Complex decision? Don't sleep on it

Neither snap judgements nor sleeping on a problem are any better than conscious thinking for making complex decisions, according to new research.

The finding debunks a controversial 2006 research result asserting that unconscious thought is superior for complex decisions, such as buying a house or car. If anything, the new study suggests that conscious thought leads to better choices.

Since its publication two years ago by a Dutch research team in the journal Science, the earlier finding had been used to encourage decision-makers to make "snap" decisions (for example, in the best-selling book Blink, by Malcolm Gladwell) or to leave complex choices to the powers of unconscious thought ("Sleep on it", Dijksterhuis et al., Science, 2006).

But in the new study, to be published in The Quarterly Journal of Experimental Psychology, scientists ran four experiments in which participants were presented with complex decisions and asked to choose the best option immediately ("blink"), after a period of conscious deliberation ("think"), or after a period of distraction ("sleep on it"), which is claimed to encourage "unconscious thought processes".

In all experiments, there was some evidence that conscious deliberation can lead to better choices and little evidence for superiority of choices made "unconsciously". Faced with making decisions such as choosing a rental apartment and buying a car, most participants made choices predicted by their subjective preferences for certain attributes (for example, safety, security, colour or price), regardless of the mode of thinking employed.

Unconscious thought is claimed to be an active process during which information is organized, weighted, and integrated in an optimal fashion. Its benefits are argued to be strongest when a decision is complex - one with multiple options and attributes - because unconscious thought does not suffer from the capacity limitations that hobble conscious thought.

"Claims that we can make superior 'snap' decisions by trusting intuition or through the 'power' of unconscious thought have received a great deal of attention in the media," says University of New South Wales psychologist, Dr Ben Newell, lead author of the new study.

Among the headlines that followed the 2006 research are these: "Dilemma? Don't give it a thought," The Times, 17-02-06; "Trust your gut instinct when those shopping decisions get tough, say scientists," The Telegraph, UK, 17-02-06; "Big decision time? Best to sleep on it," Reuters News, 16-02-06.

"At best, these sorts of headlines are misleading," says Dr Newell. "At worst, they're outright dangerous. In stark contrast to claims made by the Dutch research team and in the media, we found very little evidence of the superiority of unconscious thought for complex decisions.

"On the contrary, our research suggests that unconscious thought is more susceptible to irrelevant factors, such as how recently information has been seen rather than how important it is. If conscious thinkers are given adequate time to encode material, or are allowed to consult material while they deliberate, their choices are at least as good as those made 'unconsciously'."

Tips for making better decisions - Dr Newell's advice for making better decisions is based on seven decades of research on the psychology of decision-making, reasoning and thinking. Watch the online video courtesy of the BBC's Horizon program.
http://www.bbc.co.uk/sn/tvradio/programmes/horizon/broadband/tx/decisions/tips/

Health and marriage: The times they are a changin'

EAST LANSING, Mich. — The health of people who never marry is improving, narrowing the gap with their wedded counterparts, according to new research that suggests the practice of encouraging marriage to promote health may be misguided.

Hui Liu, assistant professor of sociology at Michigan State University and lead researcher on the project, said sociologists since the 1970s have emphasized that marriage benefits health more so for men than for women.

"Married people are still healthier than unmarried people," Liu said, "but the gap between the married and never-married is closing, especially for men."

The findings of Liu and fellow researcher Debra Umberson of the University of Texas at Austin will appear in the September issue of the Journal of Health and Social Behavior. The article is called "The Times They Are a Changin': Marital Status and Health Differentials from 1972 to 2003."

The researchers analyzed National Health Interview Survey data from that period and found that while the self-reported health of married people is still better than that of the never-married, the gap has closed considerably.

The trend is due almost exclusively to a marked improvement in the self-reported health of never-married men. Liu said that may be partly because never-married men have greater access to social resources and support that historically were found in a spouse.

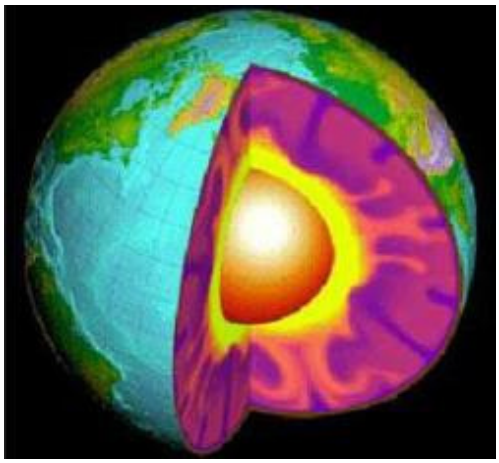
Further, the research shows that the health status of the never-married has improved for all race and gender groups examined: men, women, blacks and whites. (The health of married women also improved, while the health of married men remained stable.)

"Politicians and scholars continue to debate the value of marriage for Americans," the researchers write in the study, "with some going so far as to establish social programs and policies to encourage marriage among those socials groups less inclined to marry, particularly the poor and minorities."

But the research findings "highlight the complexity of this issue" and suggest that "encouraging marriage in order to promote health may be misguided."

In contrast, the self-reported health for the widowed, divorced and separated worsened from 1972 to 2003 relative to their married peers. This held true for both men and women, although the widening gaps between the married and the previously married groups are more pronounced for women than for men.

Did iron cyclones give Earth a wonky core?



IT'S not just the sphere of culture that has an east-west divide. The Earth's inner core of solid iron also behaves differently in each hemisphere, transmitting seismic waves faster in the eastern side than in the west.

The phenomenon has baffled scientists, but now numerical simulations developed by Julien Aubert of the French national research centre's Institute of Geophysics in Paris and his team suggest that the anomaly may be due to subterranean "cyclones" found in parts of the liquid iron outer core.

These swirling cyclones drag cooler material from the top of the outer core right down to the bottom, where iron is gradually crystallising onto the solid inner core. This cooling causes crystals to form more quickly and with random alignments. That makes the material stronger, which in turn means it is able to carry seismic waves more quickly.

Aubert's work indicates that for the past 300 million years most of these iron cyclones will have been found below Asia, so most of the cooling effect will have been in the eastern hemisphere. Over that time, the inner core has grown by about 100 kilometres, and on the eastern side of the core that layer should have formed from the fast-transmission crystals.

Invention: Morphine-cannabis super-painkiller

* 12:00 11 August 2008
* NewScientist.com news service
*** Justin Mullins**

Morphine-cannabis super-painkiller

Pain can often be better managed when two types of painkiller are used together. For example, it has recently become known that cannabinoids such as THC, the psychoactive ingredient in cannabis, enhance the painkilling effects of opioids such as morphine.

Teaming them up could allow doses to become smaller, reducing the possibility of addiction. But a simple mixture of the drugs produces unpredictable results because the body absorbs them at different rates.

A possible solution is to join together THC and morphine to create a hybrid molecule that is snipped apart by the body, say Joseph Holtman and Peter Crooks at the University of Kentucky College of Medicine in Lexington, Kentucky.

Their idea is to bind the two drugs together using a linking molecule such as an ester. When the body snips this linking group, both drugs are released at the site where they are needed. That should ensure both drugs will be absorbed at the same rate, making it easier to work out doses for patients.

Read the full morphine-cannabis supermolecule painkiller patent application.

Botox face cream

Botulinum toxin or botox is injected by cosmetic surgeons to paralyse muscles and reduce the appearance of wrinkles. But the procedure can be painful and even cause tissue damage leading to problems such as drooping eyelids. Now Robert Nicolosi and Jonathon Edelson at the University of Massachussetts Lowell Nanomanufacturing Center have developed a skin cream that can do the same trick.

It had been thought that botox could not pass through the skin. But the researchers have discovered that the toxin passes through with ease if it is attached to a nanoparticle in an emulsion.

The nanoemulsion also keeps the toxin stable, they claim, giving the cream a possible shelf life of up to two years.

Read the full botox face cream patent application.

CPR coach

A person suffering cardiac arrest is at risk of death as their blood is no longer circulating. Some studies have shown that patients' survival rates can increase by a factor of 3 when high-quality CPR is administered. But the quality of CPR is important.

Getting the depth of chest compressions right is one measure of quality. And a new gadget from Philips helps first aiders get it right, by giving physical feedback to let them know when the right depth has been reached. For an adult, that is around 4 centimetres, and for a child around 2.5cm.

The CPR coach is a pad placed over the patient's chest that contains accelerometers to monitor compression depth. When the correct depth has been reached, the device vibrates to warn the rescuer to stop. This can be combined with audio coaching, in the form of rhythmic beeps for a rescuer to follow.

Read the full force-feedback CPR coach patent application.

Basketball pros read pinkies to call shots

* 15:15 11 August 2008
* NewScientist.com news service

*** Ewen Callaway**

Professional basketball players read pinkies, not palms, to tell whether a shot will swoosh through the basket or clang off the rim.

A team of neuroscientists showed 10 Italian league players videos of free throw shots, variously missed and made. The shots were frozen at various stages – before the ball left a player's hand, to the instant before it reached the basket. Coaches and experienced basketball journalists watched the same footage, as did as novices.

Unsurprisingly, the pros proved much better and quicker at calling shots, compared to experienced basketball watchers and novices.

Less than half a second into the shot, as the player still cradled the ball, pros guessed "in" or "out" well above chance. In contrast, coaches, journalists and novices reached that criterion only after the ball left the player's fingers.

Basketball on the brain

The difference seems to be that the pros play out the shot in their brains, allowing them to make a call just from looking at the player's body, says Salvatore Aglioti, of the Sapienza University of Rome, Italy.

When his team repeated the experiment with subjects wired to a device that measured activity in the brain regions controlling two arm muscles, they found that the pros relied on a circuit that harnesses the abductor digiti minimi – the pinkie's main muscle.

Early in the video, pros activated this region during missed balls, but not during shots that swished in. The other groups' brain activities remained the same, no matter the time point or whether the shot was a brick or a basket.

Aglioti speculates that professionals can read the spin imparted on the ball by focusing on the flick of the pinkie. "When you get experience, you predict the future of an action by looking at the body," he says.

Journal reference: Nature Neuroscience, DOI: 10.1038/nn.2182

Resistant prions

Prions, the pathogens that cause scrapie in sheep, can survive in the ground for several years, as researchers have discovered. Animals can become infected via contaminated pastures. It is not yet known whether the pathogens that cause BSE and CWD are equally resistant.

A flock of sheep at pasture – a seemingly idyllic scene. But appearances can be deceptive: If the animals are suffering from scrapie, entire flocks may perish. Scrapie is an infectious disease in which prions destroy the animal’s brain, rather like BSE. The brain becomes porous, the sheep lose their orientation, they suffer from strong itching sensations and scrape off their fleece. Eventually, the infected animals die.

It is difficult to contain the disease – all too often, scrapie will break out again on the same farm several months or years after it has apparently been eradicated. Are the prions transmitted not only by direct contact, but also by the environment – perhaps by the pastures? How long do prions that get into the pasture via the saliva and excrements of the sick animals, persist in the ground? Together with fellow-scientists from the Robert Koch Institute in Berlin and the Friedrich Loeffler Institute (Federal Research Institute for Animal Health) on the island of Riems, research scientists from the Fraunhofer Institute for Molecular Biology and Applied Ecology IME in Schmallenberg investigated these questions on behalf of the German Ministry for Environment, Nature Conservation and Nuclear Safety BMU. “We mixed soil samples with scrapie pathogens to find out how long the pathogens would survive,” says Dr. Björn Seidel, who headed the investigations at IME. “Even after 29 months, in other words more than two years, we were still able to detect prions in the soil.” But are these prions still infectious? “The soil actually seems to increase the infectiousness of the pathogens. The incubation period – the time it takes for the disease to break out – is exceedingly short even after the prions

have persisted in the soil for 29 months. All of the animals that were given contaminated soil became sick within a very short time. These results indicate that fresh incidences of scrapie among sheep are due to contaminated pastures," says Seidel in summary. The results of the study reveal that sheep may even become infected from the surface water, though the risk of infection is much lower in this case. There is no danger to humans, however: scrapie pathogens seem unable to affect them.

