matter model (CDM) nor Modified Newtonian Dynamics (MOND) - a theory of modified gravity - can explain all these phenomena, with CDM running into problems at small scales and MOND facing problems at large scales.

First, researchers (Donato, et al.) have observed that the dark matter haloes (or a strong gravitational field) that surround galaxies have a surface density that is nearly constant and independent of galaxy luminosity, mass, size, form, etc. Although the discovery of this universal property of galaxies is a surprise, Hajdukovic's theory predicts a surface density that is in very good agreement with the measured density value of 140 solar masses per square parsec. The universality of the dark matter surface density of dark matter haloes can be explained by MOND, but not by CDM.

Second, the first direct measurements of dark matter distribution in two nearby dwarf galaxies, Fornax and Sculptor, were recently taken by Matt Walker and Jorge Peñarrubia. Surprisingly, the measurements revealed that (what appears to be) dark matter is evenly distributed within the central few hundred parsecs of each galaxy. Although even distribution is compatible with MOND, it contradicts predictions by CDM in which dark matter is located in a cusped halo.

"In the case of a dwarf spheroidal galaxy, the measurements show that there is a cored dark matter halo in the central part of the galaxy, while the cold dark matter model predicts a mass-density profile that diverges toward the center, forming a so-called 'cusp,'" Hajdukovic explained. "So CDM is in conflict with observations: there is a cored, not a cusped halo. In the framework of the gravitational polarization of the quantum vacuum, the cusped halo is impossible, and it is a good sign for my theory."

Third, both CDM and MOND predict the existence of a hypothetical dark matter disk to surround our Milky Way Galaxy, positioned on the same place as the visible galactic disk but thicker. When researchers (Moni Bidei, et al.) looked for a dark matter disk, they did not find evidence for the dark disk. In contrast, Hajdukovic found that when the gravitational polarization of the quantum vacuum is taken into consideration, there should be no gravitational disk.

Fourth, when scientists observed two galaxy clusters (e.g., the bullet cluster) collide, the galaxies within the clusters passed by each other without interacting due to the large distances between galaxies. However, the plasma clouds - which are made of baryonic matter - between the galaxies did interact, so much so that they slowed each other down. Currently, the plasma clouds are located between the two galaxy clusters, while the clusters are moving past and away from each other. During this collision, dark matter and baryonic matter must have separated, since dark matter is collisionless. While this separation is compatible with CDM, it contradicts the predictions of MOND, in which (the illusion of) dark matter should be centered on baryonic matter. Hajdukovic explains that this separation should be compatible with the gravitational polarization of the quantum vacuum, although simulations are needed for confirmation.

Future

Although the theory is in the very early stages, some other scientists are hopeful that it can explain the universe better than current theories. Theoretical physicist Massimo Villata of the Observatory of Turin in Italy is investigating whether the gravitational repulsion between matter and antimatter can explain the universe's expansion without dark energy.

"I am confident that we are faced with an engaging explanation of the 'dark matter' phenomenon, especially now that gravitational repulsion between matter and antimatter has a theoretical basis and is no longer a mere, questionable assumption," he said.

Astrophysicist Michael Dopita of the Australian University in Canberra, who is also editor-in-chief of Astrophysics and Space Science, thinks that Hajdukovic's idea and others that have recently been proposed look promising. "Unlike Milgrom's Modified Newtonian Dynamics (MOND), the distribution of vacuum polarization will depend on the distribution of matter, so the apparent extra acceleration towards the center of mass will vary from one object to another, and as a function of position within the object," he said. "This is an idea which can be tested. All in all, we might conclude that what is sorely needed is a true quantum gravitational theory with a quantum granulation of spacetime."

In the future, Hajdukovic plans to further investigate another intriguing consequence that arises from his equations. When he extended one equation from describing the radius of a galactic dark matter halo to the radius of the entire observable universe (about 14 billion parsecs), the equation predicted the current dark matter content of the entire universe to be about 1.7×10^{23} solar masses, which is consistent with accepted estimates. However, Hajdukovic's equation has one important difference from the accepted ratio of baryonic to dark matter, which is currently estimated at about 1:5.

"The contemporary cosmology is based on the assumption that the ratio of baryonic to dark matter is a constant, not changing with time," he said. "If my theory is correct, this ratio decreases with the expansion of the universe. The solution of the cosmological equations must be different with a fixed and a variable ratio. It will be the subject of one of my future publications."

<http://nyti.ms/vGolZd>

Really? The Claim: Coffee Can Prevent Some Medications From Working

By ANAHAD O'CONNOR

THE FACTS *For many Americans, the thought of a morning without coffee is unbearable. More than half of adults drink it regularly, typically about three cups a day.*

Most people rarely consider side effects beyond restlessness or trouble falling asleep at night. But coffee and espresso can have other consequences in people taking certain drugs, by either blocking absorption or enhancing their effects.

In many cases, the interactions are caused by caffeine. But other compounds in coffee may also play a role. Studies show that more than a dozen medications - as varied as antidepressants, estrogen and thyroid and osteoporosis drugs - can be affected by coffee consumption.

A study in 2008, for example, found that people who drank coffee shortly before or after taking levothyroxine, a common thyroid medication, experienced a reduction of up to 55 percent in absorption of the drug. Other studies have found that coffee can reduce absorption of the osteoporosis drug alendronate by up to 60 percent, and that it can lower circulating levels of estrogen and other hormones in women.

Some prescription drugs can enhance the effects of coffee and other caffeinated drinks. A number of these drugs, including some antidepressants, antibiotics and birth control pills, block an enzyme known as CYP1A2, which helps metabolize caffeine. As a result, caffeine may persist in the body for several hours longer than normal. One study showed, for example, that women taking birth control pills held caffeine in their systems four hours longer than women who were not on the pill.

THE BOTTOM LINE Research shows that coffee can interact with some medications, though the extent varies by drug.

<http://medicalxpress.com/news/2011-11-vaccine-prototype-stronger-traditional-vaccines.html>

Researchers develop a vaccine prototype stronger than traditional vaccines

Researchers have created a vaccine that is more potent than traditional vaccines available today

Brigham and Women's Hospital (BWH) researchers have created a vaccine that is more potent than traditional vaccines available today. The glycoconjugate vaccine prototype is 100 times more effective than traditional glycoconjugate vaccines. Their work is published in the December 2011 issue of *Nature Medicine*.

A glycoconjugate vaccine is comprised of covalently bound carbohydrate and protein molecules, and is the standard design for many vaccines used to protect against common diseases such as pneumonia and meningitis. Researchers designed the vaccine prototype after discovering that immune cells, called T-cells, can recognize a vaccine's carbohydrates, and from that recognition elicit an immune response. This discovery challenges popular assumptions that immune cells only recognize the protein portion of glycoconjugate vaccines.

Proof that T-cells recognize carbohydrates came when researchers immunized mice with different types of glycoconjugate vaccines against the bacteria, group B *Streptococcus*. One group was immunized with vaccines containing different proteins. Another group was immunized with vaccines with the same proteins. For both groups, the carbohydrate chain in the vaccines was the same.

Researchers saw that mice given the vaccines with different proteins had just as good an immune response as those given vaccines with the same proteins - the variability in proteins did not change immune response. This told researchers that T-cells were recognizing carbohydrates to generate a consistent immune response. They further investigated the mechanisms responsible for how carbohydrate-containing glycoconjugate vaccines activate protective immunity to a bacterial infection.

"One thing that is tremendously novel here is that we were able to find T-cells within a mouse after immunization with a glycoconjugate [vaccine] that just recognized carbohydrates," said Dennis L. Kasper, MD, director of BWH's Channing Laboratory. "So these may be the first true carbohydrate-specific T-cells found."

The understanding that it was not only proteins, but also carbohydrates that were being recognized by cells led researchers to design a vaccine that yielded many carbohydrate particles when processed by the immune system - in turn creating a vaccine that generated a stronger immune response. Researchers believe that the more effective vaccine prototype they designed may one day assist in protecting high-risk populations susceptible of disease.

"For example, pneumococcal conjugate vaccines are good in children, but are not effective in protecting the elderly," explained Kasper. So we are hopeful that by designing vaccines like this, you'll make better vaccines that will be effective in all the at-risk populations."

Fikri Avci, PhD, lead study author and instructor in the Department of Medicine at BWH and Harvard Medical School adds that the findings on how the body's immune cells interact with carbohydrates will also lead to more effective vaccines in the future.

"Carbohydrates are among the most abundant and structurally diverse molecules in nature," said Avci. "They are extremely important in many biological functions. A better understanding of carbohydrate interaction is crucial. We are hoping that our findings will provide a framework for production of new-generation therapeutics and preventive medicines not only against bacterial infections, but also for cancer and viral diseases." *Provided by Brigham and Women's Hospital*

<http://nyti.ms/rDUBNR>

Cool, Clear Water

Q. *Is it really necessary to prevent patients from drinking water for many hours before surgery?*

By C. CLAIBORNE RAY

A. The well-known rule that a preoperative patient should have "nothing by mouth after midnight" was not based on scientific evidence, and many medical organizations now have more flexible guidelines. For example, American Society of Anesthesiologists guidelines generally permit clear liquids until two hours before surgery.

A ban on eating and drinking too close to the time of general anesthesia has a practical reason: to prevent aspiration of stomach contents, resulting in pneumonia. But it turns out that this problem is "rare in healthy patients having elective surgery," according to a 2000 survey of recommendations in the online journal *Update in Anesthesia*.

The midnight cutoff was applied to both eating and drinking sometime in the 1960s, "although the reasons for it have been lost in the mists of time," the authors wrote. Before that, clear liquids had long been permitted until two hours before surgery.

In the 1980s, randomized double-blind studies were begun to find out how long it takes to empty the stomach after eating or drinking, and the effects on patients. A 2003 review of many such studies found that "drinking clear fluids up to a few hours before surgery did not increase the risk of regurgitation during or after surgery" and that drinking water actually reduced gastric volume.

<http://nyti.ms/vwZKgc>

It Could Be Old Age, or It Could Be Low B12

Ilsa Katz was 85 when her daughter, Vivian Atkins, first noticed that her mother was becoming increasingly confused.

By JANE E. BRODY

"She couldn't remember names, where she'd been or what she'd done that day," Ms. Atkins recalled in an interview. "Initially, I was not too worried. I thought it was part of normal aging. But over time, the confusion and memory problems became more severe and more frequent."

Her mother couldn't remember the names of close relatives or what day it was. She thought she was going to work or needed to go downtown, which she never did. And she was often agitated.

A workup at a memory clinic resulted in a diagnosis of early Alzheimer's disease, and Ms. Katz was prescribed Aricept, which Ms. Atkins said seemed to make matters worse. But the clinic also tested Ms. Katz's blood level of vitamin B12. It was well below normal, and her doctor thought that could be contributing to her symptoms.

Weekly B12 injections were begun. "Soon afterward, she became less agitated, less confused and her memory was much better," said Ms. Atkins. "I felt I had my mother back, and she feels a lot better, too."

Now 87, Ms. Katz still lives alone in Manhattan and feels well enough to refuse outside assistance.

Still, her daughter wondered, "Why aren't B12 levels checked routinely, particularly in older people?"

It is an important question. As we age, our ability to absorb B12 from food declines, and often so does our consumption of foods rich in this vitamin. A B12 deficiency can creep up without warning and cause a host of confusing symptoms that are likely to be misdiagnosed or ascribed to aging.

A Vital Nutrient

B12 is an essential vitamin with roles throughout the body. It is needed for the development and maintenance of a healthy nervous system, the production of DNA and formation of red blood cells.

A severe B12 deficiency results in anemia, which can be picked up by an ordinary blood test. But the less dramatic symptoms of a B12 deficiency may include muscle weakness, fatigue, shakiness, unsteady gait, incontinence, low blood pressure, depression and other mood disorders, and cognitive problems like poor memory.

Labs differ in what they consider normal, but most authorities say a deficiency occurs when B12 levels in adults fall below 250 picograms per milliliter of blood serum. Like all B vitamins, B12 is water-soluble, but the body stores extra B12 in the liver and other tissues. Even if dietary sources are inadequate for some time, a serum deficiency may not show up for years. If the amount of B12 in storage is low to begin with, a deficiency can develop within a year, even more quickly in infants.

Recommended dietary amounts of B12 vary: 2.4 micrograms daily for those age 14 and older, 2.6 micrograms for pregnant women and 2.8 micrograms for nursing women. Barring circumstances that impair B12 absorption, these are levels easily obtained from a well-balanced diet containing animal protein.

In its natural form, B12 is present in significant amounts only in animal foods, most prominently in liver (83 micrograms in a 3.5-ounce serving). Good food sources include other red meats, turkey, fish and shellfish. Lesser amounts of the vitamin are present in dairy products, eggs and chicken.

Those at Risk

Natural plant sources are meager at best in B12, and the vitamin is poorly absorbed from them. Many strict vegetarians and all vegans, as well as infants they breast-feed, must consume supplements or fortified breakfast cereals to get adequate amounts. Certain organisms, like the bacterium *Spirulina* and some algae, contain a pseudo-B12 that the body cannot use but may result in a false reading of a normal B12 level on a blood test. Despite claims to the contrary, laver, a seaweed, and barley grass are not reliable sources of B12.

In animal foods, B12 is combined with protein and must be released by stomach acid and an enzyme to be absorbed. Thus, chronic users of acid-suppressing drugs like Prilosec, Prevacid and Nexium, as well as ulcer medications like Pepcid and Tagamet, are at risk of developing a B12 deficiency and often require a daily B12 supplement.

Stomach acid levels decline with age. As many as 30 percent of older people may lack sufficient stomach acid to absorb adequate amounts of B12 from natural sources. Therefore, regular consumption of fortified foods or supplementation with 25 to 100 micrograms of B12 daily is recommended for people over 50.

Synthetic B12, found in supplements and fortified foods, does not depend on stomach acid to be absorbed. But whether natural or synthetic, only some of the B12 consumed gets into the body. Treatment to correct a B12 deficiency typically involves much larger doses than the body actually requires.

Free B12 from both natural and synthetic sources must be combined with a substance in the stomach called intrinsic factor to be absorbed through the gut. This factor is lacking in people with an autoimmune disorder called pernicious anemia; the resulting vitamin deficiency is commonly treated with injections of B12.

Although most doctors are quick to recommend injections to correct a B12 deficiency, considerable evidence indicates that, in large enough doses, sublingual (under-the-tongue) tablets or skin patches of B12 may work as well as injections for people with absorption problems, even for those with pernicious anemia.

Most often, a daily supplement of 2,000 micrograms is recommended for about a month, then lowered to 1,000 micrograms daily for another month, then lowered again to 1,000 micrograms weekly. Sublingual B12 or B12 patches, or even B12 lollipops, can be helpful for people who require a supplement but cannot swallow pills.

Others at risk of developing a B12 deficiency include heavy drinkers (alcohol diminishes B12 absorption), those who have had stomach surgery for weight loss or ulcers, and people who take aminosalicic acid (for inflammatory bowel disease or tuberculosis) or the diabetes drug metformin (sold as Glucophage and other brands). Patients who take the anticonvulsants phenytoin, phenobarbital or primidone are also at risk.

Large doses of folic acid can mask a B12 deficiency and cause permanent neurological damage if normal levels of B12 are not maintained. Supplements of potassium impair B12 absorption in some people.

Although a B12 deficiency can raise blood levels of the amino acid homocysteine, a risk factor for heart disease and stroke, supplements of B12 have not reduced cardiovascular risk.

And while high homocysteine levels are linked to Alzheimer's disease and dementia, lowering them with B12 supplements has not been shown to improve cognitive function. However, in one study, among women with a poor dietary intake of B12, supplements of the vitamin significantly slowed the rate of cognitive decline.

<http://nyti.ms/tVy0Kk>

Patterns: Less Salt Isn't Always Better for the Heart

For years, experts have believed that lowering sodium consumption reduces the risk of heart disease. Now a large new study suggests that it may not be so simple.