Another cause for concern is chronic wasting disease (CWD). Like BSE and scrapie, this is caused by prions, but it mainly affects deer. The numbers of infected animals in North America are rising steeply. How long do BSE and CWD prions survive in the ground? "To find this out, we urgently need to carry out further tests. The appropriate research applications have already been submitted," says Seidel.

Large reservoir of mitochondrial DNA mutations identified in humans

Blacksburg, Va. – Researchers at the University of Newcastle, England, and the Virginia Bioinformatics Institute at Virginia Tech in the United States have revealed a large reservoir of mitochondrial DNA mutations present in the general population. Clinical analysis of blood samples from almost 3,000 infants born in north Cumbria, England, showed that at least 1 in 200 individuals in the general public harbor mitochondrial DNA mutations that may lead to disease. The findings, which highlight the need to develop new approaches to prevent the transmission of mitochondrial diseases, were published in The American Journal of Human Genetics.*

Mitochondria, the "engines" present in each cell that produce adenosine triphosphate, are passed from mother to offspring. Mutations in mitochondrial DNA inherited from the mother may cause mitochondrial diseases that include muscle weakness, diabetes, stroke, heart failure, or epilepsy. In almost all mitochondrial diseases caused by mutant mitochondrial DNA, the patient's cells will contain a mixture of mutant and normal mitochondrial DNA. The proportion of mutant mitochondrial DNA in most cases determines the severity of disease.

Previous estimates from epidemiological studies suggested that mitochondrial diseases affect as many as one person in 5,000. However, the incidence of new mitochondrial mutations and the prevalence of those carrying these mutations were never fully established due to limitations in the methods used. Most of the earlier estimates of the frequency of mitochondrial DNA mutations in the general population, for example, have depended on identification of clinically affected patients and subsequent retracing of inheritance on the maternal side of the family. This approach fails to detect the gradual accumulation of mutations in some members of the population, including those individuals who harbor mitochondrial DNA mutations but who otherwise do not show the symptoms of disease.

Dr. David Samuels, Assistant Professor at the Virginia Bioinformatics Institute and an author on this study, commented: "We know from many clinical studies of patients and their families that our cells can tolerate a rather large amount of mutant mitochondrial DNA with no significant loss of function. From that observation we have suspected that there may be a large number of people in the general population who carry pathogenic mitochondrial DNA mutations, but who are not obviously ill with a mitochondrial disease. This study gives us, for the first time, a measurement of the number of these carriers of pathogenic mitochondrial DNA mutations in the general population. One in every 200 individuals is a lot of people – around 1.5 million people in the United States alone. "

The scientists looked at 10 mitochondrial DNA mutations (arising from single nucleotide replacements) often found in patients with mitochondrial disease. By taking advantage of a high-throughput genotyping system that uses mass spectrometry measurements, the researchers were able to detect mutated mitochondrial DNA at high sensitivity. In each positive case, DNA cloning and sequencing were used to confirm the findings. By looking at differences in tissue samples from mother and child, the researchers were also able to estimate the rate at which new DNA mutations had arisen in the population. The incidence of new mutations was close to 100 for every 100, 000 live births.

Dr. Samuels commented: "These new clinical measurements have given direct evidence for the widespread incidence of pathogenic mitochondrial DNA mutations in the human population. These findings emphasize the pressing need to develop effective ways to interrupt the transmission of these mutations to the next generation."

This research is supported by the United Mitochondrial Diseases Foundation with additional support from the Association Française contre les Myopathies. Ethical approval for this study was granted by the West Cumbria Local Research Ethics Committee.

** Hannah R. Elliott, David C. Samuels, James A. Eden, Caroline L. Relton, Patrick F. Chinnery (2008) Pathogenic mitochondrial DNA mutations are common in the general population. American Journal of Human Genetics 83(2): 254-260. doi:10.1016/j.ajhg.2008.07.004*

Political candidates and other 'phantoms': Consumer choice in changing markets

When 1 option leaves market, most similar option benefits

U.S. Senator Hillary Clinton may do more for U.S. Senator Barack Obama than Ralph Nader did for Al Gore: she could give him an unintended boost. Clinton sought the presidency and then, unlike Nader, exited the race. New research from the University of Minnesota's Carlson School of Management demonstrates that when an option enters and then leaves a market, the most similar remaining option -- in this case Obama -- stands to benefit. Whether it is political candidates or beer, health care plans or automobiles, when one attractive option becomes unavailable, people gravitate toward the most similar remaining option.

In their paper "Could Ralph Nader's Entrance and Exit have helped Al Gore? The Impact of Decoy Dynamics on Consumer Choice," forthcoming in the Journal of Marketing Research, the University of Minnesota's Akshay Rao and co-authors William Hedgcock and Haipeng (Allan) Chen (both Carlson School alumni) show that the disappearance of an option from a choice set can increase the appeal of the remaining selection that is most similar to the now-absent option. This happens, they write, because consumers and voters attach greater importance to those issues or attributes on which the two similar options competed.

"We found that the entrance and exit of a third option -- the 'Nader effect' -- can profoundly impact consumers' preference," said Rao. "The presence of the third alternative shifts the focus of the customer. If you have two automobiles extolling their fuel efficiency, while a third promotes style, purchasers pay more attention to the fuel efficiency criterion. Then, when one of the high fuel efficiency cars leaves the market, the other fuel efficient car draws consumers. In the case of automobiles it might be fuel efficiency, and in the case of political candidates it might be health care. When the third choice exits, the remaining candidate with the most similar attributes becomes the favorite - even if they weren't before." Rao goes on to say, "We also call this effect the 'phantom decoy' effect because, like pre-announced software that is never released, these desirable options that become 'unavailable' may never actually exist."

Rao illustrates phantom decoys by pointing to on-line vacation options. A consumer may search on the Internet and see three vacation options. One is a four star hotel far from the beach, a second is a lower quality hotel closer to the beach, while a third alternative is a five star hotel, also near the beach. If the buyer tries to book the five star hotel and it turns out to no longer be available, things get interesting. The research shows that the phantom decoy, the five-star hotel, causes a shift in the consumer's preference. When the five star hotel cannot be selected, the buyer now looks to the next closest option, the four star hotel, even though it was not initially preferred. The same, Rao observes, happens in political choice.

When making decisions, consumers need to pay close attention to their options. The presence of a third choice could be accidental, or it may be the consequence of smart ad execs influencing customer choice with a phantom decoy.

The researchers advise marketers and pundits to pay careful attention to this "Nader effect." "The increase in affinity that a product may receive when a decoy option, real or not, is removed can mark a significant change in consumer choice," says Rao. "In terms of elections, even a 5 percent increase in preference makes a huge difference at the ballot box."

More information about Rao's research, and a copy of the paper, may be found at www.carlsonschool.umn.edu/marketinginstitute/arao.

New research reveals why chili peppers are hot

GAINESVILLE, Fla. --- Despite the popularity of spicy cuisine among Homo sapiens, the hotness in chili peppers has always been something of an evolutionary mystery.

A plant creates fruit in order to entice animals to eat and disperse its seeds, so it doesn't make sense for that fruit to be painfully hot, said University of Florida zoology professor and evolutionary ecologist Douglas Levey.

But according to new research by Levey and six colleagues from other universities, chilies have a very good reason to make themselves hot. It boils down to protection.

Based on research on wild chili plants in rural Bolivia, the scientists found that the leading cause of seed mortality is a fungus called Fusarium. The fungus invades the fruits through wounds made by insects and destroys the seeds before they can be eaten and dispersed.

Capsaicin, the chemical that makes the peppers hot, drastically slows microbial growth and protects the fruit from Fusarium. And while capsaicin deters local mammals, such as foxes and raccoons, from consuming the chilies, birds don't have the physiological machinery to detect the spicy chemical and continue to eat the peppers and disperse seeds, Levey said.

The researchers' findings will be released today in a paper published online by the Proceedings of the National Academy of Sciences.

Levey and his colleagues were able to arrive at these conclusions because at least three of the approximately 15 species of chilies that grow in the Bolivian wild are polymorphic for pungency, which means that some individuals of those species produce pungent fruit and others produce non-pungent fruit. This provided the researchers with natural experimental conditions under which they could compare Fusarium attack on fruits with and without capsaicin.

Upon studying various chili pepper plants, the researchers observed a clear correlation between high levels of capsaicin and low seed mortality due to fungal growth, Levey said.

And the chemical doesn't just help the plants that produce it, either. Levey said the consumption of chilies can help protect humans from the dangerous diseases that are so plentiful in tropical climates.

"The use of chili peppers as a spice has spread to nearly every culture within 20 degrees of the equator, and it tends to decline as you move toward the poles," Levey said.

The capsaicin in chilies, one of the first plants domesticated in the New World, may have been used to protect human food from microbial attack long before refrigeration or artificial preservatives were available, he said.

One question Levey and his colleagues are still pondering is why any nonhot chilies remain if capsaicin is so beneficial. Their hypothesis is that the production of the chemical comes at a steep price for chili plants.

Levey said the plants that produced hot chilies had seeds with very thin coats – a presumed consequence of sacrificing the production of lignin, a complex molecule that makes up the protective seed coat, in favor of the production of capsaicin. This phenomenon represents an interesting tradeoff between chemical and physical seed protection and demonstrates the power of natural selection, Levey said.

At higher elevations, where moisture is high and Fusarium fungus is rampant, the scientists found that 100 percent of the plants produced hot chilies. In the drier lowlands, where fungus is less of a problem, only 40 percent of the plants produced fiery fruits. The remainder spent more resources developing thick seed coats, which protect against the devastating ant populations common to lower areas.

While all of the plants look identical, telling the difference between hot and non-hot chilies is not difficult, Levey said. "Just pop one in your mouth," he said. "You'll find out pretty quick."

The lead author of the paper is Joshua Tewksbury, of the University of Washington. In addition to Levey, co-authors are Karen Reagan, Noelle Machnicki, Tomás Carlo, and David Haak of the University of Washington; and Alejandra Lorena Calderón Peñaloza of Universidad Autonoma Gabriel Rene Moreno in Bolivia. The work was funded by the National Science Foundation and the National Geographic Society.

Lab-grown tendons gradually fade to bone

* 22:00 11 August 2008
* NewScientist.com news service
*** Kurt Kleiner**

Tissue engineering can produce tendons, cartilage, and even bladders. But only now have researchers managed to make different tissues blend into one another, as they do naturally in the body.

Such gradients are necessary for some structures and organs to function properly, says bioengineer Andrés García, who with colleagues at the Georgia Institute of Technology demonstrated a way to grow tendons that gradually "fade" to bone at one end.

In the body, gradients like this strengthen the ends of tendons that attach to bones. Currently, lab-grown tendons put into the body often fail at the attachment end because they lack this property, says García.

His new technique should lead to more lifelike artificially-grown tendons, and better treatments for injuries like ruptured Achilles tendons. The technique could also be applicable to other tissues, such as blood vessels.

Bone virus

At the heart of the new technique is a gene that triggers the fibroblast cells that make up tendons to start forming bone. The team used viruses carrying that gene to transform a tendon made from normal fibroblasts into one with a gradient of bony properties.

They began with a protein scaffold covered in a graded coat of a polymer called PLL. A thick coat at one end faded away to a very thin layer at the other.

The scaffold was then dipped into a liquid containing the virus. Particles of virus stuck onto the graded PLL coat, creating a gradient of virus particles.