By NICHOLAS BAKALAR

The scientists studied an international group of 28,880 men and women over age 55 at high risk for heart disease. They estimated salt intake by testing urine and followed the group for almost five years. The study appears in the Nov. 23 issue of *The Journal of the American Medical Association*.

The researchers found - unsurprisingly - that high sodium intake significantly increased the risk for heart problems.

But too little sodium was almost as bad as too much. Compared with those who excreted 4 to 6 grams of sodium daily, people who excreted 2 to 3 grams were at 19 percent greater risk for death from a cardiovascular event, and the less they consumed the greater their risk.

Nutritionists recommend a daily intake of 1.5 grams of salt for people with heart problems, a level that in this study increased the risk for cardiovascular death by 37 percent.

"It's still important to avoid consuming too much salt," said Andrew Mente, an author of the study and an assistant professor of epidemiology at McMaster University in Hamilton, Ontario. "But people who are consuming moderate amounts may not have to decrease their intake further."

<http://medicalxpress.com/news/2011-11-cancer-drug-scalpers-corner.html>

Cancer drug 'scalpers' corner US market

Pssst. Wanna buy some chemo drugs? A new trend in pharmaceutical sales has raised concerns over ethics and patient safety, as companies buy up critical cancer drugs in short supply and attempt to resell them at huge markups.

Rather than operate by the dark of night on street corners, these drug dealers work in broad daylight using fax, phone and email to deluge hospitals with offers. Experts say the so-called "gray market" is not illegal and could even be poised to surge further after President Barack Obama issued an executive order that tried to fix the problem, but may have just opened a larger loophole.

"These are a number of very small firms that have popped up out of nowhere. Most of them are relatively new," said Thomas Smith, director of palliative medicine at Johns Hopkins Medical Institutions. "It happens in every other market, we just don't expect it to happen in pharmaceuticals for cancer treatment," he told AFP.

More than half (56 percent) of the 549 hospitals surveyed by the non-profit Institute for Safe Medication Practices (ISMP) earlier this year said they received daily solicitations from gray market vendors "to purchase medications no longer available through the manufacturer or usual wholesaler." About half of hospitals surveyed (52 percent) admitted to buying one or more drugs from gray market vendors in the past two years, as manufacturers halted production of some generic drugs because they were no longer profitable.

"I would like to know why hospitals can't get these products, but the 'scalpers' can. It is unreal to have to deal with 'scalpers' in healthcare," said one survey respondent whose name was withheld by ISMP.

Drug prices ranged from 650 percent to 4,000 percent over the usual cost, said the survey, which referred to all kinds of pharmaceuticals, not just cancer drugs. Prescription drug shortages in the United States nearly tripled from 2005 to 2010, according to the Department of Health and Human Services. Just why drugs are falling out of production, particularly in cancer care, has to do with the extremely low price of generic medicines and the profit incentive that drives cancer doctors to prescribe costlier medications.

Oncologists get a portion of their pay by buying drugs wholesale and billing the government's Medicare behemoth for reimbursement, a practice that ended up paying US doctors more than they spent on the drugs by \$1.6 billion per year.

A law signed by president George W. Bush in 2003 tried to clamp down on inflated billing by ordering Medicare to pay doctors based on a drug's average selling price, plus six percent. Prices were also prohibited from rising more than six percent every six months. That limited the market's ability to respond to a shortage of a generic drug by increasing its price. Manufacturers were faced with limited demand and a 90 percent price drop for a generic drug. And cancer doctors were faced with a deep cut to their bottom line. "Why use paclitaxel (and receive six percent of \$312) when you can use Abraxane (for six percent of \$5,824)?" Smith wrote.

The rise of the gray market, viewed by experts as an unintended consequence of the Bush move, has sparked new worries about the safety of the drugs being re-sold, or that errors could be made in dosing adjustments if hospitals seek alternate medications.

It remains unknown exactly how many gray market drug vendors are out there. Five are being investigated by Congressman Elijah Cummings for offering breast, ovarian, colon and lung cancer drugs at vastly inflated prices. "Cummings said it is quite criminal, and if it's not, it should be," said spokeswoman Ashley Etienne. "It is unfortunate that these companies would take advantage of people in their most vulnerable state to make a profit."

Only one of those five, Allied Medical - which was singled out for offering a leukemia drug at over \$990 per vial when the usual price was \$12 - returned an AFP request for comment, but refused to grant an on-the-record interview.

"Recent media attention on prescription drug shortages highlights the vital role that Allied Medical Supply and other companies play to ensure that hospitals and patients have the medicines they need when they need them," it said in a statement.

Obama last month signed an executive order to require drug manufacturers to "provide adequate advance notice of manufacturing discontinuances that could lead to shortages of drugs that are life supporting or life sustaining."

Oncologist James Speyer, medical director of the Clinical Cancer Center at New York University Langone Medical Center, applauded the move as an important first step. But, he cautioned: "I don't think it is going to address every part of the problem. I believe, as do many colleagues, that the amount of money a company can charge for the drug plays a real role here."

Smith also described Obama's order as "a terrific start," but warned that it could make it easier for the gray market to function. "If it just requires manufacturers to report a drug shortage, then people who are making money off this will find an obvious entry," he said.

Europe has avoided the problem because oncologists do not have the incentive to administer more expensive drugs, and generics cost more while brand names generally cost 20 to 40 percent less than in the United States.

One solution could involve the US government partnering with cancer drug manufacturers the way it does with makers of low cost, unprofitable vaccines, to ensure companies are paid enough to supply the market, said Smith. "Manufacturers won't make the drugs unless they have a stable demand and a stable profit," he said.

http://www.eurekalert.org/pub_releases/2011-11/uog-cfi112911.php

Cobblestones fool innate immunity

Nanosized irregularities mimic body's natural structures

Coating the surface of an implant such as a new hip or pacemaker with nanosized metallic particles reduces the risk of rejection, and researchers at the University of Gothenburg, Sweden, can now explain why: they fool the innate immune system. The results are presented in the International Journal of Nanomedicine.

"Activation of the body's innate immune system is one of the most common reasons for an implant being rejected," explains Professor Hans Elwing from the University of Gothenburg's Department of Cell and Molecular Biology. "We can now show why the body more easily integrates implants with a nanostructured surface than a smooth one."

The researchers used a unique method to produce nanostructures on gold surfaces, creating gold particles just 10-18 nm in diameter and binding them to a completely smooth gold surface at carefully regulated distances. The result is something akin to a cobbled street in miniature.

Nanosized irregularities mimic body's natural structures

Giving implants this cobbled surface reduces the activation of important parts of the innate immune system. This is because several of the proteins involved are of a similar size to these nanosized cobbles, and so do not change in appearance when they land on the surface. This gives the body a greater ability to integrate foreign objects such as implants, pacemakers and drug capsules into its own tissues, as well as reducing the risk of local inflammation.

"It may be that the innate immune system is designed to react to smooth surfaces, because these are not found naturally in the body," says Elwing. "Some bacteria, on the other hand, do have a completely smooth surface."

Modern nanotechnology makes it easy and cheap to surface-treat implants and drug capsules, but it will probably be several years before this becomes a reality in human medicine. The focus now is on customising titanium implants of various kinds.

Surface can be graded

"We've developed a graded surface with different cobblestone package that we think can be used for bone implants," says Elwing. "Bone is very hard on the outside but then gets softer, so it would be good to have hard integration on the surface and softer integration underneath. We reckon we can make titanium screws that are denser at the head of the screw so that they fuse best at the top. This kind of customisation is the future."

Research into the body's innate immune system was rewarded this year with the Nobel Prize in Physiology or Medicine.

The laboratory work was carried out at the University of Gothenburg, and the project is a collaboration between the BIOMATCELL centre of excellence in Gothenburg, SP Technical Research Institute of Sweden in Borås and Bactiguard AB in Stockholm.

'Skin bones' helped large dinosaurs survive, new study says

Bones contained within the skin of some dinosaurs might have stored vital minerals to help the creatures survive tough times

Bones contained entirely within the skin of some of the largest dinosaurs on Earth might have stored vital minerals to help the massive creatures survive and bear their young in tough times, according to new research by a team including a University of Guelph scientist. Guelph biomedical scientist Matthew Vickaryous co-authored a paper published today in Nature Communications about two sauropod dinosaurs - an adult and a juvenile - from Madagascar.

The study suggests that these long-necked plant-eaters used hollow "skin bones" called osteoderms to store minerals needed to maintain their huge skeletons and to lay large egg clutches. Sediments around the fossils show that the dinosaurs' environment was highly seasonal and semi-arid, with periodic droughts causing massive die-offs.

"Our findings suggest that osteoderms provided an internal source of calcium and phosphorus when environmental and physiological conditions were stressful," he said. As a researcher in the Department of Biomedical Sciences in Guelph's Ontario Veterinary College, Vickaryous studies how skeletons develop, regenerate and evolve.

He worked with paleontologist Kristina Curry Rogers and geologist Raymond Rogers at Macalaster College in Minnesota, and paleontologist Michael D'Emic, now at Georgia Southern University on the study. Vickaryous helped to interpret the results of CT scans and fossilized tissue cores taken from the dinosaurs.

Shaped like footballs sliced lengthwise and about the size of a gym bag in the adult, these bones are the largest osteoderms ever identified. The adult specimen's bone was hollow, likely caused by extensive bone remodelling, said Vickaryous.

Osteoderms were common among armoured dinosaurs. Stegosaurus had bony back plates and tail spikes, and ankylosaurs sported heavily armoured bodies and bony tail clubs. Today these "skin bones" appear in such animals as alligators and armadillos.

Such bones were rare among sauropod dinosaurs and have appeared only in titanosaurs. These massive plant-eaters included the largest-ever land animals. "This is the only group of long-necked sauropods with osteoderms," he said.

Other studies have shown that female titanosaurs laid dozens of volleyball-sized eggs. Modern crocodiles and alligators also lay clutches of dozens of eggs and are known to reabsorb minerals from their osteoderms.

The researchers found the new osteoderms along with two skeletons of the titanosaur Rapetosaurus. Unlike the hollow adult specimen, the juvenile specimen was solid and showed little evidence of remodelling. That suggests that osteoderms became more important mineral stores as the animals grew, Vickaryous said.

<http://bit.ly/tLzuGj>

Ravens use gestures to grab each other's attention

How do you capture a raven's heart? Arrest its attention by showing it a twig or stone. Ravens use referential gestures – one of the foundations of human language - to initiate relationships.

16:01 29 November 2011 by Linda Geddes

From an early age we learn to use referential gestures such as pointing to direct another's attention. "People think that this pointing forms the basis of language," says Simone Pika at the Max Planck Institute for Ornithology in Seewiesen, Germany. "It has also been linked with mental-state attribution – the idea that you understand what I am pointing out."

Apes raised in captivity can learn to use referential gestures to communicate with their human caregivers. Now Pika and Thomas Bugnyar at the University of Vienna, Austria, have recorded common ravens (*Corvus corax*) using them for the first time.

The researchers observed seven pairs of wild ravens showing and offering stones, twigs and moss to each other – by holding the object in their beaks – in an apparent attempt to grab the attention of another bird and initiate a relationship. Importantly, the ravens made these gestures only when another bird was watching, and the items they show and offer are not food. They usually gesture only to members of the opposite sex.

Like humans, ravens form monogamous pairs that will defend a territory and raise their young together. They even develop a repertoire of vocalisations that are exclusive to the couple.

This high degree of cooperation may be what prompted the evolution of referential gestures in both humans and ravens, Pika says. "If communication is governed by cooperation, then this could be what prompted the evolution of language."

Rachel Shaw of the University of Cambridge says that the conclusions, although fascinating, should be viewed with caution. Although it might look like the birds are attempting to redirect the attention of another bird, the behaviour might simply be a mating or nesting ritual triggered by a peak in hormones, she says.

Alex Kacelnik at the University of Oxford would like to know whether the ravens have as much flexibility as humans in their range of gestures and responses: "If both sender and receiver use a small, rigid set of targets, and fixed actions for responding, then the interactions could have more in common with classic avian communication systems than with human attention-sharing."

Journal reference: *Nature Communications*, DOI: 10.1038/ncomms1567

<http://www.wired.com/wiredscience/2011/11/the-cognitive-benefits-of-chewing-gum/>

The Cognitive Benefits Of Chewing Gum

Why do people chew gum? If an anthropologist from Mars ever visited a typical supermarket, they'd be confounded by those shelves near the checkout aisle that display dozens of flavored gum options.

By Jonah Lehrer Email Author

Chewing without eating seems like such a ridiculous habit, the oral equivalent of running on a treadmill. And yet, people have been chewing gum for thousands of years, ever since the ancient Greeks began popping wads of mastic tree resin in their mouth to sweeten the breath. Socrates probably chewed gum.

It turns out there's an excellent rationale for this long-standing cultural habit: Gum is an effective booster of mental performance, conferring all sorts of benefits without any side effects. The latest investigation of gum chewing comes from a team of psychologists at St. Lawrence University. The experiment went like this: 159 students were given a battery of demanding cognitive tasks, such as repeating random numbers backward and solving difficult logic puzzles. Half of the subjects chewed gum (sugar-free and sugar-added) while the other half were given nothing. Here's where things get peculiar: Those randomly assigned to the gum-chewing condition significantly outperformed those in the control condition on five out of six tests. (The one exception was verbal fluency, in which subjects were asked to name as many words as possible from a given category, such as "animals.") The sugar content of the gum had no effect on test performance.

While previous studies achieved similar results - chewing gum is often a better test aid than caffeine - this latest research investigated the time course of the gum advantage. It turns out to be rather short lived, as gum chewers only showed an increase in performance during the first 20 minutes of testing. After that, they performed identically to non-chewers.

What's responsible for this mental boost? Nobody really knows. It doesn't appear to depend on glucose, since sugar-free gum generated the same benefits. Instead, the researchers propose that gum enhances performance due to "mastication-induced arousal." The act of chewing, in other words, wakes us up, ensuring that we are fully focused on the task at hand. Unfortunately, this boost is fleeting. The takeaway of this research is straightforward: When taking a test, save the gum for the hardest part, or for those questions when you feel your focus flagging. The gum will help you concentrate, but the help won't last long.

This latest paper only adds to the impressive body of psychological literature on gum. Last month, scientists at Coventry University found that people chewing mint gum showed a dramatic decrease in feelings of sleepiness. The subjects also looked less exhausted when assessed with the Pupillographic Sleepiness Test (PST), which uses the oscillations of the pupils as a metric of tiredness. When we chew gum, we gain alertness and attention, but without the jitters.

And then there's this paper, from a researcher at Cardiff University. 133 volunteers were given cognitive tests with and without chewing gum. (They were also randomly assigned gum flavors, treated to a selection of fruits and mints.) Approximately half of the volunteers were tested while listening to a screeching noise - this was the stress condition - while the other volunteers took the test in a quiet room. After each testing session, the volunteers rated their mood and underwent a number of physiological measurements, including heart rate and salivary cortisol levels. (Cortisol is a stress hormone, but it's also a good indicator of alertness.) As expected, gum chewers were more attentive than non-chewers, with elevated heart rates and cortisol levels. They also had much faster reaction times, especially on more difficult reaction tests. They even appeared to be in a better mood.

Given the uncanny power of gum, it seems a little silly that we don't allow it in the classroom. (If a pill achieved these same results, we'd all be popping it.) Of course, gum is disgusting and unsightly once it becomes litter, but it also appears to be a wonderful stimulant, allowing us to benefit from the attentional boost of eating without having to swallow or ingest calories. (Plus, fresh breath!) A recent review of the gum-chewing literature summarizes the science: "Gum appears to be a functional food with function but no food."

via bakadesuyo

PS. @ResearchDigest points out that another new paper on gum chewing that found chewing decreased performance on tests of short-term memory that involve serial recall. Tapping with the hands achieved the same results, suggesting that the rhythmic pulse of bodily movement might interfere with the memorization of ordered lists.

<http://news.discovery.com/animals/chimps-self-medicate-111129.html>

Chimpanzees Self-Medicate With Food

Chimps, like humans, learn from each other what foods can help cure what ails them.

By Jennifer Viegas | Tue Nov 29, 2011 01:32 PM ET

An extensive look at what chimpanzees consume each day reveals that many of the plants they consume aren't for nutrition but are likely ingested for medicinal purpose. The findings, published in the journal *Physiology & Behavior*, indicate that the origins of medicine go way back, beyond the human species.

"We conclude that self-medication may have appeared in our ancestors in association with high social tolerance and lack of herbivorous gut specialization," lead author Shelly Masi and her colleagues write.

Masi, a researcher at the National Museum of Natural History in Paris, and her team recorded the items consumed by a community of over 40 wild chimpanzees at Kibale National Park, Uganda. They also documented the availability of the foods, as well as the social interactions between the chimps.

They also documented the same information for about a dozen wild western gorillas in Dzanga-Ndoki National Park, Central African Republic.

Unusual food consumption in chimpanzees, meaning foods not normally associated with nutritional needs, was twice as high as it was for gorillas. Gorillas turn out to have more specialized guts that are better capable of detoxifying harmful compounds, making them have less of a need to self-medicate than chimps and humans may need to.

Chimpanzees and people are extremely social and both learn from each other, including what to eat. "Older and more successful individuals (such as those that are high ranking) are expected to be the best model to copy, and are mainly responsible for generating and transmitting food traditions," according to the authors.

Analysis of the mostly non-nutritional and sometimes slightly toxic foods consumed determined that most had medicinal properties. Based on the study, the chimpanzee medicine chest appears to include the following: *Antiaris toxicaria* leaves (anti-tumor), *Cordia abyssinica* pith (anti-malarial and anti-bacterial), *Ficus capensis* (anti-bacterial), *Ficus natalensis* bark (anti-diarrheal), *Ficus urceolaris* leaves (de-worming agent), and many more. The primates seemed to strategically go for the medicinal parts of these plants, and would consume them even when other more nutritious and palatable foods were available.

While chimps and humans appear to be the world's most self-medicating animals, another new study, accepted for publication in the journal *Small Ruminant Research*, documents how both wild and domesticated herbivores also consume plants for medical reasons.

Juan Villalba of Utah State University's Department of Wildland Resources, and co-author Serge Landau of Israel's Volcani Center explain how goats sometimes nibble on the anti-parasitic plant *Albizia anthelmintica*. This was "followed by expulsion of worms in the feces and alleviation" of the worm problem.

Stacy Lindshield, an Iowa State University researcher, also identified a medicated body scratcher invented by wild spider monkeys. "Spider monkeys have been observed rubbing crushed and chewed leaves on their bodies," Lindshield told *Discovery News*, explaining that "some primates select plants or invertebrates with chemical properties." In addition to medicinal purposes, she said the resulting smelly ointment might also facilitate olfactory communication.

Julio Mercader, a University of Calgary archaeologist, told *Discovery News* that he believes such medicinal and otherwise useful plant "tools" merit study via a new interdisciplinary field of primate archaeology. He said, "We used to think that culture and, above anything else, technology was the exclusive domain of humans, but this is not the case."

<http://news.discovery.com/animals/what-chimps-self-medicate-with-111129.html>

Why Chimps Eat Dead Wood and Other Plants

Chimpanzees self-medicate, suggests a new study in the journal Physiology & Behavior

By Jennifer Viegas | Tue Nov 29, 2011 01:43 PM ET

Chimpanzees self-medicate, suggests a new study in the journal *Physiology & Behavior*, which also mentions many of their consumed plants with medicinal properties.

Lead author Shelly Masi of the National Museum of Natural History in Paris and her team point out that chimpanzees and other primates learn to consume such plants by copying the eating habits of other older and

highly ranked individuals. The chimps may not directly link the consumption with treating a particular illness, but they probably just know that this plant has some value because so-and-so ate it and is doing well.

While some of these plants are also used as medicines by humans, many can be toxic. *Antiaris toxicaria*, for example, is also utilized as a dart poison.

Therefore, it has to be said that you should not consume these mentioned plants without expert guidance. That's one reason medical research is so important. Scientists can isolate the effective medicinal compounds of such plants while removing their more dangerous agents. **Here is the list:**

<i>Aneilema aequinoctiale</i>	leaves	de-wormer
<i>Antiaris toxicaria</i>	leaves	anti-tumor
<i>Bosqueia phoberos</i>	leaves	anti-bacterial
<i>Chaetacme aristata</i>	bark	anti-bacterial
<i>Cordia abyssinica</i>	pith	anti-malarial, anti-tuberculosis, anti-bacterial
<i>Diospyros abyssinica</i>	leaves	multiple biological activities
<i>Ficus capensis</i>	leaves	anti-bacterial and multiple biological activities
<i>Ficus exasperata</i>	unripe fruits	de-worming agent, reduces stomach acids
<i>Ficus natalensis</i>	bark	anti-bacterial
<i>Ficus stipulifera</i>	leaves	anti-malarial, anti-bacterial
<i>Ficus urceolaris /Ficus asperifolia</i>	leaves	dewormer
<i>Illigera pentaphylla</i>	leaves	anti-bacterial, anti-malarial
<i>Jasminum abyssinicum</i>	leaves	de-wormer
<i>Lepisanthes senegalensis</i>	leaves	anti-malarial
<i>Mimusops bagshawei</i>	leaves	anti-malarial
<i>Monodora myristica</i>	leaves	de-wormer, anti-malarial
<i>Myrianthus arboreus</i>	leaves	anti-malarial
<i>Neoboutonia macrocalyx</i>	dead wood	many biological properties
<i>Olea welwitschii</i>	leaves	anti-malarial, other properties
<i>Parinari excelsa</i>	leaves	numerous biological properties
<i>Phytolacca dodecandra</i>	unripe fruits	anti-viral, spermicidal and more
<i>Psychotria mahonii</i>	root	anti-malarial
<i>Pterygota mildbraedii</i>	leaves	anti-bacterial
<i>Rothmannia urcelliformis</i>	leaves	anti-bacterial
<i>Rubia cordifolia</i>	leaves	de-wormer
<i>Solanecio manii</i>	pith	several biological properties
<i>Teclea nobilis</i>	root	anti-malarial
<i>Trichilia rubescens</i>	leaves	anti-bacterial and more

http://www.eurekalert.org/pub_releases/2011-11/foas-sbt113011.php

Simple blood test diagnoses Parkinson's disease long before symptoms appear
New research in the FASEB Journal suggests that phosphorylated alpha-synuclein, a substance found in the blood of Parkinson's patients, could lead to definitive diagnostic tool

Bethesda, MD - A new research report appearing in the December issue of the FASEB Journal (<http://www.fasebj.org>) shows how scientists from the United Kingdom have developed a simple blood test to detect Parkinson's disease even at the earliest stages. The test is possible because scientists found a substance in the blood, called "phosphorylated alpha-synuclein," which is common in people with Parkinson's disease, and then developed a way to identify its presence in our blood.

"A blood test for Parkinson's disease would mean you could find out if a person was in danger of getting the disease, before the symptoms started," said David Allsop, Ph.D., a researcher involved in the work from the Division of Biomedical and Life Sciences and the School of Health and Medicine at the University of Lancaster, in Lancaster, UK. "This would help the development of medicines that could protect the brain, which would be better for the quality of life and future health of older people."

To develop the blood test for Parkinson's disease, Allsop and colleagues studied a group of people diagnosed with the disease and a second group of healthy people of a similar age. Blood samples from each group were analyzed to determine the levels of phosphorylated alpha-synuclein present. They found those with Parkinson's disease had increased levels of the substance. Based upon these findings, researchers developed a blood test that

detects the presence of phosphorylated alpha-synuclein, which could allow for diagnosis of the disease well before symptoms appear but when brain damage has already begun to occur.

"When most people think of Parkinson's disease, they think of the outward symptoms, such as involuntary movements," said Gerald Weissmann, M.D., Editor-in-Chief of the FASEB Journal, "but many people with Parkinson's also develop neurological problems that may be more difficult to detect right away. Having a blood test not only helps doctors rule out other possible causes of the outward symptoms, but it also allows for early detection which can help patients and their caregivers prepare for the possibility of the mental, emotional, and behavioral problems that the disease can cause."

Details: Penelope G. Foulds, J. Douglas Mitchell, Angela Parker, Roisin Turner, Gerwyn Green, Peter Diggie, Masato Hasegawa, Mark Taylor, David Mann, and David Allsop. Phosphorylated α -synuclein can be detected in blood plasma and is potentially a useful biomarker for Parkinson's disease. FASEB J. December 2011 25:4127-4137; doi:10.1096/fj.10-179192 ; <http://www.fasebj.org/content/25/12/4127.abstract>

http://www.eurekalert.org/pub_releases/2011-11/bc-mdp112911.php

MAKS: Drug-free prevention of dementia decline

New research shows that a regime of behavioral and mental exercises was able to halt the progression of dementia

There are many different causes of dementia and, although its progression can be fast or slow, it is always degenerative. Symptoms of dementia include confusion, loss of memory, and problems with speech and understanding. It can be upsetting for both the affected person and their relatives and carers. New research published in BioMed Central's open access journal BMC Medicine shows that a regime of behavioral and mental exercises was able to halt the progression of dementia.

Researchers led by Prof. Graessel, from Friedrich-Alexander-Universität Erlangen, included in their study patients with dementia from five nursing homes in Bavaria. After random selection, half the patients were included on the year-long MAKS 'intervention' consisting of two hours of group therapy, six days a week. In addition all patients maintained their normal treatment and regular activities provided by the nursing home.

The MAKS system consists of motor stimulation(M), including games such as bowling, croquet, and balancing exercises; cognitive stimulation (K), in the form of individual and group puzzles; and practicing 'daily living' activities (A), including preparing snacks, gardening and crafts. The therapy session began with a ten minute introduction, which the researchers termed a 'spiritual element' (S), where the participants discussed topics like 'happiness', or sang a song or hymn.

After 12 months of therapy the MAKS group maintained their level on the Alzheimer's Disease Assessment Scale (ADAS) and, even more importantly maintained their ability to carry out activities of daily living, while the control group all showed a decrease in cognitive and functional ability.

Prof. Graessel explained, "While we observed a better result for patients with mild to moderate dementia, the result of MAKS therapy on ADAS (cognitive function) was at least as good as treatment with cholinesterase inhibitors. Additionally we found that the effect on the patients' ability to perform daily living tasks (as measured by the Erlanger Test of Daily Living (E-ADL)) was twice as high as achieved by medication. This means that MAKS therapy is able to extend the quality of, and participation in, life for people with dementia within a nursing home environment. We are currently in the process of extending these preliminary results to see if this prevention of dementia decline can be maintained over a longer time period."

1. Non-pharmacological, multicomponent group therapy in patients with degenerative dementia: a 12-month randomised, controlled trial Elmar Graessel, Renate Stemmer, Birgit Eichenseer, Sabine Pickel, Carolin Donath, Johannes Kornhuber and Katharina Luttenberger BMC Medicine (in press)

http://www.eurekalert.org/pub_releases/2011-11/plos-o112811.php

Trail of 'stone breadcrumbs' reveals the identity of 1 of the first human groups to leave Africa

New archaeological discoveries in Oman reveals the timing and identity of one of the first modern human groups to migrate out of Africa

A series of new archaeological discoveries in the Sultanate of Oman, nestled in the southeastern corner of the Arabian Peninsula, reveals the timing and identity of one of the first modern human groups to migrate out of Africa, according to a research article published in the open-access journal PLoS ONE.

An international team of archaeologists and geologists working in the Dhofar Mountains of southern Oman, led by Dr. Jeffrey Rose of the University of Birmingham, report finding over 100 new sites classified as "Nubian Middle Stone Age (MSA)." Distinctive Nubian MSA stone tools are well known throughout the Nile Valley; however, this is the first time such sites have ever been found outside of Africa.

According to the authors, the evidence from Oman provides a "trail of stone breadcrumbs" left by early humans migrating across the Red Sea on their journey out of Africa. "After a decade of searching in southern Arabia for some clue that might help us understand early human expansion, at long last we've found the smoking gun of their exit from Africa," says Rose. "What makes this so exciting," he adds, "is that the answer is a scenario almost never considered."

These new findings challenge long-held assumptions about the timing and route of early human expansion out of Africa. Using a technique called Optically Stimulated Luminescence (OSL) to date one of the sites in Oman, researchers have determined that Nubian MSA toolmakers had entered Arabia by 106,000 years ago, if not earlier. This date is considerably older than geneticists have put forth for the modern human exodus from Africa, who estimate the dispersal of our species occurred between 70,000 and 40,000 years ago.



Nubian Type 1 core from Oman, the first time this particular stone tool technology has been found outside of Africa.
Credit: Yamandu Hilbert Rose JI, Usik VI, Marks AE, Hilbert YH, Galletti CS, et al. (2011) The Nubian Complex of Dhofar, Oman: An African Middle Stone Age Industry in Southern Arabia. PLoS ONE 6(11): e28239. doi:10.1371/journal.pone.0028239

Even more surprising, all of the Nubian MSA sites were found far inland, contrary to the currently accepted theory that envisions early human groups moving along the coast of southern Arabia. "Here we have an example of the disconnect between theoretical models versus real evidence on the ground," says co-author Professor Emeritus Anthony Marks of Southern Methodist University. "The coastal expansion hypothesis looks reasonable on paper, but there is simply no archaeological evidence to back it up. Genetics predict an expansion out of Africa after 70,000 thousand years ago, yet we've seen three separate discoveries published this year with evidence for humans in Arabia thousands, if not tens of thousands of years prior to this date."

The presence of Nubian MSA sites in Oman corresponds to a wet period in Arabia's climatic history, when copious rains fell across the peninsula and transformed its barren deserts to sprawling grasslands. "For a while," remarks Rose, "South Arabia became a verdant paradise rich in resources – large game, plentiful freshwater, and high-quality flint with which to make stone tools." Far from innovative fishermen, it seems that early humans spreading from Africa into Arabia were opportunistic hunters traveling along river networks like highways. Whether or not these pioneers were able to survive in Arabia during the hyperarid conditions of the Last Ice Age is another matter – a mystery that will require archaeologists to continue combing the deserts of southern Arabia, hot on the trail of stone breadcrumbs.

The Dhofar Archaeological Project is conducted under the auspices of the Ministry of Heritage and Culture in Oman. The team is comprised of an interdisciplinary group of researchers from the University of Birmingham and Oxford Brookes University, UK; Arizona State University and Southern Methodist University, USA; Institute of Archaeology, National Academy of Sciences, Ukraine; Institute of Archaeology of the Academy of Science, Czech Republic; University of Tübingen, Germany, and the University of Wollongong, Australia. The project is funded by research grants from the UK Arts and Humanities Research Council and the Australian Research Council.

Citation: Rose JI, Usik VI, Marks AE, Hilbert YH, Galletti CS, et al. (2011) The Nubian Complex of Dhofar, Oman: An African Middle Stone Age Industry in Southern Arabia. PLoS ONE 6(11): e28239. doi:10.1371/journal.pone.0028239

http://www.eurekalert.org/pub_releases/2011-11/acs-sfa113011.php

Stinky frogs are a treasure trove of antibiotic substances

The nastiest smelling creatures have skin that produces the greatest known variety of anti-bacterial substances

Some of the nastiest smelling creatures on Earth have skin that produces the greatest known variety of anti-bacterial substances that hold promise for becoming new weapons in the battle against antibiotic-resistant infections, scientists are reporting. Their research on amphibians so smelly (like rotten fish, for instance) that scientists term them "odorous frogs" appears in ACS' Journal of Proteome Research.

Yun Zhang, Wen-Hui Lee and Xinwang Yang explain that scientists long have recognized frogs' skin as a rich potential source of new antibiotics. Frogs live in warm, wet places where bacteria thrive and have adapted skin that secretes chemicals, known as peptides, to protect themselves from infections. Zhang's group wanted to identify the specific antimicrobial peptides (AMPs), and the most potent to give scientists clues for developing new antibiotics.