Steady gradient

Fibroblast cells were then grown over the scaffold. In places with many virus particles, a high density of fibroblasts were infected with the gene, and started to secrete bone. In places with few virus particles, few fibroblasts were infected.

The end result was a steady gradient of bone secretion along the length of the tendon, which significantly enhanced its strength.

So far, the researchers have shown that tendons made this way are stable when implanted under the skin of rats. The next step is to graft a tendon to connect bone and muscle in a rat and see if it really does perform better.

The same technique could be used to make better ligaments, which connect bones together, says García.

"Next horizon"

"I think it's very interesting as a next horizon for tissue engineering in general," says Jennifer Elisseeff, a biomedical engineer at Johns Hopkins University in Baltimore, Maryland.

"It's often [the case] that interfaces [between tissues] are the issue. Getting that transition is going to be critical in clinical application of these technologies."

Journal reference: Proceedings of the National Academy of Sciences, DOI: 10.1073/pnas.0801988105

'Adapter plug' to turn antibodies into HIV killers

* 22:00 11 August 2008
* NewScientist.com news service
*** Nora Schultz**

An "adapter plug" molecule that transforms spare antibodies into HIV killers could provide a new way to treat AIDS and other viruses.

The antibodies targeted by the molecule are called anti-gal. They are naturally present in humans and typically make up 1% of all antibodies in the blood.

They help to fight Salmonella and Escherichia coli by binding to a sugar on the bacteria's surfaces. But unless you are fighting a serious infection, most go spare.

"Most of the time these antibodies don't do much, so we thought it would be useful if we could teach them to recognise HIV," says Anders Vahlne at the Karolinska Institute in Stockholm, Sweden.

Antibody engineering

His team created a molecule with the sugar group that anti-gal recognises on one end. On the other end, they attached a string of atoms that mimics part of a receptor, found on human immune cells, that binds to HIV.

The result is a molecule that binds to both anti-gal and HIV. It acts like a kind of adapter plug for the antibodies, allowing their innate cell-destroying machinery to be unleashed on HIV-infected cells.

"The antibodies block the interaction between virus and host cell, recruit molecules that will destroy infected cells, and alert killer cells that will eat them," says Vahlne, who also does research for the company TriPep in Stockholm, which hopes to commercialise the idea.

Virus roadblock

When his team added HIV viruses to human cells that had been primed with the adapter molecules and anti-gal antibodies, almost 90% of the viruses were unable to infect the cells.

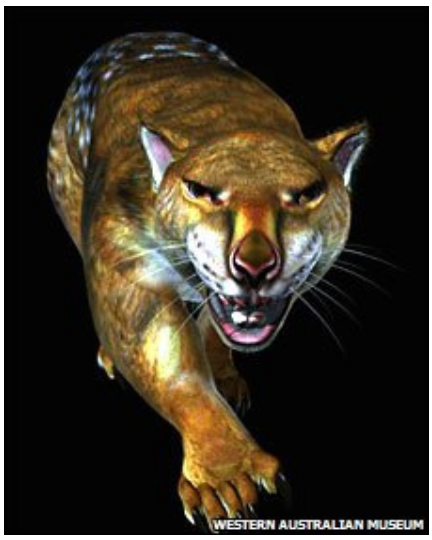
The adapters must still be tested in HIV-infected mice but Rowena Johnston of AIDS research foundation amfAR says the work shows how "we might be able to use the innate immune system in a surprising and intriguing way".

Vahlne is also tweaking the molecules to bind to MRSA, responsible for many fatal hospital infections.

Journal reference: Proceedings of the National Academy of Sciences, DOI: 10.1073/pnas.0805777105

Extinction 'by man not climate'

The extinction of many ancient species may be due to humans rather than climate change, experts say.



Prehistoric animals like the marsupial lion died out after humans arrived

Large prehistoric animals in Tasmania may have been wiped out by human hunting and not temperature changes, a team of international scientists argue.

This pattern may have been repeated around the globe on islands such as Great Britain, the scientists say.

The findings were published in the American scientific journal - Proceedings of the National Academy.

Giant kangaroos

For many years, scientists have been arguing about the causes of widespread extinctions of vast numbers of species at the end of the last Ice Age. What has caused the most debate has been the fate of megafauna - large bodied creatures in Australia that included three-metre tall giant kangaroos and marsupial lions.

Humans arrived in Tasmania about 43,000 years ago, when the island became temporarily connected by a land bridge to mainland Australia. It had been thought that many megafauna were already extinct by this stage.

But using the latest radiocarbon and luminescence dating techniques, the British and Australian scientists say they were able to determine the age of the fossilised remains of the megafauna more accurately than ever before.

They discovered that some of the giant animals survived for 2,000 years after humans arrived, and at a time when the climate was not changing dramatically.

The researchers concluded that these species were driven to extinction by hunting.

Human blame?

Professor Chris Turney, from the University of Exeter, the lead author on the research paper, said that 150 years after the publication of Charles Darwin's seminal work The Origin of Species, the argument for climate change being the cause of this mass extinction had been seriously undermined.

"It is sad to know that our ancestors played such a major role in the extinction of these species - and sadder still when we consider that this trend continues today," he said.

Given Tasmania's history as an island, the research findings should help to disentangle the role of humans and climate change in other island environments, such as Britain, the scientists said.

Previous research had found that on mainland Australia some 90% of megafauna disappeared about 46,000 years ago - soon after humans first settled on the continent.

Losing weight soon after type 2 diabetes diagnosis doubles positive outcomes

First clinical study to show benefits remain even if patients regain weight

Portland, Ore. – People who lose weight soon after a diagnosis of type 2 diabetes have better control of their blood pressure and blood sugar, and are more likely to maintain that control even if they regain their weight, according to a Kaiser Permanente study published online in Diabetes Care, the American Diabetes Association journal.

This is the first clinical study to show that benefits remain even if patients regain their weight. The study followed more than 2,500 adults with type 2 diabetes for four years. Those who lost weight within an average of 18 months after diagnosis were up to twice as likely to achieve their blood pressure and blood sugar targets as those who didn't lose weight. Those benefits can prevent diabetes-related heart disease, blindness, nerve and kidney damage, and death.

"Our study shows that early weight loss can reduce the risk factors that so often lead to diabetes complications and death," says Dr. Adrianne Feldstein, MD, MS, the study's lead author, a practicing physician and an investigator at Kaiser Permanente's Center for Health Research in Portland, Ore. "We've known for a long time that weight loss is an important component in diabetes treatment and prevention. Now it appears there may be a critical window of opportunity following diagnosis in which some lasting gains can be achieved if people are willing to take immediate steps toward lifestyle changes."

More than 20 million Americans have type 2 diabetes and most of them are overweight or obese.

Funded by the National Institutes of Health, the four-year study conducted by Kaiser Permanente in Oregon and Washington followed 2,574 patients with type 2 diabetes between 1997 and 2002. Scientists followed the weight gain and loss patterns of these patients for three years, and then in the fourth year compared glucose control tests and blood pressure readings.

Most patients remained at about the same weight during the first three years of the study, but a small group of 314 patients lost an average of 23 pounds. This group was more likely to meet blood pressure and glucose targets during the fourth year even though, by that time, most of them had regained their weight.

"We don't know if the initial weight loss increased the body's sensitivity to insulin, or if the sustained lifestyle changes were the reason for the long-term health benefits," said Gregory A. Nichols, Ph.D., a study co-author at Kaiser Permanente's Center for Health Research. "But we do know that losing weight reduces the risk factors that often lead to heart disease, blindness, nerve and kidney damage, amputations, and death in type 2 diabetes patients."

Although the study didn't examine specific methods for weight loss, prior studies conducted at Kaiser Permanente's Center for Health Research have demonstrated effective weight loss strategies. One recent study reported that diabetic patients who had nutritional counseling were about twice as likely to lose weight. Another study found that people who keep food diaries lose twice as much weight as those who don't, and that people who attend support groups also lose more weight.

This study -- The Weight Change in Diabetes and Glycemic and Blood Pressure Control study -- was supported by a grant from National Institute of Diabetes and Digestive and Kidney Diseases at the National Institutes of Health. Study authors include: Adrianne C. Feldstein, MD, MS; Gregory A. Nichols, Ph.D.; David H. Smith, RPh, MHA, Ph.D.; Victor J. Stevens, Ph.D.; A. Gabriela Rosales, M.S. and Nancy Perrin, Ph.D. of the Kaiser Permanente Center for Health Research, and Keith Bachman, MD, of the Northwest Permanente Medical Group.

Weight Loss Tips for People with Pre-Diabetes or Diabetes

* Choose whole grains, brown rice and vegetables instead of french fries, white bread and white rice
* Avoid the hidden calories in processed foods: Eat fresh foods without hidden fats or added sweeteners whenever possible
* Skip soda and fruit juice: opt instead for sugar-free soda, tomato juice or water, or eat a piece of fruit
* Don't drink your calories: Except for 1% or non-fat milk, get your calories from foods
* Establish consistent eating times, including breakfast
* Write down everything you eat so you avoid mindless eating and control how much you eat, at home and away: a recent Kaiser Permanente study showed that people who keep food diaries lose twice as much weight as those who don't.
* Educate yourself: find a registered dietitian or nutrition class -- a recent Kaiser Permanente study showed that diabetic patients who had nutritional counseling were about twice as likely to lose weight
* Visit kp.org/diabetes and kp.org/weight for more information on pre-diabetes, diabetes and weight management, in English and Spanish

Source: Kaiser Permanente www.kp.org

Rare Case In A Baltimore Couple Explains Why Some Infected With Hiv Remain Symptom Free For Years Without Antiretroviral Drugs

Finding renews promise of vaccine against AIDS; disproves theory of defective virus

AIDS experts at Johns Hopkins say they have compelling evidence that some people with HIV who for years and even decades show extremely low levels of the virus in their blood never progress to full-blown AIDS and remain symptom free even without treatment, probably do so because of the strength of their immune systems, not any defects in the strain of HIV that infected them in the first place.

Their conclusions about so-called elite suppressors, published this month in the Journal of Virology, come from rigorous blood and genetic studies from a monogamous, married, African-American couple in Baltimore, in which the wife was infected through sex with her husband more than a decade ago.

Unlike her husband, the wife remains symptom free, has consistently had viral counts of fewer than 50 copies per cubic milliliter of blood, and has not needed any treatment to keep the disease in check. The husband, as a so-called progressor, takes a potent drug cocktail to keep his infection from developing into full-blown AIDS, as demonstrated by viral counts in the hundreds of thousands per cubic milliliter of blood. The couple has been married for two decades and the husband was an intravenous drug user.

The scientists say the case study disproves some suspect theories about elite suppression that suggest it always involves a defective or "weakened" viral strain, which is easier for the immune system to attack, or that genetic variants confer a protective effect in suppressors.

"This is an extremely rare case of co-infection in a controlled, monogamous relationship, which showed us how a strong immune system in the elite suppressor kept the virus from replicating and infecting other cells," says senior study investigator and infectious disease specialist Joel Blankson, M.D., Ph.D.

"Our findings offer hope to vaccine researchers because they reveal that the immune system's primary offense, known as CD8 killer T-cells, can effectively halt disease progression by a pathogenic form of HIV," says Blankson, an assistant professor at the Johns Hopkins University School of Medicine.

"Moreover, the strength of the immune response was not dependent on infection by a weakened form of the virus. And if we can harness the means by which these elite white blood cells stop the virus, then we can hopefully 'teach' or reprogram white blood cells in others to also target HIV," he says.

Included in the blood analysis was genetic testing which confirmed that both husband and wife were infected with the same pathogenic strain of HIV and ruled out the possibility that there were genetic deficiencies in the virus that infected the wife. Genetic testing also confirmed that both husband and wife had an overactive strand of genetic material tied to gene HLA B57, found in previous studies to be more common in those whose HIV infection was suppressed or slowed.