They identified more than 700 of these substances from nine species of odorous frogs and concluded that the AMPs account for almost one-third of all AMPs found in the world, the greatest known diversity of these germ-

killing chemicals. Interestingly, some of the AMPs have a dual action, killing bacteria directly and also activating the immune system to assist in the battle.

The authors acknowledge funding from the National Basic Research Program of China and The National Natural Science Foundation of China.

http://www.eurekalert.org/pub_releases/2011-11/rpi-sts113011.php

Setting the stage for life: Scientists make key discovery about the atmosphere of early Earth

Scientists in the New York Center for Astrobiology at Rensselaer Polytechnic Institute have used the oldest minerals on Earth to reconstruct the atmospheric conditions present on Earth very soon after its birth.

Troy, N.Y. - The findings, which appear in the Dec. 1 edition of the journal *Nature*, are the first direct evidence of what the ancient atmosphere of the planet was like soon after its formation and directly challenge years of research on the type of atmosphere out of which life arose on the planet.

The scientists show that the atmosphere of Earth just 500 million years after its creation was not a methane-filled wasteland as previously proposed, but instead was much closer to the conditions of our current atmosphere. The findings, in a paper titled "The oxidation state of Hadean magmas and implications for early Earth's atmosphere," have implications for our understanding of how and when life began on this planet and could begin elsewhere in the universe. The research was funded by NASA.

For decades, scientists believed that the atmosphere of early Earth was highly reduced, meaning that oxygen was greatly limited. Such oxygen-poor conditions would have resulted in an atmosphere filled with noxious methane, carbon monoxide, hydrogen sulfide, and ammonia. To date, there remain widely held theories and studies of how life on Earth may have been built out of this deadly atmosphere cocktail.

Now, scientists at Rensselaer are turning these atmospheric assumptions on their heads with findings that prove the conditions on early Earth were simply not conducive to the formation of this type of atmosphere, but rather to an atmosphere dominated by the more oxygen-rich compounds found within our current atmosphere - including water, carbon dioxide, and sulfur dioxide. "We can now say with some certainty that many scientists studying the origins of life on Earth simply picked the wrong atmosphere," said Bruce Watson, Institute Professor of Science at Rensselaer.

The findings rest on the widely held theory that Earth's atmosphere was formed by gases released from volcanic activity on its surface. Today, as during the earliest days of the Earth, magma flowing from deep in the Earth contains dissolved gases. When that magma nears the surface, those gases are released into the surrounding air.

"Most scientists would argue that this outgassing from magma was the main input to the atmosphere," Watson said. "To understand the nature of the atmosphere 'in the beginning,' we needed to determine what gas species were in the magmas supplying the atmosphere."

As magma approaches the Earth's surface, it either erupts or stalls in the crust, where it interacts with surrounding rocks, cools, and crystallizes into solid rock. These frozen magmas and the elements they contain can be literal milestones in the history of Earth. One important milestone is zircon. Unlike other materials that are destroyed over time by erosion and subduction, certain zircons are nearly as old as the Earth itself. As such, zircons can literally tell the entire history of the planet - if you know the right questions to ask.

The scientists sought to determine the oxidation levels of the magmas that formed these ancient zircons to quantify, for the first time ever, how oxidized were the gases being released early in Earth's history. Understanding the level of oxidation could spell the difference between nasty swamp gas and the mixture of water vapor and carbon dioxide we are currently so accustomed to, according to study lead author Dustin Trail, a postdoctoral researcher in the Center for Astrobiology. "By determining the oxidation state of the magmas that created zircon, we could then determine the types of gases that would eventually make their way into the atmosphere," said Trail.

To do this Trail, Watson, and their colleague, postdoctoral researcher Nicholas Tailby, recreated the formation of zircons in the laboratory at different oxidation levels. They literally created lava in the lab. This procedure led to the creation of an oxidation gauge that could then be compared with the natural zircons.

During this process they looked for concentrations of a rare Earth metal called cerium in the zircons. Cerium is an important oxidation gauge because it can be found in two oxidation states, with one more oxidized than the other. The higher the concentrations of the more oxidized type cerium in zircon, the more oxidized the atmosphere likely was after their formation.

The calibrations reveal an atmosphere with an oxidation state closer to present-day conditions. The findings provide an important starting point for future research on the origins of life on Earth.

"Our planet is the stage on which all of life has played out," Watson said. "We can't even begin to talk about life on Earth until we know what that stage is. And oxygen conditions were vitally important because of how they affect the types of organic molecules that can be formed."

Despite being the atmosphere that life currently breathes, lives, and thrives on, our current oxidized atmosphere is not currently understood to be a great starting point for life. Methane and its oxygen-poor counterparts have much more biologic potential to jump from inorganic compounds to life-supporting amino acids and DNA. As such, Watson thinks the discovery of his group may reinvigorate theories that perhaps those building blocks for life were not created on Earth, but delivered from elsewhere in the galaxy.

The results do not, however, run contrary to existing theories on life's journey from anaerobic to aerobic organisms. The results quantify the nature of gas molecules containing carbon, hydrogen, and sulfur in the earliest atmosphere, but they shed no light on the much later rise of free oxygen in the air. There was still a significant amount of time for oxygen to build up in the atmosphere through biologic mechanisms, according to Trail.

http://www.sciencenews.org/view/generic/id/336525/title/Immune_booster_also_works_in_reverse

Immune booster also works in reverse

Interleukin-2 calms runaway reactions

By Nathan Seppa

A multitasking immune protein once pursued as a treatment to rev up the body's defenses might work better at toning them down. The compound, called interleukin-2, can halt and even reverse aberrant immune reactions where standard treatment has failed, French and U.S. research teams report in the Dec. 1 New England Journal of Medicine.

Interleukin-2, or IL-2, is a signaling protein that has been approved for use against cancer and was also tried as an immune booster for fighting HIV, the AIDS virus. But despite some success against melanoma and kidney cancer, IL-2 has been a disappointment. It turns out that IL-2 does more than send immune fighters into battle. It also ratchets down these defenses by triggering production of T regulatory cells, or T-regs, which keep other immune troops in line. That quality could benefit patients with disorders in which the immune system attacks healthy tissues, such as lupus, multiple sclerosis or rheumatoid arthritis.

Both new studies take advantage of IL-2's alter ego. Low-dose injections of the protein boosted T-reg levels, dampening immunity and improving symptoms in half of the U.S. patients, who had complications arising from bone marrow transplants, and in nearly all of the French patients, who had problems related to hepatitis C.

Although the small studies are "more like case reports," the early findings could signal a major shift in IL-2 use, says Jeffrey Bluestone, an immunologist at the University of California, San Francisco who wasn't involved in the studies. "It might be a tricky balancing act, but perhaps IL-2 at the right doses at the right times can promote T-regs preferentially" and quell immune mutiny.

The researchers in France identified 10 hepatitis C patients who had a reaction called vasculitis in which their immune systems unleash rogue antibodies that damage blood vessels. Giving the patients daily IL-2 injections on and off over 10 weeks improved symptoms in eight of the 10 patients. Levels of T-regs in these patients more than tripled during IL-2 treatment, but levels of the hepatitis C virus in the patients also fell, suggesting that the treatment didn't shut off normal defenses, says study coauthor David Klatzmann, an immunologist at Pierre and Marie Curie University in Paris.

In the U.S. study, hematologist John Koreth of the Dana-Farber Cancer Institute in Boston and his colleagues monitored 23 people who had received a bone marrow transplant for leukemia or lymphoma. In these people, the donor cells were attacking their new host, a complication called graft-versus-host disease. Steroids or other medication had failed to control the condition.

IL-2 injections over eight weeks stabilized the graft-versus-host disease in 11 of the patients and relieved symptoms in the other 12, who showed fewer skin lesions, improved liver function and better mobility. Ten patients have continued on IL-2 for the long term, and some of them no longer need immune suppressant drugs, Koreth says.

Previous attempts to use T-regs directly as a treatment proved complicated since that required growing the cells in culture. Simply giving low doses of IL-2 lets the body do that work, says Thomas Malek, an immunologist at the University of Miami who wasn't involved in the studies. The key, he says, will be careful dosing of IL-2 to ensure, with its multiple talents, that it doesn't switch on the wrong immune cells.

Klatzmann's team has now turned to using IL-2 against type 1 diabetes, while the Boston scientists are exploring the use of IL-2 earlier in the course of graft-versus-host disease.

How animals predict earthquakes

Animals may sense chemical changes in groundwater that occur when an earthquake is about to strike.

By Victoria Gill Science reporter, BBC Nature

This, scientists say, could be the cause of bizarre earthquake-associated animal behaviour.

Researchers began to investigate these chemical effects after seeing a colony of toads abandon its pond in L'Aquila, Italy, in 2009 - days before a quake. They suggest that animal behaviour could be incorporated into earthquake forecasting.

The team's findings are published in the International Journal of Environmental Research and Public Health. In this paper, they describe a mechanism whereby stressed rocks in the Earth's crust release charged particles that react with the groundwater.

Animals that live in or near groundwater are highly sensitive to any changes in its chemistry, so they might sense this days before the rocks finally "slip" and cause a quake.

The team, led by Friedemann Freund from Nasa and Rachel Grant from the UK's Open University hope their hypothesis will inspire biologists and geologists to work together, to find out exactly how animals might help us recognise some of the elusive signs of an imminent earthquake.

Strange behaviour

The L'Aquila toads are not the first example of strange animal behaviour before a major seismic event. There have been reports throughout history of reptiles, amphibians and fish behaving in unusual ways just before an earthquake struck.

In 1975, in Haicheng, China, for example, many people spotted snakes emerging from their burrows a month before the city was hit by a large earthquake. This was particularly odd, because it occurred during the winter. The snakes were in the middle of their annual hibernation, and with temperatures well below freezing, venturing outside was suicide for the cold-blooded reptiles.

But each of these cases - of waking reptiles, fleeing amphibians or deep-sea fish rising to the surface - has been an individual anecdote. And major earthquakes are so rare that the events surrounding them are almost impossible to study in detail. This is where the case of the L'Aquila toads was different.

Toad exodus

Ms Grant, a biologist from the Open University, was monitoring the toad colony as part of her PhD project. "It was very dramatic," she recalled. "It went from 96 toads to almost zero over three days."

Ms Grant published her observations in the Journal of Zoology.

"After that, I was contacted by Nasa," she told BBC Nature.

Scientists at the US space agency had been studying the chemical changes that occur when rocks are under extreme stress. They wondered if these changes were linked to the mass exodus of the toads. Their laboratory-based tests have now revealed, not only that these changes could be connected, but that the Earth's crust could directly affect the chemistry of the pond that the toads were living and breeding in at the time.

Nasa geophysicist Friedemann Freund showed that, when rocks were under very high levels of stress - for example by the "gargantuan tectonic forces" just before an earthquake, they release charged particles.

These charged particles can flow out into the surrounding rocks, explained Dr Freund. And when they arrive at the Earth's surface they react with the air - converting air molecules into charged particles known as ions.

"Positive airborne ions are known in the medical community to cause headaches and nausea in humans and to increase the level of serotonin, a stress hormone, in the blood of animals," said Dr Freund. They can also react with water, turning it into hydrogen peroxide.

This chemical chain of events could affect the organic material dissolved in the pond water - turning harmless organic material into substances that are toxic to aquatic animals.

It's a complicated mechanism and the scientists stress that it needs to be tested thoroughly.

But, Dr Grant says this is the first convincing possible mechanism for a "pre-earthquake cue" that aquatic, semi-aquatic and burrowing animals might be able to sense and respond to.

"When you think of all of the many things that are happening to these rocks, it would be weird if the animals weren't affected in some way," she said.

Dr Freund said that the behaviour of animals could be one of a number of connected events that might forecast an earthquake. "Once we understand how all of these signals are connected," he told BBC Nature, "if we see four of five signals all pointing in [the same] direction, we can say, 'ok, something is about to happen'."

How much coffee is safe?

Large variations in the amount of caffeine present in coffees sold on the high street means our daily caffeine intake may be higher than we think.

By Philippa Roxby Health reporter, BBC News

But is this a problem? How much caffeine is it actually safe to drink?

The caffeine content of a cup of coffee depends on how big the cup is, how finely the coffee is ground, how dark the roast, the brewing method used, how much coffee is used to make the drink and the type of coffee bean used.

A cup of instant coffee will be different from a mug of brewed coffee, a home-made cappuccino different from a large latte bought in a coffee shop.

Caffeine is also found in tea, chocolate, some soft drinks, and certain medicines.

People are affected by caffeine in different ways too. Some people are more sensitive to its properties than others and have to adjust their intake as a result.

When it comes to pregnant women this is particularly important. Their daily recommended maximum is 200mg of caffeine, equivalent to two mugs or four cups of coffee. This advice was issued in 2008 by the Food Standards Agency, which warns that too much caffeine could result in miscarriage or a baby with lower birth weight. Too much caffeine while pregnant could also increase the risk of some health conditions in later life, the FSA says.

The agency had previously recommended a maximum daily intake of 300mg. However, research published in the British Medical Journal, suggested that a lower limit per would help to reduce this low risk even further.

The research found that caffeine was rapidly absorbed into the body of pregnant women and crossed the placenta freely, circulating in the unborn baby. Too much caffeine intake interfered with blood flow in the placenta and affected foetal growth.

Professor Janet Cade, co-author of the study from the University of Leeds, said: "Everyone wants the best for their baby. Limiting daily caffeine intake is one way which you can ensure your baby has the best start in life."

The Department of Health's Pregnancy Book suggests trying to vary the liquids drunk while pregnant, although they say there is no need to cut out caffeine completely.

"Try decaffeinated tea and coffee, fruit juice or water and limit the amount of 'energy' drinks, which may be high in caffeine.

"Don't worry if you occasionally have more than this, because the risks are quite small." For everyone else, the advice is much less clear-cut.

Coffee can have health benefits. It is thought to increase alertness, performance and mental ability by stimulating the central nervous system. A large US study found that women who drank two or more cups of coffee a day were less likely to get depressed.

Recent research suggests that coffee could be linked to a reduced risk of prostate cancer and breast cancer and another study said it could protect against the onset of Alzheimer's. But it can also be addictive, seriously so.

Gaynor Bussell, registered dietician with the British Dietetic Association, says we should all try to drink coffee in moderation while paying attention to our our own bodies. "Different people have different tolerances. Some people react strongly to caffeine, some don't. It's a question of knowing your own limit and knowing your own body.

"If you enjoy a cappuccino in the morning then that's fine, but if you start to get palpitations, you're running to the toilet or noticing an increase in nervousness and sleeplessness, you should probably cut back your caffeine intake."

The general advice is that four or five cups of coffee a day is safe, around 400mg of caffeine.

The Food Standards Agency says there is no limit set for healthy individuals. They recommend a balance of drinks and a sensible, moderate approach to coffee-drinking.

CAFFEINE IN FOOD AND DRINK

1 mug of instant coffee: 100mg

1 mug of filter coffee: 140mg

1 mug of tea: 75mg

1 can of cola: 40mg

1 can of 'energy' drink: up to 80mg

1 x 50g bar of plain chocolate: up to 50mg

1 x 50g bar of milk chocolate: up to 25mg

So if you eat...

one bar of plain chocolate and one mug of filter coffee
two mugs of tea and one can of cola, or
one mug of instant coffee and one can of energy drink
...you have reached almost 200mg of caffeine.

Source: Department of Health

http://www.eurekalert.org/pub_releases/2011-12/uom-ips120111.php

Israeli public supports middle east nuclear free zone: UMD poll

Nearly two-thirds of Israeli Jews, 64 percent, favor establishing a nuclear free zone in the Middle East

COLLEGE PARK, Md. - Nearly two-thirds of Israeli Jews, 64 percent, favor establishing a nuclear free zone in the Middle East - even when it was spelled out that this would mean both Israel and Iran would have to forego nuclear weapons - finds a new University of Maryland poll. The research is a joint project of the Anwar Sadat Chair at the University of Maryland and the Program on International Policy Attitudes (PIPA).

Pressure for such a nuclear free zone has grown with the potential for Iran acquiring a nuclear weapon, possibly leading to a regional arms race, the researchers say. Next year the United Nations will sponsor a conference devoted to the idea. The Israeli government opposes creation of such a zone.

In the new poll, fewer than half, 43 percent, support an attack on Iran's nuclear facilities. Recently, even leading voices within Israel's defense community have said that such a strike would merely slow, but not stop Iran and that Israeli cities would be vulnerable to retaliation.

At the same time the Israeli public acknowledges Iran's potential for acquiring nuclear weapons. An overwhelming 90 percent say it is likely that Iran will eventually acquire a nuclear capacity.

When asked which would be better - for both Israel and Iran to have nuclear weapons, or for neither to have them - a robust 65 percent say it would be better for neither to have them. Only 19 percent prefer a nuclear armed Israel and Iran.

"I find the results surprising given the long held assumption that the Israeli public is not prepared to even discuss the nuclear issue given their deep seated sense of insecurity," says Shibley Telhami, the University of Maryland's Anwar Sadat Professor for Peace and Development.

"If Israel and Iran were to indicate a readiness to join a process toward turning the Middle East into a nuclear free zone this would be a major game changer in negotiations on Iran's nuclear program," adds Steven Kull, director of PIPA, a joint program of the Center on Policy Attitudes and the Center on International Security Studies at Maryland.

The researchers point to another one of their findings as highly significant in terms of future negotiations with Iran: Israeli Jews not only expressed support for the long term goal of eliminating nuclear weapons from the region, but also for an interim step of making their nuclear facilities transparent together with Iran's.

Asked about having all countries in the region, including Israel and Iran, "agree to have a system of full international inspections of all facilities where nuclear components could be built or maintained," 60 percent favored it.

The poll of 510 Israeli Jews has a margin of error of plus or minus 4.4 percent. The poll was fielded by the Dahaf Institute in Israel. Interviews were conducted by telephone November 10-16. The research is a joint project of the Program on International Policy Attitudes and the Anwar Sadat Chair at the University of Maryland, The results were released in conjunction with the start of the Saban Forum on US-Israeli Relations at the Brookings Institution.

http://www.eurekalert.org/pub_releases/2011-12/f-sf-wdm120111.php

Where does my beer come from?

Researchers at the University of Seville (Spain) have developed a technique based on chemical patterns for identifying the country of origin of beer.

The content of iron, potassium, phosphates and polyphenols is found to be determining components. German, Spanish and Portuguese beers have been detected with 99% accuracy thanks to the model. "Beers can be differentiated from one another according to their country of origin by using parameters linked to raw materials, such as water (metals and anions) and the type of hop (polyphenol content)," tells SINC José Marcos Jurado, chemist at the University of Seville and director of the study that aims to find out the country of origin of beers.

Using a statistical test, the first step is to select the variables that differentiate beers the most. These include the amount of aluminium, iron or strontium for example. A mathematic analysis is then applied to do away with the parameters that fail to describe the origin of beers very well. The result is a model based on the content of iron, potassium, phosphorous, phosphates and polyphenols.

Jurado points out that "the differences can seem very subtle but the model is capable of detecting the relationship between these chemical descriptors and the country of origin of beers." The last step involves applying support vector machines – a set of algorithms that recognises data patterns.

The researchers have used this technique to differentiate between beers produced in Germany, Spain or Portugal and they have managed to identify the country of origin with 99.3% accuracy, according to the results published in the Food Control journal.

Jurado clarifies that "this type of study can be extended to include other geographic areas. However, we have to remember that by increasing the number of beer types, obtaining an accurate model becomes more complicated. Differentiating should be dealt with by taking large geographical areas into account and then considering possible groupings in smaller areas."

An important identification for the food industry

According to the researcher, authenticity and geographical identification studies are "very important" for the food industry "given that they allow the differentiating characteristics of a product to be established. This can have an impact of their marketing."

Twenty brands of German, Czech and British beer are registered on the DOOR database (Database of Origin and Registration) of the European Commission of Agriculture and Rural Development, which brings together Protected Geographical Indication products. Studies like this one can offer innovative techniques for confirming the country of origin of such drinks.

References: Ángela Alcázar, José Marcos Jurado, Ana Palacios-Morillo, Fernando de Pablos, María Jesús Martín. "Recognition of the geographical origin of beer based on support vector machines applied to chemical descriptors". Food Control 23: 258-262, 2012 (available on line). Doi:10.1016/j.foodcont.2011.07.029.

http://www.eurekalert.org/pub_releases/2011-12/w-gtf120111.php

Green tea flavonoid may prevent reinfection with hepatitis C virus following liver transplantation

Researchers have determined that a flavonoid found in green tea inhibits the hepatitis C virus (HCV) from entering liver cells

German researchers have determined that epigallocatechin-3-gallate (EGCG)-a flavonoid found in green tea-inhibits the hepatitis C virus (HCV) from entering liver cells. Study findings available in the December issue of *Hepatology*, a journal published by Wiley-Blackwell on behalf of the American Association for the Study of Liver Diseases, suggest that EGCG may offer an antiviral strategy to prevent HCV reinfection following liver transplantation.

HCV infection can lead to chronic hepatitis, cirrhosis, and hepatocellular carcinoma (HCC) or primary liver cancer. HCV is one of the most common causes of chronic liver disease and a primary indication for liver transplantation, affecting up to 170 million individuals worldwide according to estimates from the World Health Organization (WHO). Prior studies report that nearly 2% of the world population is infected with chronic HCV and up to 20% of the population in some countries.

While standard treatment with interferon with ribavirin and newer protease inhibitors may clear infection in some individuals, a substantial number of patients still may not respond to these therapies. For individuals receiving liver transplants due to complications from HCV, reinfection of the healthy donor liver remains a significant concern. Antiviral strategies that target HCV in its early stages are urgently needed to prevent graft reinfection and improve long-term outcomes for patients.

To address this critical issue, Dr. Sandra Ciesek and Dr. Eike Steinmann from the Hannover Medical School in Germany investigated the effect of the EGCG molecule, which is a major component of green tea, in preventing HCV from attaching to liver cells. "Green tea catechins such as EGCG and its derivatives epigallocatechin (EGC), epicatechingallate (ECG), and epicatechin (EC) have been shown to exhibit antiviral and anti-oncogenic properties," explains Dr. Ciesek. "Our study further explores the potential effect these flavonoids have in preventing HCV reinfection following liver transplantation."

Results showed that unlike its derivatives, EGCG inhibits entry of HCV into liver cells. The authors suggest that EGCG may impede HCV cell entry by acting on the host cell as the green tea catechin was not found to alter the density of virus particles. Pretreatment of cells with EGCG before HCV inoculation did not reduce the infection; however application during inoculation inhibited the rapid spread of the HCV.

Lastly, researchers showed that EGCG inhibits viral attachment-the initial step in the HCV infection process. "The green tea antioxidant EGCG inhibits HCV cell entry by blocking viral attachment and may offer a new approach to prevent HCV infection, particularly reinfection following liver transplantation." concludes Dr. Ciesek.

Full Citation: The Green Tea Polyphenol Epigallocatechin-3-Gallate (EGCG) Inhibits Hepatitis C Virus (HCV) Entry." Sandra Ciesek, Thomas von Hahn, Che C. Colpitts, Luis M Schang, Martina Friesland, Jörg Steinmann, Michael P. Manns, Michael Ott, Heiner Wedemeyer, Philip Meuleman, Thomas Pietschmann and Eike Steinmann. Hepatology; Published Online: November 30, 2011 (DOI: 10.1002/hep.24610); Print Issue Date: December 2011. <http://onlinelibrary.wiley.com/doi/10.1002/hep.24610/abstract>.

http://www.eurekalert.org/pub_releases/2011-12/joci-rsc112311.php

Repairing spinal cord injury with dental pulp stem cells

Rats with severe spinal cord injury transplanted with human dental pulp stem cells showed recovery of hind limb function

One of the most common causes of disability in young adults is spinal cord injury. Currently, there is no proven reparative treatment. Hope that a stem cell population, specifically dental pulp stem cells, might be of benefit to individuals with severe spinal cord injury has now been provided by the work of Akihito Yamamoto and colleagues, at Nagoya University Graduate School of Medicine, Japan, in a rat model of this devastating condition.

In the study, when rats with severe spinal cord injury were transplanted with human dental pulp stem cells they showed marked recovery of hind limb function. Detailed analysis revealed that the human dental pulp stem cells mediated their effects in three ways: they inhibited the death of nerve cells and their support cells; they promoted the regeneration of severed nerves; and they replaced lost support cells by generating new ones. Yamamoto and colleagues therefore hope that this approach can be translated into an effective treatment for severe spinal cord injury.

TITLE: Human dental pulp-derived stem cells promote locomotor recovery after complete transection of the rat spinal cord by multiple neuro-regenerative mechanisms

<http://www.physorg.com/news/2011-12-entomologists-instance-intact-neurons-nucleus.html>

Entomologists discover first instance of intact neurons without nucleus - in fairy wasps

A group of researchers describe the fairy wasp has a lot of neurons without any nucleus

Fairy wasps are really tiny; so tiny, they can barely be seen with the naked eye. They're so tiny that they're the smallest organism when shown on a slide alongside an amoeba and a Paramecium. And because of this, a group of researchers from Moscow State University began wondering how a neurological system in such a tiny insect could work at all.

As it turns out, as they describe in their paper published in Science Direct, the fairy wasp (*M. mymaripenne*), the third smallest of all insects, has a lot of neurons without any nucleus.

A cell's nucleus is of course, usually pretty important, it's where the DNA is generally stored after all. It's also usually the part of the cell that runs things, like causing a replenishment of proteins to keep cells alive, etc. This of course got the researchers to wondering how an insect could survive if most of its neurons had no nucleus.

The secret, the team writes, lies in the fact that the insect is so small, that neurons (with nuclei intact) that develop during the pupa stage apparently make enough protein to last the full five days of its adulthood, so, not needing them any longer, all but a few hundred of the nuclei are destroyed by bursting, making the cell smaller and saving room for other more important cells

The team notes that this is the first recorded instance of neurons existing in the wild without benefit of nuclei.

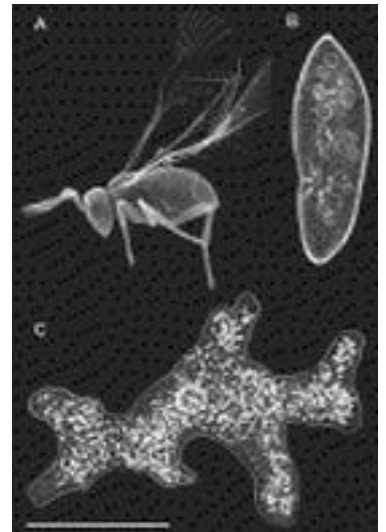
Size of the smallest insect and two protozoans in comparison. (A) Megaphragma mymaripenne. (B) Paramecium caudatum. (C) Amoeba proteus. Scale bar for A–C is 200 μm. Alexey A. Polilov

The team also found that the fairy wasp has one of the smallest nervous systems around, with just 7,400 neurons, but can still fly, search for food and figure out where to lay it's eggs; which is inside the eggs of another tiny insect, the thrips, which itself is no bigger than a millimeter in length. It manages this feat by cramming virtually all of its nervous system into just its head, hence the need for downsizing the number of neurons and reducing cell size wherever possible.

The fairy wasp also has other adaptations that allow it to survive in its small state. It has a reduced wing surface for example which means wings that amount to little more than bare strands as opposed to the rather broad based flappers other larger insects sport, just enough to allow it to coast along with moving air.

More information: Arthropod Structure & Development, Volume 41, Issue 1, January 2012, Pages 29-34.

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Turn on, tune in and get better?

Hallucinogens and other street drugs are increasingly being studied for legitimate therapeutic uses, such as helping patients deal with post-traumatic stress disorder, addiction, chronic pain, depression and even terminal illness.

By Melissa Healy, Los Angeles Times

Janeen Delany describes herself as an "old hippie" who's smoked plenty of marijuana. But she never really dabbled in hallucinogens - until two years ago, at the age of 59.

A diagnosis of incurable leukemia had knocked the optimism out of the retired plant nurserywoman living in Phoenix. So she signed up for a clinical trial to test whether psilocybin - the active ingredient in "magic mushrooms" - could help with depression or anxiety following a grim diagnosis.

Delaney swallowed a blue capsule of psilocybin in a cozy office at Johns Hopkins University in Baltimore. She donned a blindfold, a blood pressure cuff and a headset playing classical music. With two researchers at her side, she embarked on a six-hour journey into altered consciousness that she calls "the single most life-changing experience I've ever had."

What a long, strange trip it's been. In the 1960s and '70s, a rebellious generation embraced hallucinogens and a wide array of street drugs to "turn on, tune in and drop out." Almost half a century later, magic mushrooms, LSD, Ecstasy and ketamine are being studied for legitimate therapeutic uses. Scientists believe these agents have the potential to help patients with post-traumatic stress disorder, drug or alcohol addiction, unremitting pain or depression and the existential anxiety of terminal illness.

"Scientifically, these compounds are way too important not to study," said Johns Hopkins psychopharmacologist Roland Griffiths, who conducted the psilocybin trial.

In their next incarnation, these drugs may help the psychologically wounded tune in to their darkest feelings and memories and turn therapy sessions into heightened opportunities to learn and heal.

"We're trying to break a social mind-set saying these are strictly drugs of abuse," said Rick Doblin, a public policy expert who founded the Multidisciplinary Assn. for Psychedelic Studies in 1986 to encourage research on therapeutic uses for medical marijuana and hallucinogens. "It's not the drug but how the drug is used that matters."

Regulators and medical researchers remain wary. But among at least some experts at the National Institutes of Health and the Food and Drug Administration, the shift in attitude "has been dramatic," Doblin said.

Researchers explored the usefulness of hallucinogenic agents as an adjunct to psychotherapy in the 1950s and '60s. But allegations that hallucinogens were used in government-funded "mind control" efforts, freewheeling experimentation by proponents like Dr. Timothy Leary, and the drugs' appeal to a generation in revolt quashed legitimate research for decades.

The thaw has been slow in coming. In 2008, Griffiths co-wrote a report in the *Journal of Psychopharmacology* comparing psilocybin with a placebo for people dealing with incurable diseases. Psilocybin resulted in "mystical experiences having substantial and sustained personal meaning and spiritual significance," according to the study, the first since 1972 to explore a hallucinogen's therapeutic value.

In January, a team led by UCLA psychiatrist Charles Grob reported in *Archives of General Psychiatry* that psilocybin improved the mood of patients with "existential anxiety" related to advanced-stage cancer. The benefits lasted at least three months.

Janeen Delany is a typical case: The insights she gleaned during her encounter with psilocybin continue to shape her attitudes toward life and death.

Delany said her "trip" awakened a deep and reassuring sense of "knowing." She came to see the universe and everything in it as interconnected. As the music in her headphones reached a crescendo, she held her breath and realized it would OK - no, really easy - not to breathe anymore. She sensed there was nothing more she needed to know and therefore nothing she needed to fear about dying.

And that, paradoxically, has allowed her to live.

"When you take the veil of fear away from your life, you can see and experience everything in such a present way," she said. "I don't have to know what the future is. Every day is the day of days."

Fighting addiction

Such mystical insights are central in another potential use for psilocybin - as an addiction treatment. Griffiths is conducting a pilot study combining psilocybin with cognitive behavioral therapy to help smokers quit. Four people have completed the program, and so far none has returned to smoking, Griffiths says.

At the University of Arizona in Tucson, addiction specialist Dr. Michael P. Bogenschutz has proposed a clinical trial to test whether psilocybin can help ease alcohol dependence. If the NIH agrees to fund the study, it would be the first instance in decades of government financial support for a trial involving any drug of abuse.