"The presence of this genetic spot is a discordant result that strongly contradicts theories that various genetic factors alone play a protective role in suppression," says Blankson.

He notes that study findings revealed a beneficial side effect to spurring the immune system cells to attack HIV.

Using new laboratory tests that precisely measure the immune response to various strains of HIV, researchers first tested T-cells from both the wife and husband to see if their immune system cells suppressed viral replication. They found that activated T-cells from the wife stalled HIV replication by as much as 90 percent, while the husband's T-cells stopped it by only 30 percent.

In subsequent genetic analyses, the viral strain in the wife's blood was found to have at least two mutations known to weaken the virus, while the viral strain in the husband's blood had fewer mutations affecting fitness.

According to Blankson, the stronger immune system in elite suppression not only lowers the viral count in the body, but also exerts selective, evolutionary pressure on the original strain of HIV to mutate away from the strong version that initially infected the couple, and towards weaker, less-fit forms.

"Elite suppression offers clues to vaccine researchers on many fronts: how CD8 killer T-cells can attack HIV and how a stronger immune response can force HIV into a permanent defensive state," says Blankson.

Antibody-based HIV vaccines have generally failed to work, and Blankson says, a new approach is needed and may be based on T-cell action.

He also plans to study differences in CD8 T-cells in elite suppressors and progressors, with the goal of retooling and activating T-cell action in progressors to act more like those in elite suppressors.

Funding for this latest study was provided by the National Institute of Allergy and Infectious Diseases, a member of the National Institutes of Health (NIH).

In addition to Blankson, other Hopkins researchers involved in these studies were Justin Bailey, M.D., Ph.D.; Karen O'Connell; Hung-Chih Yang, M.D., Ph.D.; Yefei Han, Ph.D.; Jie Xu; Benjamin Jilek; Stuart Ray, M.D.; and Robert Siliciano, M.D., Ph.D. Silicano is also a Howard Hughes Medical Institute investigator. Additional assistance was provided by Thomas Williams, M.D., from the University of New Mexico.

For additional information, go to:

http://www.hopkinsmedicine.org/Medicine/id/faculty.html

http://jvi.asm.org/content/vol82/issue15/

http://www.hopkinsmedicine.org/Press_releases/2006/08_14a_06.html

Well

Early Test for Cancer Isn't Always Best Course

By TARA PARKER-POPE

Sometimes what you don't know might end up being better for you.

For years patients have been told that early cancer detection saves lives. Find the cancer before the symptoms appear, the thinking goes, and you've got a better chance of beating the disease.

So it might have seemed surprising last week when a panel of leading medical experts offered exactly the opposite advice. They urged doctors to stop screening older men for prostate cancer, which will kill an estimated 28,600 men in the United States this year.

Their advice offered a look at the potential downside of cancer screening and our seemingly endless quest to detect cancer early in otherwise healthy people. In this case, for men 75 and older, the United States Preventive Services Task Force concluded that screening for prostate cancer does more harm than good.

"We've done a great job in public health convincing people that cancer screening tests work," said Peter B. Bach, a pulmonologist and epidemiologist at Memorial Sloan-Kettering Cancer Center in New York City. "We're uncomfortable with the notion that some screening tests work and others don't. That seems mystifying to people."

But the reality is that while some cancer screening tests — like the Pap smear for cervical cancer or mammography for breast cancer — clearly save lives, the benefits of other screening tests are less clear.

Studies of lung cancer screening, for instance, have failed to prove that it prolongs life. A mass screening for neuroblastoma in Japanese infants was halted after it became clear that the effort wasn't saving children and worse, led to risky treatments of tumors that weren't life threatening.

The case seemed stronger for screening for prostate cancer. By some measures, death rates from the disease in the United States have plummeted since the introduction of the screening test for prostate specific antigen, which detects levels of a protein that can signal prostate cancer.

The data, in fact, are highly misleading. The introduction of screening can trigger big statistical fluctuations that can be difficult to interpret. But if you look at prostate cancer statistics in the 1970s, long before screening was introduced, death rates have dropped only slightly since then. The small decline seems largely because of improvements in treatment, many experts say, though others point to early detection as the reason.

Whether there really is a measurable benefit from PSA screening for younger men won't be known for a few more years, after data from two major clinical trials studying the test are reported.

How can it be that finding prostate cancer early doesn't help save lives? For starters, a large percentage of prostate cancers aren't deadly. They are slow growing and unlikely to result in any symptoms before the end of a man's natural life expectancy. By some estimates, as many as 44 percent of the men who are treated for prostate cancer as a result of PSA testing didn't need to be. Had they been left alone, they would have died of something else and never known they had cancer.

"Screening tests don't only pick up life-threatening cancers, they pick up tumors that look identical to traditional tumors, but they don't have the same biologic behavior," said Dr. Barry Kramer, associate director

for disease prevention at the National Institutes of Health. “Some are so slow growing they never would have caused medical problems in the person’s natural life span.”

In the case of PSA testing, the Preventive Services Task Force, an expert panel that makes recommendations about preventive care for healthy people, said there was not enough evidence to recommend for or against screening of younger men, although they urged doctors to advise men of all the risks and benefits of screening. But they did conclude that 75 is the age at which the risks clearly begin to outweigh the benefits, and the disease, if detected, would most likely not have a meaningful effect on life expectancy.

Another problem with determining the value of screening is that it results in “lead time bias.” For instance, someone diagnosed with lung cancer at the age of 65 may die at 67 and be remembered as a two-year survivor. If the same man had been diagnosed at 57 through screening and died at the age of 67, he would be known as a 10-year survivor. That sounds a lot better, but the reality is that diagnosis and treatment didn’t prolong his life. He died at 67 either way.

“Even a harmful screening test could appear on the surface as a helpful test,” Dr. Kramer said. “Because you measure survival from the date of diagnosis, even if the person dies of the same cause on the same day they would have without screening, it looks like survival was longer.”

Any screening test can lead to false positives, followed by invasive and risky tests. Large numbers of people often end up being poked, prodded and tested only to discover they’re fine.

Biopsies to detect prostate cancer get mixed reviews. Some men find them to be a minor discomfort; others say they were left in debilitating pain. Once cancer is found, surgery, radiation or hormone therapy, or “watchful waiting,” may be advised.

Treatments for prostate cancer can cause significant harm, rendering men incontinent or impotent, or with other urethral, bowel or bladder problems. Hormone treatments can cause weight gain, hot flashes, loss of muscle tone and osteoporosis.

“It’s just a needle stick, but the cascade of events that follows are fairly serious,” Dr. Bach said. “I think the burden is on medicine to try and generate some evidence that the net benefits are there before drawing that tube of blood.”

The problem with prostate screening is that some men are very likely to have been saved by early detection. But how many have been hurt?

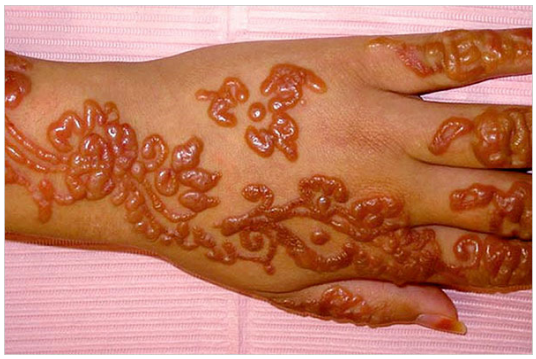
“I’m a little worried we may look back on the prostate cancer screening era, after we learn results of clinical trials, and see that we’ve harmed a lot of people without doing them good,” said Dr. David Ransohoff, a professor of medicine and cancer screening researcher at the University of North Carolina at Chapel Hill. “By being so aggressive with so many people, did we do the right thing? I don’t know that it’s going to turn out that way.”

In Some Henna Tattoos, a Harmful Dye

By NICHOLAS BAKALAR

Henna tattoos are widely available and usually harmless. But certain kinds can cause a powerful allergic reaction.

Henna is a vegetable dye that can be brown, red or green, and it wears off in a matter of days. But to produce a darker color, some tattoo artists add a chemical called para-phenylenediamine, or PPD. The Food and Drug Administration says the only legal use for PPD is as a hair dye.



A blistering allergic reaction to a temporary henna tattoo. **Massachusetts Medical Society**

This photograph, published in the Aug. 6 issue of The New England Journal of Medicine, shows the blistered hands of a 19-year-old Kuwaiti woman who had a temporary tattoo applied at a wedding eight days earlier. She was treated with topical corticosteroids.

The blisters lasted a week or so,” said Dr. Colby C. Evans, a Texas dermatologist and a co-author of the article. “It left behind a dark pigmentation that will take six months or more to fade.” Is henna without PPD any safer? “There have been some reported cases of allergy to henna itself, but it’s rare,” Dr. Evans said. “Allergy to PPD is extremely common.”

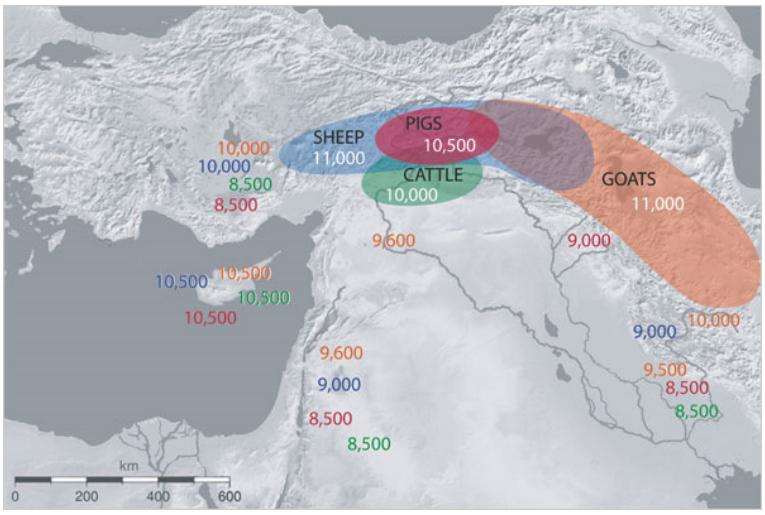
Science Visuals

How the First Farmers Colonized the Mediterranean

By NICHOLAS WADE

The invention of agriculture was a pivotal event in human history, but archaeologists studying its origins may have made a simple error in dating the domestication of animals like sheep and goats. The signal of the process, they believed, was the first appearance in the archaeological record of smaller boned animals. But in

fact this reflects just a switch to culling females, which are smaller than males, concludes Melinda Zeder, an archaeologist at the Smithsonian Institution.



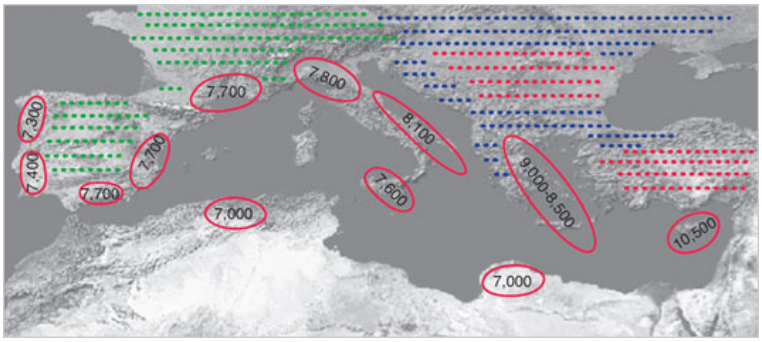
Using a different criterion, that of when herds first show signs of human management, Dr. Zeder finds that goats and sheep were first domesticated about 11,000 years ago, much earlier than previously thought, with pigs and cattle following shortly afterwards. The map, from her article in the August 11 issue of the Proceedings of the National Academy of Sciences, shows the regions and dates where the four species were first domesticated. Other dates, color-coded as to species, show where domesticated animals first appear elsewhere in the Fertile Crescent.

The earlier dates mean that animals were domesticated at much the same time as crop plants, and bear on the issue of how this ensemble of new agricultural species – the farming package known as the Neolithic revolution – spread from the Near East to Europe.

Some experts say the technology spread by cultural diffusion, others that the first farmers themselves moved into Europe, bringing their new technology with them and displacing the resident hunter gatherers.

Dr. Zeder concludes that both processes were involved. A test case is the island of Cyprus, where the four domesticated species of livestock appear as early as 10,500 years ago, replacing native fauna such as pygmy elephants and pygmy hippopotamuses (large animals often get downsized in island settings).

Since Cyprus lies 60 kilometers off the Turkish coast, the suite of agricultural species must have been brought there on boats by the new farmers. That establishes one episode of colonization, and Dr. Zeder sees evidence for several others. The second map shows, in red circles, the dates when farming colonists' enclaves were set up around the Mediterranean.



Dr. Zeder believes that in France and Spain the indigenous hunter gatherers adopted the new farming technology by cultural diffusion (shown as green dots). The farmers themselves settled the regions that are now Turkey and the Balkans (red dots) but in surrounding areas they integrated with indigenous peoples (blue dots).

Dr. Zeder says her evidence indicates that several waves of settlers spread the new farming technology through the Mediterranean. It's yet not known what drove the expansion, or what the relationship was between the colonists and the native inhabitants. Studies of ancient DNA, she said, may help test her thesis that farming spread through a mix of colonization and cultural diffusion.

Personal Health

Living Better With Rheumatoid Arthritis

By JANE E. BRODY

Alan Moore was 52 years old, teaching statistics at the University of Wyoming, playing the violin in the university's symphony and accompanying soloists on the piano when his health took a nosedive in April 2001.

"I felt like I had the flu," Mr. Moore recalled in an interview last month. "I was very weak and fatigued. I had extreme pain and swelling in a lot of my joints. I was in agony when I got up in the morning, so stiff I had to shuffle to the bathroom. I couldn't peel a banana, turn the key in the ignition or even pull the tab of a tea bag. My wife, Cindy, had to help me with the simplest of tasks. Needless to say, I couldn't play the violin or piano or use the computer."

Doctors diagnosed it as rheumatoid arthritis.

"And I thought that my life as I knew it was over," said Mr. Moore, now 59, of Laramie, Wyo.

But by enrolling in a clinical trial of one of the drugs and drug combinations that are revolutionizing the treatment of the disease, Mr. Moore got his life back.

Rheumatoid arthritis is the world's most common autoimmune disease, striking up to 1 in 100 in the course of a lifetime. It is most often diagnosed in people ages 30 to 60 but it can occur at any time, including childhood.

As with other autoimmune diseases, women are three to four times likelier than men to develop rheumatoid arthritis. About 80 percent of Caucasians with the disease have a genetic marker, a gene sequence in the HLA-D region of chromosome 6 that is found in only about 35 percent of the general population.

The disease causes chronic joint inflammation and progressive destruction of the cartilage at the ends of bones, which can result in an inability to use the affected joints. Other effects include fatigue, malaise, anemia and damage to organs throughout the body, including the cardiovascular system.

Untreated, 20 to 30 percent of people become permanently disabled within three to five years of diagnosis. Life expectancy may be reduced by as much as 15 years, with half of patients succumbing to cardiovascular disease.

A Therapeutic Revolution

Doctors traditionally treated the symptoms of rheumatoid arthritis, usually with anti-inflammatory and pain-relieving medications. But the underlying destruction of tissues continued, leading to chronic disability and premature death.

The goal today is suppression of the disease and prevention of progressive joint destruction by treating patients early with synthetic or biologic agents called disease-modifying antirheumatic drugs.

Though he did not know it at the time, Mr. Moore was randomly assigned to the study group that every two weeks self-injected a biologically derived drug called Humira, which acts to block a protein involved in the inflammation associated with rheumatoid arthritis. Humira is one of six federally approved biologic treatments for the disease. Three other biologic remedies are nearing approval by the Food and Drug Administration.

“Within days my symptoms declined to nearly zero,” Mr. Moore said, “and I’ve had no symptoms since.” He has continued the injections of Humira and participates in a registry of patients to help assess the drug’s long-term benefits and potential risks.

Combining Treatments

The costly biologic drugs are often used in combination with much cheaper synthetic disease-modifying drugs taken orally, like methotrexate. In some cases, oral medications are all that patients need to keep symptoms and joint destruction under control. But well-designed clinical trials have typically shown that in patients facing moderate to severe disease, combining the treatments often results in fewer symptoms and less destruction of joints, especially if therapy begins early.

In a study published July 16 in The Lancet, researchers in Leeds, England, reported that among 542 patients randomly assigned to receive either methotrexate alone or in combination with Enbrel, another biologic agent, those receiving the combination were almost twice as likely to become symptom free and more likely to show no X-ray signs of progressive joint destruction a year later.

In a commentary with the Lancet report, Dr. Joel M. Kremer, a rheumatologist at Albany Medical College, said it was important to consider the long-term consequences and costs of the disease when deciding how much to spend on therapy. “Most of the biologic agents cost in the range of $16,000 to $18,000 a year, whereas the oral medications cost only about a tenth that,” Dr. Kremer said in an interview.

But, he added, inadequately treated rheumatoid arthritis typically leads to a need for multiple joint replacements, lost productivity, lost tax revenue and a greatly diminished quality of life, as well as an increased risk of life-threatening infections and cardiovascular disease.

“Most patients diagnosed at age 45 will be disabled in five or six years,” Dr. Kremer said. “You have to consider what it costs to fix a bridge against what it will cost when the bridge collapses.”

Before the use of disease-modifying drugs, direct medical costs from rheumatoid arthritis were estimated at $5.5 billion, and that did not include the indirect costs of lost wages and productivity, the need for custodial care and the emotional and social consequences of chronic disability.

A Tailored Approach

While not everyone with rheumatoid arthritis responds to the new treatments as vividly as Mr. Moore did, many large studies have shown there is no longer any reason for pessimism about the diagnosis. But it is vitally important to begin treatment early.

The recent therapeutic developments, Dr. Kremer said, mean doctors in general practice need to remain alert to symptoms of the disease in its early stages and quickly refer patients to rheumatologists who can confirm the diagnosis and prescribe up-to-date treatment before irreparable damage to joints occurs. Treatment is most effective if begun within one year after symptoms appear.

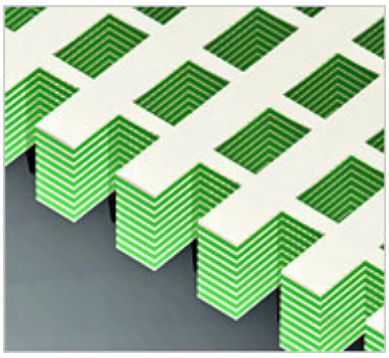
There is no one treatment approach that works for everyone. Rather, studies have indicated that treatment should be tailored to individual patients: the nature and extent of their disease, their other health issues and how they respond to various therapies.

Dr. Kremer said many patients could be started on a single, low-cost drug like methotrexate, as long as their condition was closely monitored and the treatment adjusted if there are signs of progressive disease.

Regular exercise and physical and occupational therapy, along with medication, can help patients maintain function. In addition to antirheumatic drugs to reduce inflammation, Dr. Kremer recommends fish oil at a daily dose of 2 grams of EPA and DHA — about six capsules as they are currently formulated.

Surpassing Nature, Scientists Bend Light Backward

By KENNETH CHANG



Using tiny wires and fishnet structures, researchers at the University of California, Berkeley, have found new ways to bend light backward, something that never occurs in nature.

This technology could lead to microscopes able to peer more deeply and clearly into living cells. And the same kind of structures might one day be adapted to bend light in other unnatural ways, creating a Harry Potter-like invisibility cloak. "This is definitely a big step toward that idea," said Jason Valentine, a graduate student and a lead author of a paper to be published online Wednesday by the journal Nature. But scientists are still far from designing and manufacturing such a cloak.

Schematic of the three-dimensional fishnet metamaterial. **J.Valentine**

The work involves materials that have a property known as negative refraction, which means that they essentially bend light backward. Once thought to be pure fantasies, these substances, called metamaterials, have been constructed in recent years, and scientists have shown they can bend long-wavelength microwaves.

Negative refractive materials can in principle lead to fantastical illusions; someone looking down at a fish in a pool of negative refractive liquid would see the fish swimming in the air above.

Two separate advances are described in two scientific papers being published this week, one demonstrating negative refraction at infrared and visible wavelengths. The second article will be published in Friday's issue of the journal Science. Both papers come out of the research laboratory of Xiang Zhang, a professor at the Nanoscale Science and Engineering Center in Berkeley.

When a ray of light crosses the boundary from air to water, glass or other transparent material, it bends, and the degree of bending is determined by a property known as the index of refraction. Transparent materials like glass, water and diamonds all have an index of 1 or higher for visible light, meaning that when the light enters, its path bends toward an imaginary line perpendicular to the surface.

With the engineered metamaterials, scientists can create refractive indices less than 1 or even negative. Light entering a material with a negative index of refraction would take a sharp turn, almost as if it had bounced off the imaginary perpendicular line.

In the Nature paper, the Berkeley researchers created a fishnet structure with 21 layers, alternating between a metal and magnesium fluoride, resulting in a metamaterial with a negative index of refraction for infrared light. The researchers said by making the fishnet structure even smaller, they should be able to do the same with visible light.

In the Science paper, a different group of scientists in Dr. Zhang's laboratory used a different approach, building an array of minuscule upright wires, which changed the electric fields of passing light waves. That structure was able to bend visible red light.

Dr. Zhang said both approaches had advantages and disadvantages. "There are many roads to Rome," he said. "At this point, honestly speaking, we don't know which road will be the best."

One application of negative index materials could be a "superlens." Light is usually thought of as having undulating waves. But much closer up, light is a much more jumbled mess, with the waves mixed in with more complicated "evanescent waves."

The evanescent waves quickly dissipate as they travel, and thus are usually not seen. A negative refraction lens actually amplifies the evanescent waves, preserving detail lost in conventional optics, and the hope is to eventually build an optical microscope that could make out tiny biological structures like individual viruses.

Scientist at Work: *Diana Beresford-Kroeger*

Advocating an Unusual Role for Trees

By JIM ROBBINS

MERRICKVILLE, Ontario — Diana Beresford-Kroeger pointed to a towering wafer ash tree near her home.

The tree is a chemical factory, she explained, and its products are part of a sophisticated survival strategy. The flowers contain terpene oils, which repel mammals that might feed on them. But the ash needs to attract pollinators, and so it has a powerful lactone fragrance that appeals to large butterflies and honeybees. The chemicals in the wafer ash, in turn, she said, provide chemical protection for the butterflies from birds, making them taste bitter.

Many similar unseen chemical relationships are going on in the world around us. “These are at the heart of connectivity in nature,” she said.

Ms. Beresford-Kroeger, 63, is a native of Ireland who has bachelor’s degrees in medical biochemistry and botany, and has worked as a Ph.D.-level researcher at the University of Ottawa school of medicine, where she published several papers on the chemistry of artificial blood. She calls herself a renegade scientist, however, because she tries to bring together aboriginal healing, Western medicine and botany to advocate an unusual role for trees.

She favors what she terms a bioplan, reforesting cities and rural areas with trees according to the medicinal, environmental, nutritional, pesticidal and herbicidal properties she claims for them, which she calls ecofunctions.