Psilocybin's effect on the brain can be described, if not explained. It increases the activity of serotonin, a chemical that affects mood. Brain networks associated with emotions are highly active in the presence of psilocybin, as are structures involved in higher reasoning and judgment, MRI scans show.

Griffiths says that subjects routinely describe their psilocybin experience as one that "helps reorganize their thinking." For those facing death, that can bring new perspective on loved ones, on life and on what lies beyond; for those stymied by addiction, it can cut the addictive substance down to size. "Their enslavement to cigarette smoking will be almost funny," Griffiths said.

Psilocybin isn't the only drug on the cusp of a medical renaissance. Ketamine, best known as "Special K," has shown promise as a fast-acting antidepressant. It induces euphoria, hallucinations and "out of body" experiences when smoked or snorted. When administered intravenously at low doses, it can lift symptoms of deep depression in a matter of hours. Ketamine's use in anesthesia has made it easier for researchers to study. They suspected its influence on a neurochemical called NMDA would make it a good antidepressant, since NMDA's activity is altered in people with depression.

In case reports, severely depressed patients who got ketamine in preparation for electroconvulsive shock therapy showed improvements in mood (even when the shock therapy failed), and several small clinical trials have demonstrated its fast-acting abilities. The findings indicate that for suicidal patients who can't afford to wait weeks or months for a standard antidepressant to take effect, ketamine could be a valuable rescue drug.

LSD may also be on the road to legitimacy. A 2006 study in Neurology surveyed people who used the drug to cope with persistent cluster headaches and found that it cleared them up and made them less frequent in most cases. The results prompted Dr. John Halpern of Harvard Medical School's McLean Hospital to test a nonhallucinogenic LSD analog from the vaults of pharmaceutical giant Sandoz. At a research meeting in June, Halpern reported that 2-Bromo-LSD reduced the number of daily cluster headaches in six sufferers who participated in a pilot study.

Treating trauma

War has also created openings for the rehabilitation of some of these drugs. Ecstasy is a case in point.

The drug - whose chemical name is methylene dioxy methamphetamine, or MDMA - was patented in 1912 by Merck & Co. Its psychoactive properties prompted doctors to prescribe it for their patients; one pharmacologist called it "penicillin for the soul." But in 1988, the Drug Enforcement Agency declared MDMA a Schedule 1 controlled substance with high potential for abuse. Psychotherapists stopped prescribing it or continued to do so furtively.

On the street, Ecstasy has a reputation for dissolving anxiety and fear, suppressing social inhibition and enhancing one's willingness to trust others. PTSD sufferers avoid reminders of their pain or shut down at the prospect of facing it. A dose of Ecstasy appears to help these patients revisit their traumas and reflect on them without fear. "It can connect people more with their emotions without them feeling they'll be overwhelmed by them," said psychiatrist Michael Mithoefer of Charleston, S.C., a clinical investigator for the Multidisciplinary Assn. for Psychedelic Studies.

Mithoefer has received FDA permission to test whether Ecstasy can help Iraq and Afghanistan veterans overcome their PTSD when used during psychotherapy sessions; six veterans have enrolled in the study. In an earlier clinical trial, Ecstasy helped 10 of 12 women recover from PTSD stemming from child sexual trauma. Only 2 out of 8 women who took a placebo had similar results, Mithoefer reported last year in the *Journal of Psychopharmacology*.

Ecstasy's reputation for enhancing trust has clear roots in its biological effect. Using brain scans, Columbia University psychologist Gillinder Bedi found that subjects who took MDMA showed heightened activity in a brain region associated with processing rewards and depressed activity in the amygdala - a source of fear reactions. In animals, MDMA boosts the hormone oxytocin, which promotes trust, sociability and interpersonal attachment. A drug can't be dismissed because of a dangerous reputation or colorful history, Bedi said, if trials demonstrate that it is safe and can benefit patients.

New life

Janeen Delany said her psilocybin experience had added life to her years - and perhaps years to her life.

Every three months, she gets her white blood cells checked. With her form of leukemia, those counts are expected to rise steadily as the disease progresses. But in June 2009, four months after her psilocybin session, they went down. Every three months since, they have retreated further, leading two of her three doctors to

declare her in remission. Delany said her psychological improvement may have helped reverse her fortunes. Her lead oncologist is skeptical, but her neurologist is not so quick to dismiss the link. One should never underestimate "the healing power of the psyche," he told her. Whatever, Delany said. Remission is beside the point.

"The fear is gone. It's all about living," she said. "The big stuff? Sheeesh - it's handled."

<http://www.sciencedaily.com/releases/2011/12/111201132501.htm>

Age-Old Remedies Using White Tea, Witch Hazel and Rose May Be Beneficial, Study Suggests

Age-old remedies could hold the key to treating a wide range of serious medical problems, as well as keeping skin firmer and less wrinkled, according to scientists from London's Kingston University.

ScienceDaily - A collaboration between the university and British beauty brand Neal's Yard Remedies has seen experts discover that white tea, witch hazel and the simple rose hold potential health and beauty properties which could be simply too good to ignore. The research suggests a number of naturally-occurring substances may offer the hope of new treatments to block the progression of inflammation. It is credited with a major role in both the initiation and development of diseases ranging from cancer, diabetes and arthritis through to neurodegenerative conditions and cardiovascular and pulmonary problems.

"For thousands of years people used natural remedies to try - and sometimes succeed - in curing their ailments and preserving their youth," Professor Declan Naughton, from the University's School of Life Sciences, said. "Now the latest research we have carried out suggests a number of naturally-occurring substances may offer the hope of new treatments to block the progression of inflammation."

Inflammation is credited with a major role in both the initiation and development of diseases ranging from cancer, diabetes and arthritis through to neurodegenerative conditions and cardiovascular and pulmonary problems. It is also implicated in premature aging and early death. "Inflammation is a secret killer - helping arrest its development, or being able to stop it happening at all, would clearly be of benefit," Professor Naughton explained.

The new study builds on work undertaken by Professor Naughton and Kingston University PhD student Tamsyn Thring, along with the technical team from Neal's Yard. They tested 21 plant extracts for evidence of their efficiency in fighting cancer and also in the battle against aging. Of the 21 extracts, three - white tea, witch hazel and rose - showed considerable potential, with white tea displaying the most marked results. "Indeed it appeared that drinking a simple cup of white tea might well help reduce an individual's risk of cancer, rheumatoid arthritis or even just age-associated wrinkles," Professor Naughton said.

Spurred on by their laboratory findings, the team members decided to take the work further to see if they could replicate the results in human skin cells, looking more closely at the anti-inflammatory and anti-oxidant activity of the three extracts. Using human skin cells as their model, the researchers added three different concentrations of white tea (freeze dried powder), witch hazel (dried herb) and rose extract (in a medicinal tincture form) to see what effect the mixtures might have on suppressing rogue enzymes and oxidants which play a key role in helping inflammation develop, as well as aging the skin.

"As the largest organ in the body, the skin provides a barrier against UV radiation, chemicals, microbes and physical pollutants," Ms Thring said. "Challenges like this can contribute to both inflammation and skin aging. "We also know that when inflammation starts - be it a simple cut to a finger or in an arthritic joint - the body starts producing a compound called interleukin 8, which helps the process along. We began wondering if there was a way we could switch that signal off, thereby blocking the inflammation's progress." Even though the team's previous research had intimated there might be some promising results ahead, the experts were astonished to see just how good the various concentrations of the three extracts were at doing the job.

<http://www.scientificamerican.com/article.cfm?id=other-greenhouse-gases-slide-show>

Catastrophic Climate Could Be Forestalled by Cutting Overlooked Gases [Slide Show] *Carbon dioxide gets all the attention, but there are a host of compounds responsible for global warming*

By David Biello | Thursday, December 1, 2011 | 12

When the world talks climate change - as is currently under way in Durban, South Africa - the main issue is carbon dioxide emissions. CO₂ is emanating from the negotiators' mouths and the power plants and cars of their home countries - and that simple molecule is responsible for the bulk of global warming to date.

But CO₂ isn't the only molecule trapping heat in the atmosphere. The warm conditions of the earth get a big boost from water vapor as well as several other culprits, some of which never existed in the atmosphere prior to

human influence. Together, the other greenhouse gases account for roughly a third of the molecules trapping heat in the atmosphere - and more than a third of the overall warming of average temperatures globally.

What's more, cleaning up emissions of some of these other greenhouse gases may prove quite a lot simpler than cutting back on CO₂ - forestalling catastrophic climate change. In fact, some of the measures - such as capturing the methane released during oil production - actually save money in addition to the climate. The United Nations Environment Program estimates that cutting back on methane and soot emissions alone could prevent 0.7 degree Celsius of additional warming by 2040 - and those cooling benefits could come faster than comparable cuts in CO₂.

METHANE: More commonly known as natural gas, CH₄ is also a fossil fuel. It is the second most common greenhouse gas after carbon dioxide, at 1.8 parts-per-million in the atmosphere. Concentrations have risen by 158 percent since 1750, according to the World Meteorological Organization. Rice paddies, livestock and manure lagoons as well as the gas released during coal and oil production dominate human sources, while decomposition in wetlands is the biggest natural source.

The molecule lasts for roughly a decade in the atmosphere - but is 25 times more powerful at trapping heat than CO₂ when compared over a century span. In other words, in the short period of time that it is in the atmosphere it traps 25 times more heat than a molecule of CO₂ will over an entire century. And there are several methane "bombs" waiting to go off around the world - icy clathrates scattered across all seven seafloors that may thaw as oceans warm. Permafrost also stores roughly 1,000 gigatons of carbon around the world that microbes could transform into methane as polar regions warm. Already, atmospheric measurements have begun to detect a greater proportion of such permafrost methane in the atmosphere.

Cutting human methane levels involves improving wastewater treatment, recovering methane released by oil production and coal mining, and capturing it as it wafts out of landfills. In addition to climate benefits, cutting back on methane would also cut down on smog, or ground-level ozone, which has turned once-blue skies milky, in addition to damaging crops and human health.

NITROUS OXIDE: Perhaps better known as laughing gas, N₂O levels in the atmosphere have risen by 20 percent since 1750, reaching a concentration of 323 parts-per-billion in 2010, according to the World Meteorological Organization. That may not sound like much, but over 100 years laughing gas contributes roughly 300 times the warming of an equivalent amount of CO₂ - and a single molecule of N₂O lasts roughly 120 years in the atmosphere.

So where is all this extra laughing gas coming from? Fertilizers and manure, mostly. Given that the world's growing human population will require food, growth in emissions of this greenhouse gas are very likely to keep rising, but more judicious application of fertilizers - and better waste management for livestock - could help reduce levels of the gas in the atmosphere.

COOLING CHEMICALS: To help keep cool, a series of chemical refrigerants have been crafted in recent decades. Early refrigerants proved lethal to the planet's protective stratospheric ozone layer, as evidenced by the ozone hole pictured here. But their replacements - hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs) - are potent greenhouse gases: more than 11,000 times more effective at trapping heat over a century than a molecule of CO₂. Growing demand means emissions of this set of gases are also growing as fast as 10 percent per year.

The solution is to come up with yet more chemical alternatives - or cutting back on the need for refrigeration and air-conditioning. Given global warming, however, that may be a faint hope - and Brazil, China and India have explicitly blocked efforts to discuss phasing the chemicals out.

SULFUR HEXAFLUORIDE: This colorless, odorless gas - SF₆ - is an insulator used in the circuit breakers of power equipment - and the most potent greenhouse gas known to science. Since the 1990s, its concentration in the atmosphere has doubled thanks to leaks from an ever-more sprawling global electric grid. That concentration is very likely to continue growing as the world gets increasingly wired for electricity. The gas persists in the atmosphere for millennia and contributes nearly 23,000 times as much warming per molecule as CO₂ over the course of a century.

BLACK CARBON: Although it's not technically a gas - more of an aerosol - soot, otherwise known as black carbon, can help warm the atmosphere during its residency of a few short weeks. And when it falls out of the atmosphere onto ice or snow, it helps melt it faster - a main reason such soot is helping speed warming in the Arctic.

Such black carbon comes from one source: inefficient burning, whether dung fires or bad diesel engines. Eliminating those sources could begin to cool temperatures in weeks or months rather than the years required to see impacts from reducing CO₂ emissions. Cutting down on smoky indoor air would also be a health boon.

CARBON DIOXIDE: This colorless, odorless molecule is the primary greenhouse gas responsible for global warming. Concentrations of CO₂ in the atmosphere are now at roughly 390 parts-per-million - up from roughly 280 ppm a few short centuries ago. As a result, CO₂ is responsible for roughly 64 percent of the extra heat trapped by all greenhouse gases, which has resulted in warming global average temperatures by nearly one degree Celsius.

Burning fossil fuels is the primary culprit, backed up by cutting down forests and clearing land for agriculture or urbanization. Changing those habits is hard, which is why the rate at which CO₂ is added to the atmosphere continues to tick up—in 2010, atmospheric concentrations jumped by 2.3 ppm, compared with an average of roughly 2 ppm for the past decade and 1.5 ppm in the 1990s.

<http://www.bbc.co.uk/news/world-europe-15995845>

New Icelandic volcano eruption could have global impact

Hundreds of metres under one of Iceland's largest glaciers there are signs of a looming volcanic eruption that could be one of the most powerful the country has seen in almost a century.

By Jane O'Brien BBC News, Reykjavik

Mighty Katla, with its 10km (6.2 mile) crater, has the potential to cause catastrophic flooding as it melts the frozen surface of its caldera and sends billions of gallons of water surging through Iceland's east coast and into the Atlantic Ocean. "There has been a great deal of seismic activity," says Ford Cochran, the National Geographic's expert on Iceland. There were more than 500 tremors in and around the caldera of Katla just in October, which suggests the motion of magma. "And that certainly suggests an eruption may be imminent."

Scientists in Iceland have been closely monitoring the area since 9 July, when there appears to have been some sort of disturbance that may have been a small eruption.

Eruption 'long overdue'?

Even that caused significant flooding, washing away a bridge across the country's main highway and blocking the only link to other parts of the island for several days. "The 9 July event seems to mark the beginning of a new period of unrest for Katla, the fourth we know in the last half century," says Professor Pall Einarsson, who has been studying volcanoes for 40 years and works at the Iceland University Institute of Earth Sciences. "The possibility that it may include a larger eruption cannot be excluded," he continues. "Katla is a very active and versatile volcano. It has a long history of large eruptions, some of which have caused considerable damage."

The last major eruption occurred in 1918 and caused such a large glacier meltdown that icebergs were swept into the ocean by the resulting floods. The volume of water produced in a 1755 eruption equalled that of the world's largest rivers combined.

Thanks to the great works of historic literature known as the Sagas, Iceland's volcanic eruptions have been well documented for the last 1,000 years. But comprehensive scientific measurements were not available in 1918, so volcanologists have no record of the type of seismic activity that led to that eruption. All they know is that Katla usually erupts every 40 to 80 years, which suggests the next significant event is long overdue.

Katla is part of a volcanic zone that includes the Laki craters. In 1783 volcanoes in the area erupted continuously for eight months, generating so much ash, hydrogen fluoride and sulphur dioxide that it killed one in five Icelanders and half of the country's livestock. "And it actually changed the Earth's climate," says Mr Cochran. "Folks talk about a nuclear winter - this eruption generated enough sulphuric acid droplets that it made the atmosphere reflective, cooled the planet for an entire year or more and caused widespread famine in many places around the globe. "One certainly hopes that Katla's eruption will not be anything like that!"

The trouble is scientists do not know what to expect. As Prof Einarsson explains, volcanoes have different personalities and are prone to changing their behaviour unexpectedly. "When you study a volcano you get an idea about its behaviour in the same way you judge a person once you get to know them well.

"You might be on edge for some reason because the signs are strange or unusual, but it's not always very certain what you are looking at. We have had alarms about Katla several times."

Changing climate

He says the fallout also depends on the type of eruption and any number of external factors.

"This difficulty is very apparent when you compare the last two eruptions in Iceland - Eyjafjallajokull in 2010 and Grimsvotn in 2011. "Eyjafjallajokull, which brought air traffic to a halt across Europe, was a relatively small eruption, but the unusual chemistry of the magma, the long duration and the weather pattern during the eruption made it very disruptive.

The Grimsvotn eruption of 2011 was much larger in terms of volume of erupted material. "It only lasted a week and the ash in the atmosphere fell out relatively quickly.

"So it hardly had any noticeable effect except for the farmers in south-east Iceland who are still fighting the consequences."

Of course, volcanoes are erupting around the world continuously. Scientists are particularly excited about an underwater volcano near El Hierro in the Canary Islands, which is creating new land. But Iceland is unique because it straddles two tectonic plates and is the only place in the world where the mid-Atlantic rift is visible above the surface of the ocean. "It means you actually see the crust of the earth ripping apart," says Mr Cochran. "You have an immense amount of volcanic activity and seismic activity. It's also at a relatively high latitude so Iceland is host to among other things, the world's third-largest icecap."

But the biggest threat to Iceland's icecaps is seen as climate change, not the volcanoes that sometimes melt the icecaps. They have begun to thin and retreat dramatically over the last few decades, contributing to the rise in sea levels that no eruption of Katla, however big, is likely to match.

http://www.eurekalert.org/pub_releases/2011-12/haog-and120211.php

A natural dye obtained from lichens may combat Alzheimer's disease

A red dye derived from lichens that has been used for centuries to color fabrics and food appears to reduce the abundance of small toxic protein aggregates in Alzheimer's disease.

The dye, a compound called orcein, and a related substance, called O4, bind preferentially to small amyloid aggregates that are considered to be toxic and cause neuronal dysfunction and memory impairment in Alzheimer's disease. O4 binding to small aggregates promotes their conversion into large, mature plaques which researchers assume to be largely non-toxic for neuronal cells. Further research with animal models is needed to determine whether this new approach by Dr. Jan Bieschke (Max Delbrück Center for Molecular Medicine, MDC, Berlin-Buch), Dr. Martin Herbst (Charité – Universitätsmedizin Berlin) and Professor Erich Wanker (MDC) in Berlin, Germany, will be useful for therapy development (Nature Chemical Biology, doi: <http://dx.doi.org/10.1038/NCHEMBIO.719>)*.

Protein misfolding is considered to be the cause of Alzheimer's, Parkinson's and also Huntington's disease. In a multistep process, proteins misfold and accumulate into large extra- or intracellular plaques. Researchers assume that small misfolded protein aggregates that are precursors of mature plaques are toxic for nerve cells and are the reason why they are eventually destroyed.

Dye from the Canary Islands

The dye orcein is isolated from lichens that grow on the Canary Islands, among other places. Lichens have been used for centuries to color fabrics and food. Eight years ago Professor Wanker screened hundreds of natural compounds to find potential candidate drug molecules for the treatment of neurodegenerative diseases. Among those substances he found orcein, a compound made up of about 14 small molecules. As these molecules might have different biological effects, the researchers in Berlin began to search for pure chemicals with similar properties. They identified the substance O4, a blue dye, which is structurally very similar to one of the 14 molecules. Moreover, they showed that O4 stimulates the formation of large, non-toxic protein plaques from small toxic protein assemblies.

New Mechanism

A few years ago Professor Wanker and his colleagues discovered that EGCG (Epigallocatechin-3-gallate), a natural chemical compound found in green tea, renders toxic protein assemblies non-toxic. With orcein and O4 the researchers have now found another mechanism to eliminate small toxic protein aggregates. However, instead of remodeling protein plaques, the dyes reduce the abundance of small, toxic precursor protein assemblies by accelerating the formation of large plaques, as the researchers could now show in their laboratory.

"This is a new mechanism," Professor Wanker explained. "Up to now it has been considered to be very difficult to stop the formation of small toxic protein assemblies. If our hypothesis is correct that the small aggregates, which are precursors of plaques, indeed cause neuronal death, with O4 we would have a new mechanism to attack the disease."

The synthetic dye methylene blue is currently being tested in clinical trials. This dye also seems to stimulate the formation of large plaques in a way similar to O4. Other therapeutic approaches tested in clinical trials which aim at eliminating small precursor aggregates have so far not led to a significant improvement of disease symptoms.

However, it still remains to be seen whether the blue dye O4 can also be effective against small amounts of misfolded proteins in the brains of Alzheimer's patients and whether the accelerated formation of larger plaques can indeed reduce the signs and symptoms of Alzheimer's disease in humans. Further studies will be necessary to address the question whether the accelerated formation of large plaques can be a therapeutic approach. "We

hope that our findings will stimulate research activities in this direction, especially in drug discovery," Professor Wanker said.

**Small-molecule conversion of toxic oligomers to nontoxic β -sheet-rich amyloid fibrils*

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http://www.eurekalert.org/pub_releases/2011-12/afps-eus120211.php

Even unconsciously, sound helps us see

Findings show that the senses of hearing and vision can also interact at a more basic level, before they each even produce an estimate

"Imagine you are playing ping-pong with a friend. Your friend makes a serve. Information about where and when the ball hit the table is provided by both vision and hearing. Scientists have believed that each of the senses produces an estimate relevant for the task (in this example, about the location or time of the ball's impact) and then these votes get combined subconsciously according to rules that take into account which sense is more reliable. And this is how the senses interact in how we perceive the world. However, our findings show that the senses of hearing and vision can also interact at a more basic level, before they each even produce an estimate," says Ladan Shams, a UCLA professor of psychology, and the senior author of a new study appearing in the December issue of *Psychological Science*, a journal published by the Association for Psychological Science. "If we think of the perceptual system as a democracy where each sense is like a person casting a vote and all votes are counted (albeit with different weights) to reach a decision, what our study shows is that the voters talk to one another and influence one another even before each casts a vote."

"The senses affect each other in many ways," says cognitive neuroscientist Robyn Kim. There are connections between the auditory and visual portions of the brain and at the cognitive level. When the information from one sense is ambiguous, another sense can step in and clarify or ratify the perception. Now, for the first time, Kim, Megan Peters, and Ladan Shams, working at the University of California Los Angeles, have shown behavioral evidence that this interplay happens in the earliest workings of perception—not just before that logical decision-making stage, but before the pre-conscious combination of sensory information.

To demonstrate that one sense can affect another even before perception, the researchers showed 63 participants a bunch of dots on a screen, in two phases with a pause between them. In one phase, the dots moved around at random; in the other, some proportion moved together from right to left. The participants had to indicate in which phase the dots moved together horizontally. In experiment 1, the subjects were divided into three groups. While they looked at the dots, one group heard sound moving in the same direction as the right-to-left dots, and stationary sound in the random phase. A second group heard the same right-to-left sound in both phases. The third group heard the identical sound in both phases, but it moved in the opposite direction of the dots. In the second and third conditions, because the sound was exactly the same in both phases, it added no cognitively useful information about which phase had the leftward-moving dots. In experiment 2, each participant experienced trials in all three conditions.

The results: All did best under the first condition—when the sound moved only in the leftward-motion phase. The opposite-moving sound neither enhanced nor worsened the visual perception. But surprisingly, the uninformative sound—the one that traveled leftward both with the leftward-moving dots and also when the dots moved randomly—helped people correctly perceive when the dots were moving from one side to the other. Hearing enhanced seeing, even though the added sense couldn't help them make the choice.

The study, says Kim, should add to our appreciation of the complexity of our senses. "Most of us understand that smell affects taste. But people tend to think that what they see is what they see and what they hear is what they hear." The findings of this study offer "further evidence that, even at a non-conscious level, visual and auditory processes are not so straightforward," she says. "Perception is actually a very complex thing affected by many factors."

"This study shows that at least in regards to perception of moving objects, hearing and sight are deeply intertwined, to the degree that even when sound is completely irrelevant to the task, it still influences the way we see the world," Shams says.

<http://www.physorg.com/news/2011-12-suns.html>

A novel way to concentrate sun's heat

Most technologies for harnessing the sun's energy capture the light itself, which is turned into electricity using photovoltaic materials.

Others use the sun's thermal energy, usually concentrating the sunlight with mirrors to generate enough heat to boil water and turn a generating turbine. A third, less common approach is to use the sun's heat — also concentrated by mirrors — to generate electricity directly, using solid-state devices called thermophotovoltaics, which have their roots at MIT dating back to the 1950s.

Now, researchers at MIT have found a way to use thermophotovoltaic devices without mirrors to concentrate the sunlight, potentially making the system much simpler and less expensive. The key is to prevent the heat from escaping the thermoelectric material, something the MIT team achieved by using a photonic crystal: essentially, an array of precisely spaced microscopic holes in a top layer of the material.

The approach mimics Earth's greenhouse effect: Infrared radiation from the sun can enter the chip through the holes on the surface, but the reflected rays are blocked when they try to escape. This blockage is achieved by a precisely designed geometry that only allows rays that fall within a very tiny range of angles to escape, while the rest stay in the material and heat it up.

The new device was described in a paper by Research Laboratory of Electronics research scientist Peter Bermel and other MIT researchers, published in October in the journal *Nanoscale Research Letters*.

Bermel explains that if you put an ordinary, dark-colored, light- and heat-absorbing material in direct sunlight, "it can't get much hotter than boiling water," because the object will reradiate heat almost as fast as it absorbs it. But to generate power efficiently, you need much higher temperatures than that. By concentrating sunlight with parabolic mirrors or a large array of flat mirrors, it's possible to get much higher temperatures — but at the expense of a much larger and more complex system.

"What I'm looking at is an alternative to that paradigm," Bermel says, by "concentrating the sunlight thermally": capturing it and reflecting it back into the material. The result, he says, is that the device can absorb as much heat as a standard black object, but "in practice, we can get it extremely hot, and not reradiate much of that heat."

Such a system, he says, "at large scale, is efficient enough to compete with more conventional forms of power. This is an alternative to concentrators."

In addition, the system is simple to manufacture using standard chip-fabrication technology. By contrast, the mirrors used for traditional concentrating systems, he says, require "extremely good optics, which are expensive."

The next step in the research, Bermel says, is to test different materials in this configuration to find those that produce power most efficiently. With existing solar thermophotovoltaic systems, he says, "the highest efficiency [in converting solar energy to electricity] is 10 percent, but with this angular-selective approach, maybe it could be 35 to 36 percent." That, in turn, is higher than the theoretical maximum that could ever be achieved by traditional photovoltaic solar cells.

In the solar-cell business, Bermel points out, "even small differences of 1 percent or so are considered important." At this point, however, his research has been "mainly theory," so the next step is building and testing more actual devices. So far, he says, "we have some preliminary results" that validate the theory.

Jason Fleischer, an associate professor of electrical engineering at Princeton University who was not involved in this work, says that for thermophotovoltaic systems to work well, "sunlight typically needs to be concentrated, and re-emission back into space is a problem." The advance made by Bermel and his co-authors, he says, is to use existing light-absorbing material and create a photonic structure in it, "so that it preferentially emits light in a direction and wavelength range that is optimal for photovoltaic conversion." By doing so, this "increases the efficiency significantly beyond classical predictions based on unconcentrated sunlight, enabling a small device to generate as much electricity as a conventional one that is much larger."

This research, Fleischer says, was of "exceedingly high" caliber.

*The paper was co-authored by MIT's John Joannopoulos, the Francis Wright Davis Professor of Physics; professor of physics Marin Soljačić; and four students. It was funded by the National Science Foundation, the MIT S3TEC Energy Research Frontier Center of the Department of Energy, and the Institute for Soldier Nanotechnologies. More information: *Nanoscale Research Letters* 2011, 6:549 [doi:10.1186/1556-276X-6-549](https://doi.org/10.1186/1556-276X-6-549)*

<http://www.physorg.com/news/2011-12-simple-technique-results-repellency.html>

Simple technique results in surprising repellency results

After some tweaking, soot becomes a truly remarkable repellency material

PhysOrg.com - Anyone who has ever worn eyeglasses for any length of time can surely attest to the annoyance of constantly having to clean off the oil left behind by finger touching. Not only does it dirty the lens, but removal requires a solvent, rather than a simple tissue. Doris Vollmer can relate, and that's just what got her thinking about the soot given off by her Christmas candles. As a polymer research scientist with the Max Planck Institute in Germany, she knew the soot was water resistant, but what she wanted to know was whether it was oil resistant as well. So, she and her colleagues held a glass slide over a candle and then tested it. In doing so, as she and her team describe in Science, they found that after some tweaking, the result was a truly remarkable repellency material.

After discovering that the soot that showed up on the glass slide not only coated the glass in black, making it impossible to see through, they also found that it wasn't very stable either. Water dripped on it rolled right off, but carried some of the soot with it, which would mean constant reapplication if trying to use it as a repellent. To counter the instability, they coated the soot with silica using a chemical vapor process. Then, to make the black coating clear, the whole works was calcined (heated to bring about a thermal decomposition). The result was a clear omniphobicity (repels both oil and water) coating that could have many uses in commercial products.

It turns out the soot is naturally water resistant due to the way its carbon particles align themselves on a surface, much like a fractal type network, where there just isn't enough space for water or other liquids to pass through. The team found that the bonds were so strong that the material retained its repellency qualities even when blasted with sand or abused in other ways.

It's not clear just yet if the coating will indeed one day be applied to eyeglasses, forever relieving wearers from the vagaries of fingerprints, but the results thus far look promising for treating various metals or glass to create non-stick surfaces for use in a variety of industrial applications.

More information: Science DOI: [10.1126/science.1207115](https://doi.org/10.1126/science.1207115)

<http://medicalxpress.com/news/2011-12-blood-poisoning-quickly.html>

Recognizing blood poisoning quickly

In future, physicians will be able to analyze blood there and then and have the results within twenty minutes.

Medical Xpress - Is the patient suffering from blood poisoning? To answer this question, the doctor draws a blood sample and sends it to a central laboratory for testing. This takes up valuable time, which could cost the patient his life.

In future, physicians will be able to analyze blood there and then and have the results within twenty minutes. This is made possible by a biochip, developed by scientists at the Fraunhofer Institute for Physical Measurement Techniques IPM in Freiburg. "To analyze the biochip we have also designed a fully automatic device to carry out all the examination steps," explains Dr. Albrecht Brandenburg, group manager at the IPM. "All the doctor has to do is place the sample in the apparatus and wait for the results."

Meanwhile, within the device there's plenty going on: it starts by preparing the blood sample. Red blood cells are separated from the blood and the plasma that remains is guided onto the biochip. When patients are suffering from sepsis, their immune system reacts by producing certain proteins. The biochip uses these in its diagnosis: there are antibodies positioned on the chip which fit these proteins like a key fits a lock. If the proteins are present in the blood, the antibodies fish them out of the fluid and bind them to the chip. But how does the apparatus know if proteins have been caught? "The chip is rinsed with a solution containing the appropriate antibodies, which have in turn been marked with a fluorescent dye," explains IPM scientist Dr. Manuel Kemmler. "These bind to the proteins – meaning antibodies, protein and marked antibodies are all firmly linked to each other and to the chip's surface. When the chip is illuminated, the dye lights up." The apparatus sees lots of little illuminated dots that show the protein was in the blood. If the patient is healthy, however, the chip remains dark.

The researchers can even test for different proteins at the same time in one cycle. This is done by placing various different catcher molecules on the chip, to which specific molecules in the blood attach themselves. A cunning selection of proven protein markers allows the scientists to obtain additional important information about the severity and cause of the illness.

Together with colleagues from a university hospital, the researchers have already successfully tested prototypes of the device and biochip. Each biochip can only be used once – so they have to be affordable. "We

predict that in the long run, with production on a large enough scale, each chip will cost no more than one euro," says Brandenburg. There are various possible applications: other conditions such as heart attacks or cancers can also be investigated this way. What's more, the chip facilitates doping and urine testing as well as the quality assessment of foodstuffs. *Provided by Fraunhofer-Gesellschaft*

<https://www.llnl.gov/news/newsreleases/2011/Dec/NR-11-12-01.html>

Livermore and Russian scientists propose new names for elements 114 and 116
The International Union of Pure and Applied Chemistry (IUPAC) today recommended new proposed names for elements 114 and 116, the latest heavy elements to be added to the periodic table.