Wafer ash, for example, could be used in organic farming, she said, planted in hedgerows to attract butterflies away from crops. Black walnut and honey locusts could be planted along roads to absorb pollutants, she said.

“Her ideas are a rare, if not entirely new approach to natural history,” said Edward O. Wilson, a Harvard biologist who wrote the foreword for her 2003 book, “Arboretum America” (University of Michigan Press). “The science of selecting trees for different uses around the world has not been well studied.”

Miriam Rothschild, the British naturalist who died in 2005, wrote glowingly of Ms. Beresford-Kroeger’s idea of bioplanning and called it “one answer to ‘Silent Spring’ ” because it uses natural chemicals rather than synthetic ones.

But some of Ms. Beresford-Kroeger’s claims for the health effects of trees reach far outside the mainstream. Although some compounds found in trees do have medicinal properties and are the subject of research and treatment, she jumps beyond the evidence to say they also affect human health in their natural forms. The black walnut, for example, contains limonene, which is found in citrus fruit and elsewhere and has been shown to have anticancer effects in some studies of laboratory animals. Ms. Beresford-Kroeger has suggested, without evidence, that limonene inhaled in aerosol form by humans will help prevent cancer.

David Lemkay, the general manager of the Canadian Forestry Association, a nonprofit group that promotes the sustainable use of Canada’s forests, is familiar with her work. “She holds fast to the notion that if you are in the aura of a black walnut tree there’s a healing effect,” Mr. Lemkay said. “It needs more science to be able to say that.”

Memory Elvin-Lewis, a professor of botany at Washington University in St. Louis and co-author, with her husband, Walter H. Lewis, of “Medical Botany: Plants Affecting Human Health” (2003, John Wiley & Sons), said such a role for trees could be true. In India, she said, compounds from neem trees are said to have anti-inflammatory and antiviral properties and are planted around hospitals and sanitariums. “It’s not implausible,” Dr. Elvin-Lewis said; it simply hasn’t been studied.

Colin Rowe for The New York Times
The butternut seed, endangered in North America. The fatty acids of the flower and developing testa can be used for abdominal surgery as a temporary adhesive.

Colin Rowe for The New York Times
The early Siberian sour cherry can begrown in extreme circumstances.

On a more solid scientific footing, Ms. Beresford-Kroeger is also concerned about the fate of the Northern forests because of overharvest and the destruction of ecosystems. Federal scientists estimate more than 93 percent of old growth has been cut. As forests are fragmented, they dry out, losing wildlife and insect species. As a result, subtle relationships, the nerve system of biodiversity, are breaking down before they have been studied.

“In a walk through old growth forest, there are thousands if not millions of chemicals and their synergistic effects with one another,” she said. “What trees do chemically in the environment is something we’re only beginning to understand.”

Trees also absorb pollutants from the ground, comb particulates from the air and house beneficial insects.

Some studies support a role for trees in human health. A recent study by researchers at Columbia found that children in neighborhoods that are tree-lined have asthma rates a quarter less than in neighborhoods without trees. The Center for Urban Forest Research estimates that each tree removes 1.5 pounds of pollutants from the air. Trees are also used to remove mercury and other pollutants from the ground, something called phytoremediation. And, of course, trees store carbon dioxide, which mitigates global warming.

Dr. Wilson, at Harvard, said that more research into the role of trees in the ecosystem was imperative and that it was alarming how little was known. “We need more research of this kind to use the things we have, such

as trees, to their fullest," he said.

Both Dr. Wilson and Ms. Beresford-Kroeger proposed using stock from old-growth forests for planting new forest in the hopes of taking advantage of good genetics. "There's an enormous difference between old-growth forests and tree plantations," Dr. Wilson said.

Ms. Beresford-Kroeger is famous in Canadian horticulture circles for her sprawling gardens, which she maintains with her husband, Christian Kroeger, and are often open to the public. She has 60,000 daffodils, more than 100 rare hellebores from Turkey and Iran and extremely rare peonies from China that are dark brown with red leaves and smell like chocolate.

And she grows more than 100 types of trees, including rare fir trees and Siberian cherry trees, and disease-resistant chestnuts, elms and butternut.

Ms. Beresford-Kroeger recently completed the book "Arboretum Borealis" about the boreal forest in Canada, which cuts across the northern half of the country. Canadian officials have recently announced plans to preserve 55 million acres — roughly half. "Trees are a living miracle," Ms. Beresford-Kroeger said. "Leaves can take in carbon dioxide and create oxygen. And all creatures must have oxygen."

'Erasing' drug-associated memories may stop drug addiction relapses

Findings could lead to more effective treatments for addiction

'Erasing' drug-associated memories may prevent recovering drug abusers from relapsing, researchers at the University of Cambridge have discovered. The team, led by Professor Barry Everitt, was able to reduce drug-seeking behaviours in rats by blocking a brain chemical receptor important to learning and memory during the recall of drug-associated memories. Their research, which was funded by the Medical Research Council, was reported in the 13 August issue of The Journal of Neuroscience.

The Cambridge scientists found that by disrupting or erasing memories associated with drug use during recall, they could prevent the memories from triggering relapses and drug taking. Memories exist in different states depending on whether they are being recalled or not. When memories are recalled, they become 'unstable' or malleable and can be altered or erased during the process called reconsolidation. Because relapse by drug abusers is often prompted when they recall drug-associated memories, the scientists found that by blocking these memories they could prevent relapse.

In order to undertake the experiments, the researchers trained rats to associate the switching on of a light with cocaine. The researchers then exposed the rats to the light, thereby 'reactivating' the memory, without the cocaine. In an effort to receive more cocaine, the rats would perform tasks that the scientists had created which would turn on the light.

When the animals were given a chemical that interfered with the action of the NMDA-type glutamate receptor (which plays an important role in memory) prior to the 'reactivation' session, the rats showed reduced cocaine-seeking behaviours. A single treatment reduced or even stopped drug-seeking behaviours for up to four weeks.

In contrast, blocking the receptors after or without the reactivation session had no effect on subsequent drug-seeking behaviours, indicating that drug-associated memories can be disrupted during but not after reconsolidation of memories.

Professor Barry Everitt said, "The results suggest that efforts should be made to develop drugs that could be given in a controlled clinical or treatment environment in which addicts would have their most potent drug memories reactivated. Such treatments would be expected to diminish the effects of those memories in the future and help individuals resist relapse and maintain their abstinence."

Dr Amy Milton, a co-author, said, "This is a new approach to the treatment of drug addiction that has great potential. Additionally, this might also be used to treat other neuropsychiatric disorders characterized by maladaptive memories, including post-traumatic stress and phobic anxiety disorders."

For additional information please contact:
Genevieve Maul, Office of Communications, University of Cambridge
Tel: +44 (0) 1223 332 300 Mob: +44 (0) 7774 017 464 Email: Genevieve.maul@admin.cam.ac.uk

Women, Work, and Wage

Changes in Work Force, not Pay, Narrowing the Gender Wage Gap

Are working women treated more fairly in today's labor market than they were 30 years ago? Absolutely not, according to groundbreaking new research by Brown University economist Yona Rubinstein and Casey Mulligan of the University of Chicago. Disputing decades of economic literature, the economists show that the apparent narrowing of the wage gap between working men and women is actually due to the type of women who are now working — not how much they're being paid. The findings are published in The Quarterly Journal of Economics.

PROVIDENCE, R.I. [Brown University] — The apparent narrowing of the wage gap between working men and women in the last 30 years reflects changes in the type of women in the workforce, rather than in how much they're being paid, according to groundbreaking new research by Brown University economist Yona Rubinstein and Casey Mulligan of the University of Chicago. Rubinstein says the impression that the labor market treats women better today than three decades ago is a "statistical illusion." The findings are published in the August issue of The Quarterly Journal of Economics.

"Though decades of economic research suggest men and women are equalizing in the labor market, the notion that today's working women are being paid more and treated better than ever before is simply wrong," said Rubinstein, assistant professor of economics. "The growing equality between genders reflects the entry of the most able women to the workforce rather than better pay. While there may be more women holding high-power positions today, they are still being paid as their counterparts were three decades ago."

After years of a fairly constant gender wage gap in the United States, women's wages grew from the late 1970s to the mid 1990s, and the gap seemed to narrow. At that same time, wages became much less equal within gender groups. Although previous economic observers have called these simultaneous growths "curiously coincidental," Rubinstein and Mulligan connect these two phenomena and show that growing wage inequality within gender groups was actually a catalyst for bringing "highly able" women into the labor market.

Rubinstein explained that in the 1970s, the labor market had an increased demand for "skilled workers." Because most of the "skilled men" were already in the workforce, the demand increasingly pulled in a pool of smart, skilled, and "highly able" women — those who were previously choosing to be at home. As a result, the United States saw an increase in how much the average working woman earned. The authors show that this wage growth for women might not have happened if the workforce composition had been held constant.

The authors suggest that growing inequality within gender, through its effect on women's selection into the labor force, their labor force attachment, and their human capital investment, is a major reason why the wages of the female workforce have grown relative to men's — thus giving the impression that they are being treated more fairly than they were 30 years ago. Using data from the Current Population Survey and IQ data taken from the National Longitudinal Survey, the authors used three different empirical approaches to measure the existence and importance of these effects.

The National Science Foundation and the Sloan Foundation funded this research.

Editors: Brown University has a fiber link television studio available for domestic and international live and taped interviews, and maintains an ISDN line for radio interviews. For more information, call (401) 863-2476.

X-rays use diamonds as a window to the center of the Earth

Diamonds from Brazil have provided the answers to a question that Earth scientists have been trying to understand for many years: how is oceanic crust that has been subducted deep into the Earth recycled back into volcanic rocks? A team of researchers, led by the University of Bristol, working alongside colleagues at the STFC Daresbury Laboratory, have gained a deeper insight into how the Earth recycles itself in the deep earth tectonic cycle way beyond the depths that can be accessed by drilling. The full paper on this research has been published (31 July) in the scientific journal, Nature.

The Earth's oceanic crust is constantly renewed in a cycle which has been occurring for billions of years. This crust is constantly being renewed from below by magma from the Earth's mantle that has been forced up at mid-ocean ridges. This crust is eventually returned to the mantle, sinking down at subduction zones that extend deep beneath the continents. Seismic imaging suggests that the oceanic crust can be subducted to depths of almost 3000km below the Earth's surface where it can remain for billions of years, during which time the crust material develops its own unique 'flavour' in comparison with the surrounding magmas. Exactly how this happens is a question that has baffled Earth scientists for years.

The Earth's oceanic crust lies under seawater for millions of years, and over time reacts with the seawater to form carbonate minerals, such as limestone, When subducted, these carbonate minerals have the effect of lowering the melting point of the crust material compared to that of the surrounding magma. It is thought that this melt is loaded with elements that carry the crustal 'flavour'.

This team of researchers have now proven this theory by looking at diamonds from the Juina area of Brazil. As the carbonate-rich magma rises through the mantle, diamonds crystallise, trapping minute quantities of minerals in the process. They form at great depths and pressures and therefore can provide clues as to what is happening at the Earth's deep interior, down to several hundred kilometres - way beyond the depths that can be physically accessed by drilling. Diamonds from the Juina area are particularly renowned for these mineral inclusions.

At the Synchrotron Radiation Source (SRS) at the STFC Daresbury Laboratory, the team used an intense beam of x-rays to look at the conditions of formation for the mineral perovskite which occurs in these diamonds but does not occur naturally near the Earth's surface. With a focused synchrotron X-ray beam less than half the

width of a human hair, they used X-ray diffraction techniques to establish the conditions at which perovskite is stable, concluding that these mineral inclusions were formed up to 700km into the Earth in the mantle transition zone.

These results, backed up by further experiments carried out at the University of Edinburgh, the University of Bayreuth in Germany, and the Advanced Light Source in the USA, enabled the research team to show that the diamonds and their perovskite inclusions had indeed crystallised from very small-degree melts in the Earth's mantle. Upon heating, oceanic crust forms carbonatite melts, super-concentrated in trace elements with the 'flavour' of the Earth's oceanic crust. Furthermore, such melts may be widespread throughout the mantle and may have been 'flavouring' the mantle rocks for a very long time.

Dr Alistair Lennie, a research scientist at STFC Daresbury Laboratory, said: "Using X-rays to find solutions to Earth science questions is an area that has been highly active on the SRS at Daresbury Laboratory for some time. We are very excited that the SRS has contributed to answering such long standing questions about the Earth in this way."

Dr. Michael Walter, Department of Earth Sciences, University of Bristol, said: "The resources available at Daresbury's SRS for high-pressure research have been crucial in helping us determine the origin of these diamonds and their inclusions."

Adverse reactions to antibiotics send thousands of patients to the ER

Adverse events from antibiotics cause an estimated 142,000 emergency department visits per year in the United States, according to a study published in the September 15, 2008 issue of Clinical Infectious Diseases.

"This number is an important reminder for physicians and patients that antibiotics can have serious side effects and should only be taken when necessary," said study author Daniel Budnitz, M.D., at the Centers for Disease Control and Prevention (CDC).

Prior to this study, detailed data on the scope and burden of antibiotic adverse events in the U.S. were not available. This investigation is the first to use timely, nationally representative surveillance data to estimate and compare the numbers and rates of adverse events from systemic antibiotics by class, drug, and event type.

Half of the visits were for reactions to penicillins and the other half were from reactions to other antibiotics used to treat a wide variety of bacterial infections. After accounting for how often antibiotics were prescribed, children less than one year old were found to have the highest rate of adverse drug events.

Almost 80 percent of all antibiotic adverse events in the study were allergic reactions, ranging from rash to anaphylaxis, and the remaining 20 percent were caused by errors and overdoses. Unlike errors and overdoses from other drugs, allergic reactions to antibiotics typically can only be prevented by avoiding exposure to the drug in the first place.

The study draws from the National Electronic Injury Surveillance System-Cooperative Adverse Drug Event Surveillance (NEISS-CADES) project, a sample of 63 hospitals in the United States and its territories. NEISS-CADES is a joint effort of the CDC, the United States Consumer Product Safety Commission, and the Food and Drug Administration.

Previous studies have suggested that half of the estimated 100 million antibiotic prescriptions written in the community setting each year for respiratory tract infections may be unnecessary. "For conditions in which antibiotics have questionable benefit, such as many mild upper respiratory tract infections, weighing the benefits of antibiotics with the risks of a serious adverse event will be especially important," said Budnitz. "Because antibiotics are frequently used, both appropriately and inappropriately, if doctors would reduce the number of antibiotics they prescribe to their patients by even a small percentage, we could significantly reduce the number of emergency visits for antibiotic adverse events. Physicians need to communicate to their patients that antibiotics are not harmless," he added.

The researchers found that only 6 percent of the patients who experienced adverse events required hospitalization. The others were all treated and released. However, the study only reflected emergency department admissions. Unreported cases and visits to a physician's office could not be taken into account.

Additional Resources: CDC has resources for both clinicians and patients on appropriate use of antibiotics for upper respiratory infections. Visit the Get Smart: Know When Antibiotics Work campaign website at: www.cdc.gov/getsmart.

Nano vaccine for hepatitis B shows promise for third world

Nanoemulsion could save more lives by removing current vaccines' drawbacks

ANN ARBOR, Mich. — Chronic hepatitis B infects 400 million people worldwide, many of them children. Even with three effective vaccines available, hepatitis B remains a stubborn, unrelenting health problem, especially in Africa and other developing areas. The disease and its complications cause an estimated 1 million deaths globally each year.

In many poor countries, refrigerated conditions required for the current vaccines are costly and hard to come by. It's often difficult in the field to keep needles and syringes sterile. The need to have people return for the three shots currently required also limits success. Now, a new vaccine that avoids these drawbacks has moved a step closer to human trials. Health researchers hope it will make it possible to immunize large numbers of children and adults in Africa, Asia and South America efficiently and safely.

Scientists at the Michigan Nanotechnology Institute for Medicine and Biological Sciences at the University of Michigan report that a novel, needle-less method for getting an immunity-stimulating agent into the body has proved non-toxic and able to produce strong, sustained immune responses in animal studies. The vaccine is based on a super-fine emulsion of oil, water and surfactants placed in the nose.

The research was supported by the Grand Challenges in Global Health initiative, which is funded by the Bill & Melinda Gates Foundation, the Foundation for the National Institutes of Health, the Wellcome Trust and the Canadian Institutes of Health Research. The findings appear online in the journal PLoS ONE.

The nanoemulsion represents a new delivery method for an antigen already used in existing hepatitis B vaccines to activate the body's immune defenses.

"Our results indicate that needle-free nasal immunization, using a combination of nanoemulsion and hepatitis B antigen, could be a safe and effective hepatitis B vaccine, and also provide an alternative booster method for existing vaccines," says James R. Baker, Jr., M.D., the study's senior author and director of the institute. He also is Ruth Dow Doan Professor and allergy division chief in the U-M Department of Internal Medicine.

The nanoemulsion is made up of soybean oil, alcohol, water and detergents emulsified into droplets less than 400 nanometers in diameter.

The study suggests that the new type of hepatitis B vaccine will not have rigid cold storage requirements and could require fewer administrations than current vaccines, which require three shots given over a period of six months. Protective immunity with the new vaccine required only two immunizations in animals. The vaccine also avoids the risk of spreading needle-borne infections.

The nanoemulsion vaccine also avoids the temporary pain and redness that results after people get shots with the current vaccines, in which an irritating compound, alum, is used as an adjuvant, or enhancer of a vaccine's effect. There was no local inflammation at the nasal site of administration with the new vaccine.

This finding may be significant, because one of the major concerns for nasal administration of vaccines is that they can find their way to the olfactory bulb in the brain and cause side effects, says Paul E. Makidon, D.V.M., co-first author of the study and a U-M research fellow. "Our studies, however, indicate no inflammation and no evidence of the vaccine in the olfactory bulb," he says.

Baker's team has published earlier studies affirming the promise of nasal nanoemulsions as a strategy for smallpox, influenza, anthrax and HIV vaccines. The nanoemulsion technology is patented by U-M and licensed to Ann Arbor-based NanoBio Corporation. Baker is a founder and equity holder of NanoBio.

Research details:

The research team determined effective doses of the antigen and nanoemulsion. In results obtained in mice, rats and guinea pigs, the nanoemulsion vaccine proved effective at producing three types of immunity: systemic, mucosal and cellular. Further toxicity studies in rodents and dogs showed the vaccine was safe and well-tolerated.

The vaccine was as effective as current hepatitis B vaccines in eliciting systemic protective antibodies in the blood of animals. The nanoemulsion acted as an effective adjuvant, without the need for a traditional adjuvant or inflammatory compound as in the current hepatitis B vaccines.

In addition, the nanoemulsion vaccine produced sustained cellular immunity in Th1 cells, which could make the vaccine useful in treating people with chronic hepatitis B whose own cellular immune responses are inadequate.

The animals given the nasal nanoemulsion in the study also activated a third type of immunity, mucosal immunity, which is gaining recognition among immunologists as a key first-line response to infectious agents in diseases such as hepatitis B where mucosal tissues are involved in transmission. Baker and his team found the same effect of activating mucosal immunity that was seen in their previous studies of other nanoemulsion-based vaccines.

The researchers tested whether the vaccine could remain stable and effective even if not refrigerated. They found the nanoemulsion vaccine retained its effectiveness for six months when kept at 25 degrees Celsius (77 degrees Fahrenheit), and even was stable and effective for six weeks at 40 degrees C (104 degrees F). This suggests that refrigeration will not be needed for the final distribution of the vaccine in developing countries, making it easier to vaccinate underserved people.

Current studies are focused on developing the preclinical data required to enter human trials, Baker says. The researchers hope that the first human trial can begin within a year.

Additional U-M authors include: Anna U. Bielinska, Shraddha S. Nigavekar, Katarzyna W. Janczak, Jessica Knowlton, Alison J. Scott, Nicholas Mank, Zhengyi Cao, Sivaprakash Rathinavelu, Michael R. Beer, J. Erby Wilkinson, Luz P. Blanco and Jeffrey J. Landers. Citation: PLoS ONE, http://dx.plos.org/10.1371/journal.pone.0002954

US boasts of laser weapon's 'plausible deniability'

* 15:45 12 August 2008
* NewScientist.com news service
*** David Hambling**

An airborne laser weapon dubbed the "long-range blowtorch" has the added benefit that the US could convincingly deny any involvement with the destruction it causes, say senior officials of the US Air Force (USAF).

The Advanced Tactical Laser (ATL) is to be mounted on a Hercules military transport plane. Boeing announced the first test firing of the laser, from a plane on the ground, earlier this summer.

Cynthia Kaiser, chief engineer of the US Air Force Research Laboratory's Directed Energy Directorate, used the phrase "plausible deniability" to describe the weapon's benefits in a briefing (powerpoint format) on laser weapons to the New Mexico Optics Industry Association in June.

Plausibly deniable

John Corley, director of USAF's Capabilities Integration Directorate, used the same phrase to describe the weapon's benefits at an Air Armament Symposium in Florida in October 2007 (see page 15, pdf format).

As the term suggests, "plausible deniability" is used to describe situations where those responsible for an event could plausibly claim to have had no involvement in it.

Corley and Kaiser did not respond to requests from New Scientist to expand on their comments. But John Pike, analyst with defence think-tank Global Security, based in Virginia, says the implications are clear.

"The target would never know what hit them," says Pike. "Further, there would be no munition fragments that could be used to identify the source of the strike."

Silent strike

A laser beam is silent and invisible. An ATL can deliver the heat of a blowtorch with a range of 20 kilometres, depending on conditions. That range is great enough that the aircraft carrying it might not be seen, especially at night. With no previous examples for comparison, it may be difficult to discern whether damage to a vehicle or person was the result of a laser strike.

The 5.5-tonne ATL combines chlorine and hydrogen peroxide molecules to release energy, which is used in turn to stimulate iodine into releasing intense infra-red light.

The US uses Hercules aircraft for accurate cannon strikes on moving vehicles. The ATL is touted as bringing a new level of accuracy to such attacks, for example being able to pinpoint a vehicle's tyres to disable it safely.

A second, larger version of the laser is also nearing initial testing. The much larger Airborne Laser is intended for missile defence and will be carried by a Boeing 747.

Why real and imagined disgust have the same effect

* 00:01 13 August 2008 * NewScientist.com news service
*** Helen Thomson**

Warning: this story contains a paragraph of disgusting text.

How can reading a good book or watching a film be almost as emotional an experience as events in your own life? The answer may be that you use the same brain region to make sense of them all.

Previous studies indicated that the same brain regions – the anterior insula and adjacent frontal operculum, known collectively as the IFO – are activated both when we observe someone experiencing an emotion such as disgust, delight or pain, and when we experience it ourselves.

It is thought that this allows us to empathise with others and understand their intentions. But is the IFO also active when we imagine an emotion, such as when we read about it in a book?