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Scientists of the Lawrence Livermore National Laboratory (LLNL)-Dubna collaboration proposed the names as Flerovium for element 114 and Livermorium for element 116.

In June 2011, the IUPAC officially accepted elements 114 and 116 as the heaviest elements, more than 10 years after scientists from the Joint Institute for Nuclear Research in Dubna and Lawrence Livermore chemists discovered them.



Flerovium (atomic symbol Fl) was chosen to honor Flerov Laboratory of Nuclear Reactions, where superheavy elements, including element 114, were synthesized. Georgiy N. Flerov (1913-1990) was a renowned physicist who discovered the spontaneous fission of uranium and was a pioneer in heavy-ion physics. He is the founder of the Joint Institute for Nuclear Research. In 1991, the laboratory was named after Flerov - Flerov Laboratory of Nuclear Reactions (FLNR).

Livermorium (atomic symbol Lv) was chosen to honor Lawrence Livermore National Laboratory (LLNL) and the city of Livermore, Calif. A group of researchers from the Laboratory, along with scientists at the Flerov Laboratory of Nuclear Reactions, participated in the work carried out in Dubna on the synthesis of superheavy elements, including element 116. (Lawrencium -- Element 103 -- was already named for LLNL's founder E.O. Lawrence.)

In 1989, Flerov and Ken Hulet (1926-2010) of LLNL established collaboration between scientists at LLNL and scientists at FLNR; one of the results of this long-standing collaboration was the synthesis of elements 114 and 116.

"Proposing these names for the elements honors not only the individual contributions of scientists from these laboratories to the fields of nuclear science, heavy element research, and superheavy element research, but also the phenomenal cooperation and collaboration that has occurred between scientists at these two locations," said Bill Goldstein, associate director of LLNL's Physical and Life Sciences Directorate.

LLNL scientists Ken Moody, Dawn Shaughnessy, Jackie Kenneally and Mark Stoyer were critical members of the team along with a team of retired LLNL scientists including John Wild, Ron Lougheed and Jerry Landrum. Former LLNL scientists Nancy Stoyer, Carola Gregorich, Jerry Landrum, Joshua Patin and Philip Wilk also were on the team. The research was supported by LLNL Laboratory Research and Development funds (LDRD).

Scientists at LLNL have been involved in heavy element research since the Laboratory's inception in 1952 and have been collaborators in the discovery of six elements -- 113,114,115,116,117 and 118.

Livermore also has been at the forefront of investigations into other areas related to nuclear science such as cross-section measurements, nuclear theory, radiochemical diagnostics of laser-induced reactions, separations chemistry including rapid automated aqueous separations, actinide chemistry, heavy-element target fabrication, and nuclear forensics.

The creation of elements 116 and 114 involved smashing calcium ions (with 20 protons each) into a curium target (96 protons) to create element 116. Element 116 decayed almost immediately into element 114. The scientists also created element 114 separately by replacing curium with a plutonium target (94 protons).

The creation of elements 114 and 116 generate hope that the team is on its way to the "island of stability," an area of the periodic table in which new heavy elements would be stable or last long enough for applications to be found.

The new names were submitted to the IUPAC in late October and now remain in the public domain. The new names will not be official until about five months from now when the public comment period is over.

Scalable amounts of liver and pancreas precursor cells created using new stem cell production method

Scientists have overcome a hurdle to developing regenerative treatments for diabetes and liver disease with a technique to produce useful amounts of endoderm cells from human pluripotent stem cells

Scientists in Canada have overcome a key research hurdle to developing regenerative treatments for diabetes and liver disease with a technique to produce medically useful amounts of endoderm cells from human pluripotent stem cells. The research, published in *Biotechnology and Bioengineering*, can be transferred to other areas of stem cell research helping scientists to navigate the route to clinical use known as the 'valley of death'.

"One million people suffer from type 1 diabetes in the United States, while liver disease accounts for 45,000 deaths a year," said Dr Mark Ungrin from the University of Toronto. "This makes stem cells, and the potential for regenerative treatments, hugely interesting to scientists. Laboratory techniques can produce thousands, or even millions, of these cells, but generating them in the numbers and quality needed for medicine has long been a challenge."

The research focused on the process of using pluripotent stem cells (PSC) to generate endoderm cells, one of the three primary germ layers which form internal organs including the lungs, pancreas, and liver. The ability to differentiate, or transform, PSCs into endoderm cells is a vital step to developing regenerative treatments for these organs.

"In order to produce the amount of endoderm cells needed for treatments it is important to understand how cells behave in larger numbers, for example how many are lost during the differentiation process and if all the cells will differentiate into the desired types," said Ungrin.

The team stained cells with fluorescent dye and as the cells divided, the dye was shared equally between the divided cells. By measuring the fluorescence of cell populations at a later stage the team were able to work out the frequency of cell division, which allowed them to predict how many cells would be present in a population at any given time.

This technique allowed the team to detect cell inefficiencies and develop a new understanding of the underlying cell biology during the differentiation of PSCs. This allowed the team to increase effective cell production 35 fold. "Our results showed significant increases in the amount of endoderm cells generated," said Ungrin. "This new concept allows us to scale up the production of useful cells, while ensuring PSC survival and effective differentiation."

Overcoming this bottleneck in research will also help future stem cell researchers navigate the often long and challenging route from laboratory testing to clinical use, and accelerate the time from biomedical advance to beneficial therapy, often referred to as the bench-to-bedside process.

"Most research in this field focuses on the purity of generated cell populations; the efficiency of differentiation goes unreported," concluded Dr Ungrin. "However our research provides an important template for future studies of pluripotent stem cells, particularly where cells will need to be produced in quantity for medical or industrial uses."

More information: Biotechnology and Bioengineering, Wiley-Blackwell, December, 2011, DOI: 10.1002/bit.24375 Provided by Wiley

<http://bit.ly/uXzZWO>

Neandertals' mammoth building project *Extinct hominids may have been first to build with bones*

By Bruce Bower

Neandertals are stumping for bragging rights as the first builders of mammoth-bone structures, an accomplishment usually attributed to Stone Age people.

Humanity's extinct cousins constructed a large, ring-shaped enclosure out of 116 mammoth bones and tusks at least 44,000 years ago in West Asia, say archaeologist Laëtitia Demay of the National Museum of Natural History in Paris and her colleagues. The bone edifice, which encircles a 40-square-meter area in which mammoths and other animals were butchered, cooked and eaten, served either to keep out cold winds or as a base for a wooden building, the scientists propose in a paper published online November 26 in *Quaternary International*.

Mammoth-bone huts previously discovered at *Homo sapiens* sites in West Asia date to between 27,500 and 15,000 years ago. The new discovery comes from Molodova, a Ukrainian site first excavated in the 1950s.

There, Neandertals erected a mammoth-bone structure that's unlike later mammoth-bone huts, suggesting that the two Homo species developed these practices independently, says study coauthor Stéphane Péan, also of France's National Museum of Natural History.

Researchers have argued for decades about whether Molodova Neandertals left mammoth bones scattered about or built something out of them.

"My own inclination is to assume that some type of mammoth-bone structure, maybe a wind break, was present at Molodova," remarks archaeologist John Hoffecker of the University of Colorado Boulder. A Czech Republic site of comparable age contains a similar circle of mammoth bones, Hoffecker says.

It's hard to know whether Neandertals or modern humans occupied Molodova, he cautions. African Homo sapiens reached Europe by 45,000 years ago (SN Online: 11/2/11), and discoveries in the last few years indicate that those early migrants made stone tools much like those found at Molodova and traditionally attributed to Neandertals, Hoffecker says. No fossils have been unearthed at the Ukrainian site, leaving the identity of its occupants uncertain, in his view.

Demay's team regards Molodova stone tools as typical of Neandertals that lived in Europe and West Asia before modern humans showed up.

Neandertals assembled the circular Molodova structure out of the largest and strongest parts of mammoth skeletons - mainly tusks, shoulders, ribs and hips, the scientists say. Weathering and water damage on the bones indicate that they were placed in a shallow trench.

Remains of at least 15 mammoths, all bearing stone-tool marks but few signs of chewing by nonhuman animals, were uncovered inside the bone enclosure. Excavations also produced bones of red deer, bison and other animals that contained butchery marks. Meat from these animals was cooked in 15 fire pits arrayed throughout the site.

Neandertal groups consisting of no more than around 30 individuals, Péan proposes, periodically camped at Molodova while cutting up and consuming mammoth and other prey.

<http://www.physorg.com/news/2011-12-japan-russia-chance-clone-mammoth.html>

Japan, Russia see chance to clone mammoth

Scientists from Japan and Russia believe it may be possible to clone a mammoth after finding well-preserved bone marrow in a thigh bone recovered from permafrost soil in Siberia, a report said Saturday.

Teams from the Sakha Republic's mammoth museum and Japan's Kinki University will launch fully-fledged joint research next year aiming to recreate the giant mammal, Japan's Kyodo News reported from Yakutsk, Russia.

By replacing the nuclei of egg cells from an elephant with those taken from the mammoth's marrow cells, embryos with mammoth DNA can be produced, Kyodo said, citing the researchers. The scientists will then plant the embryos into elephant wombs for delivery, as the two species are close relatives, the report said.

Securing nuclei with an undamaged gene is essential for the nucleus transplantation technique, it said.

For scientists involved in the research since the late 1990s, finding nuclei with undamaged mammoth genes has been a challenge. Mammoths became extinct about 10,000 years ago. But the discovery in August of the well-preserved thigh bone in Siberia has increased the chances of a successful cloning.

Global warming has thawed ground in eastern Russia that is usually almost permanently frozen, leading to the discoveries of a number of frozen mammoths, the report said. (c) 2011 AFP

<http://www.bbc.co.uk/news/health-15999489>

Liking a lie-in in people's genes, researchers say

People who like a lie-in may now have an excuse - it is at least partly down to their genes, according to experts.

Experts, who studied more than 10,000 people across Europe, found those with the gene ABCC9 need around 30 minutes more sleep per night than those without the gene. The gene is carried by one in five Europeans, they say in their study, published in Molecular Psychiatry. The researchers said the finding could help explain "sleep behaviour".

Over 10,000 people took part, each reporting how long they slept and providing a blood sample for DNA analysis. People's sleep needs can differ significantly. At the extreme, Margaret Thatcher managed on four hours of sleep a night while Albert Einstein needed 11.

Fruit flies

People from the Orkney Isles, Croatia, the Netherlands, Italy, Estonia and Germany took part in the study. All were asked about their sleep patterns on "free" days, when people did not need to get up for work the next day, take sleeping pills or work shifts.

When the researchers from the University of Edinburgh and Ludwig Maximilians University in Munich compared these figures with the results of the genetic analysis, they found those with a variation of a gene known as ABCC9 needed more sleep than the eight-hour average. They then looked at how the gene works in fruit flies, who also have it and found flies without ABCC9 slept for three hours less than normal. The gene ABCC9 is involved in sensing energy levels of cells in the body.

They say this opens up a new line of research in sleep studies, and it is hoped that future work could establish exactly how this gene variant regulates how long people sleep for.

Dr Jim Wilson, from the University of Edinburgh's centre for population health sciences, said: "Humans sleep for approximately one-third of their lifetime. "A tendency to sleep for longer or shorter periods often runs in families despite the fact that the amount of sleep people need can be influenced by age, latitude, season and circadian rhythms. "These insights into the biology of sleep will be important in unravelling the health effects of sleep behaviour."

Sleep expert Neil Stanley said around half a dozen genes had been linked to sleep patterns. He added: "It's interesting to know about these genes, but in a way our genes are an irrelevance unless you were actually to obey them - but none of us do that."

<http://nyti.ms/vG5zum>

In Southern Arizona, Rare Sightings of Ocelots and Jaguars Send Shivers *The Serengeti is associated with safaris. The Maasai Mara, too. But southern Arizona?*

By MARC LACEY

PHOENIX - A series of recent sightings of rare wild cats in the southern part of the state has prompted considerable excitement among wildlife experts and camera-toting naturalists alike. Twice this year, the Arizona Game and Fish Department has announced sightings in the southeast of endangered ocelots, small spotted cats with jaguarlike markings.

A third ocelot sighting reported on Friday by a homeowner who snapped some blurry photos of an odd-looking cat was probably a serval, an African cat popular in the pet trade, state officials said Saturday. The animal had long ears, long legs and appeared to have only solid spots instead of the solid spots and haloed spots on an ocelot.



A jaguar along an isolated canyon in Sonora State in Mexico. A jaguar sighting was recently confirmed in southern Arizona. Sky Island Alliance, via Associated Press

On Nov. 19, it was a rare jaguar that was seen in the same part of the state — the first confirmed appearance of that elusive and endangered cat in Arizona since 2009. The jaguar is the third-largest feline after the tiger and the lion, and the only one found in the wild in the Western Hemisphere.

Donnie Fenn, a professional guide based in Benson, Ariz., who specializes in mountain lion hunts — which are fairly common in Arizona — was taking his 10-year-old daughter out on her first lion hunt that morning when his pack of eight hounds took off in a frenzy. Before he knew it, he said, the dogs had a creature cornered in a tree, which he saw from afar with a telephoto lens was not the mountain lion he was looking for but instead an endangered jaguar.

"I was scared," Mr. Fenn said in a telephone interview on Friday. "I didn't know if that thing was going to turn on me. I could feel its power. It was twice the size of a big mountain lion. It was definitely the experience of a lifetime."

Mr. Feen said that his dogs were scratched pretty badly by the cornered jaguar, who probably had roamed north from Mexico.

In June, a helicopter pilot working along the border for the federal Department of Homeland Security reported seeing a jaguar in the Santa Rita Mountains south of Tucson, officials said. Because the pilot had previously seen mountain lions, which are sometimes confused by the non-experts with jaguars, and was able to hover about 100 feet above the spotted cat and clearly describe it, wildlife experts took the report seriously. But

biologists who went to the scene about a week after the spotting could not find tracks, hair or droppings from the animal, making it an unconfirmed sighting.

Mr. Fenn, 32, made sure to confirm his run-in with the jaguar, which took place in an undisclosed mountain range in Cochise County. He crept up close after the jaguar was chased up a mesquite tree and took photos and a video of the animal. He also notified state wildlife officials, who were later able to find 15 hair samples left behind by the animal and a tree trunk that showed signs of being climbed by a large clawed animal. Experts believe Mr. Fenn saw an adult male jaguar that weighed about 200 pounds.

“What’s so appealing to the general public is that jaguars are so exotic,” said Mark Hart, a spokesman for the Arizona Game and Fish Department. “They are jungle cats from Central and South America, and the fact that they might be in our state really gets people’s attention. It’s a romantic notion.”

Mr. Fenn, whose Chasin’ Tail Guide Service offers five-day mountain lion hunts for \$3,500, said his Web site has been barraged with hits since the jaguar sighting. And his daughter Alyson, initially disappointed that she did not get her first mountain lion kill that day, now realizes that seeing a jaguar was memorable, too.

“It was quite an experience, even if she didn’t get to kill anything,” Mr. Fenn said.

Lunar Eclipse 2011-Dec-10 Oamishirasato, JAPAN

Latitude: 35° 30' 09" N Longitude: 140° 21' 13" E Altitude: 5.8m Time Zone: 09:00 E

Calendar Date	Ecl. Type	Pen. Mag.	Umbral Mag.	Pen. Eclipse Begins	Alt	Partial Eclipse Begins	Alt	Total Eclipse Begins	Alt	Mid. Eclipse	Alt	Total Eclipse Ends	Alt	Partial Eclipse Ends	Alt	Pen. Eclipse Ends	Alt
2011-Dec-10	T	2.186	1.106	20:34	+50	21:46	+64	23:06	+76	23:32	+77	23:57	+76	01:18	+64	02:30	+50