Yuk yuk yuk

To answer this question, Mbemba Jabbi and colleagues at the University of Groningen in the Netherlands, focused just on disgust – an easy emotion to evoke. "You can't just tell someone to get into a scanner and be 'happy' for 30 seconds," says co-researcher Christian Keysers. "But it's relatively easy to make someone disgusted." They placed quinine – which has a bitter, "disgusting" taste - onto the tongues of 12 volunteers while they lay in an MRI scanner. The volunteers also watched a video of someone acting disgusted and read a story describing a disgusting situation:

You turn around because someone is leaning on your shoulder, suddenly looking into the open mouth of a drunken beggar… you see his rotten teeth, surrounded by pustulant sores, while he suddenly releases the reeking content of his stomach all over you… You feel your stomach turn over as you suddenly feel the acidic taste of a clump of his vomit on your lips.

The researchers found that the IFO was activated in all three tasks. They say this similarity between first-hand experience and imagination could help to explain why books can be so vivid and compelling.

Understanding others

"There is a partial overlap – if you taste something disgusting, see something disgusting or imagine a disgusting scenario there's a common pathway," says Keysers. "This is why books and movies work - because they stimulate the area of the brain which is involved in what it really feels like to be disgusted."

The team suspects that reading about delight or pain also activates similar converging networks in the brain.

The next step will be to study IFO activation in autism. It is generally assumed that autistic people can't identify the emotions of others, but clinical studies alternatively suggest that perhaps they feel others' emotions too well, to the point that they are overwhelmed. "These experiments can help tease these options apart," says Keyser *Journal reference: PLoS ONE, DOI: 10.1371/journal.pone.0002939*

How flesh-eating bacteria attack the body's immune system

"Flesh-eating" or "Strep" bacteria are able to survive and spread in the body by degrading a key immune defense molecule, according to researchers at the University of California, San Diego, School of Medicine and Skaggs School of Pharmacy and Pharmaceutical Sciences. The finding, which could aid in development of new treatments for serious infections in human patients, will be reported in the August 14 issue of the journal Cell Host & Microbe.

Led by senior author Victor Nizet, M.D., UC San Diego professor of pediatrics and pharmacy and an infectious diseases physician at Rady Children's Hospital, San Diego, the researchers showed that a protease known as SpyCEP (Strep. pyogenes cell envelope protease) – produced in large amounts by the most dangerous strains of Strep –inactivates an immune system molecule that controls the body's white blood cells ability to fight bacteria. Without signals from this molecule, white blood cells become slower and weaker, and infections can spread out of control.

"These findings may suggest a new approach to treating serious Strep infections by supporting our body's natural defense system," said Nizet.

The research focuses on the major human pathogen group A Streptococcus. Among the most important of all bacterial pathogens, Strep is responsible for a wide range of diseases – from simple strep throat to life-threatening conditions such as necrotizing fasciitis ("flesh-eating disease") and toxic shock syndrome.

The UC San Diego investigators examined the interaction of Strep bacteria with neutrophils, specialized white blood cells that play a front-line role in humans' immune defense against pathogenic microbes. Previous research had shown that Strep bacteria change their pattern of gene expression dramatically during the course of infection, including a massive increase in production of SpyCEP, which has the unique ability to inactivate an immune defense molecule known as interleukin-8 (IL-8). IL-8 is produced at sites of infection and serves as a signal for neutrophils to migrate out of the bloodstream and into the tissues to clear the infection.

The UC San Diego team used a molecular genetic approach for their studies, knocking out the gene encoding the SpyCEP from a pathogenic strep strain that was originally isolated from a patient suffering from necrotizing fasciitis.

"Lacking this single protease, the mutant Strep strain was easily killed by human neutrophils," said lead author Annelies Zinkernagel, M.D., a postgraduate researcher in the UCSD department of pediatrics. "In addition, the mutant Strep bacteria no longer produced a spreading infection when injected into the skin of experimental mice."

The critical role of the Strep protease was confirmed by cloning the corresponding gene into a normally non-pathogenic bacterial strain, which then became resistant to neutrophil killing. More detailed analysis demonstrated that by inactivating IL-8, SpyCEP blocked neutrophil migration across blood vessels as well as neutrophil production of "extracellular traps" used to ensnare bacteria.

The immune-blocking effects of SpyCEP produced by Strep were strong enough to allow other bacterial species to survive at the site of infection, which may contribute to mixed infections that require complex antibiotic regimens. The researchers also showed that a pathogen of fish, Streptococcus iniae, produces its own version of SpyCEP that may contribute to recent reports of severe skin infections caused by this bacterium in fish handlers.

Nizet explained that the researchers' findings could lead to novel treatments for Strep-related diseases. "In addition to attempting to kill the bacteria directly with standard antibiotics, new treatment strategies could be targeted to inhibit the Strep protease and thereby disarm the pathogen, making it susceptible to clearance by our normal immune defenses," he said.

This study was financed by grants from the National Institutes of Health and the Swiss National Science Foundation. Co-authors contributing to the study were Anjuli Timmer, Ph.D., Jeffrey Locke, Ph.D., and John Buchanan, Ph.D., of the UCSD

Department of Pediatrics; Morgan Pence, UCSD graduate student in biomedical sciences; Claire Turner and Shiranee Sriskandan, Ph.D., of Imperial College, London; and Inbal Mishalian and Emmanuel Hanski, Ph.D., of the Hebrew University in Jerusalem.

Oceans on the Precipice: Scripps Scientist Warns of Mass Extinctions and 'Rise of Slime'

Threats to marine ecosystems from overfishing, pollution and climate change must be addressed to halt downward trends

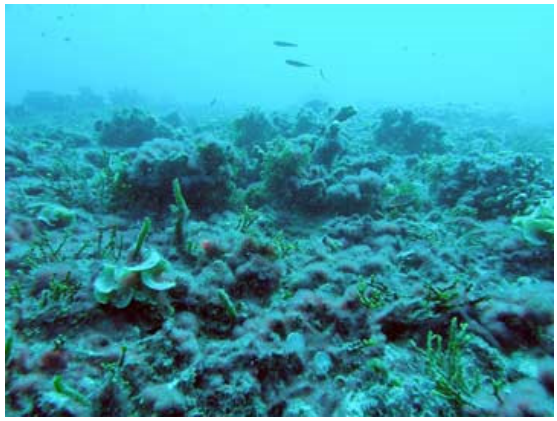
Human activities are cumulatively driving the health of the world's oceans down a rapid spiral, and only prompt and wholesale changes will slow or perhaps ultimately reverse the catastrophic problems they are facing. Such is the prognosis of Jeremy Jackson, a professor of oceanography at Scripps Institution of Oceanography at UC San Diego, in a bold new assessment of the oceans and their ecological health. Publishing his study in the online early edition of the Proceedings of the National Academy of Sciences (PNAS), Jackson believes that human impacts are laying the groundwork for mass extinctions in the oceans on par with vast ecological upheavals of the past.

He cites the synergistic effects of habitat destruction, overfishing, ocean warming, increased acidification and massive nutrient runoff as culprits in a grand transformation of once complex ocean ecosystems. Areas that had featured intricate marine food webs with large animals are being converted into simplistic ecosystems dominated by microbes, toxic algal blooms, jellyfish and disease.

Jackson, director of the Scripps Center for Marine Biodiversity and Conservation, has tagged the ongoing transformation as "the rise of slime." The new paper, "Ecological extinction and evolution in the brave new ocean," is a result of Jackson's presentation last December at a biodiversity and extinction colloquium convened by the National Academy of Sciences.

"The purpose of the talk and the paper is to make clear just how dire the situation is and how rapidly things are getting worse," said Jackson. "It's a lot like the issue of climate change that we had ignored for so long. If anything, the situation in the oceans could be worse because we are so close to the precipice in many ways."

In the assessment, Jackson reviews and synthesizes a range of research studies on marine ecosystem health, and in particular key studies conducted since a seminal 2001 study he led analyzing the impacts of historical overfishing. The new study includes overfishing, but expands to include threats from areas such as nutrient runoff that lead to so-called "dead zones" of low oxygen. He also incorporates increases in ocean warming and acidification resulting from greenhouse gas emissions.



***During a recent research expedition to Kiritimati, or Christmas Island, Jeremy Jackson and other researchers documented a coral reef overtaken by algae, featuring murky waters and few fish. The researchers say pollution, overfishing, warming waters or some combination of the three are to blame*. Photo credit: Jennifer E. Smith**

Jackson describes the potently destructive effects when forces combine to degrade ocean health. For example, climate change can exacerbate stresses on the marine environment already brought by overfishing and pollution.

"All of the different kinds of data and methods of analysis point in the same direction of drastic and increasingly rapid degradation of marine ecosystems," Jackson writes in the paper.

During a recent research expedition to Kiritimati, or Christmas Island, Jeremy Jackson and other researchers documented a coral reef overtaken by algae, featuring murky waters and few fish. The researchers say pollution, overfishing, warming waters or some combination of the three are to blame. Photo credit: Jennifer E. Smith

Jackson furthers his analysis by constructing a chart of marine ecosystems and their "endangered" status. Coral reefs, Jackson's primary area of research, are "critically endangered" and among the most threatened ecosystems; also critically endangered are estuaries and coastal seas, threatened by overfishing and runoff; continental shelves are "endangered" due to, among other things, losses of fishes and sharks; and the open ocean ecosystem is listed as "threatened" mainly through losses at the hands of overfishing.

"Just as we say that leatherback turtles are critically endangered, I looked at entire ecosystems as if they were a species," said Jackson. "The reality is that if we want to have coral reefs in the future, we're going to have to behave that way and recognize the magnitude of the response that's necessary to achieve it."

To stop the degradation of the oceans, Jackson identifies overexploitation, pollution and climate change as the three main "drivers" that must be addressed.

"The challenges of bringing these threats under control are enormously complex and will require fundamental changes in fisheries, agricultural practices and the ways we obtain energy for everything we do," he writes.

"So it's not a happy picture and the only way to deal with it is in segments; the only way to keep one's sanity and try to achieve real success is to carve out sectors of the problem that can be addressed in effective terms and get on it as quickly as possible."

The research described in the paper was supported by the William E. and Mary B. Ritter Chair of Scripps Institution of Oceanography.

Computer users are digitizing books quickly and accurately with Carnegie Mellon method

PITTSBURGH—Millions of computer users collectively transcribe the equivalent of 160 books each day with better than 99 percent accuracy, despite the fact that few spend more than a few seconds on the task and that most do not realize they are doing valuable work, Carnegie Mellon University researchers reported today in Science Express.

They can work so prodigiously because Carnegie Mellon computer scientists led by Luis von Ahn have taken a widely used Web site security measure, called a CAPTCHA, and given it a second purpose — digitizing books produced prior to the computer age. When Web visitors solve one of the distorted-letter puzzles so they can register for email or post a comment on a blog, they simultaneously help turn the printed word into machine-readable text.

More than a year after implementing their version, called reCAPTCHA, http://recaptcha.net/ on thousands of Web sites worldwide, the researchers conclude that their word deciphering process achieves the industry standard for human transcription services — better than 99 percent accuracy. Their report, published online today, will appear in an upcoming issue of the journal Science.

Furthermore, the amount of work that can be accomplished is herculean. More than 100 million CAPTCHAs are solved every day and, though each puzzle takes only a few seconds to solve, the aggregate amount of time translates into hundreds of thousands of hours of human effort that can potentially be tapped. During the reCAPTCHA system's first year of operation, more than 1.2 billion reCAPTCHAs have been solved and more than 440 million words have been deciphered. That's the equivalent of manually transcribing more than 17,600 books.

"More Web sites are adopting reCAPTCHAs each day, so the rate of transcription keeps growing," said von Ahn, an assistant professor in the School of Computer Science's Computer Science Department. "More than 4 million words are being transcribed every day. It would take more than 1,500 people working 40 hours a week at a rate of 60 words a minute to match our weekly output."

Von Ahn said reCAPTCHAs are being used to digitize books for the Internet Archive and to digitize newspapers for The New York Times. Digitization allows older works to be indexed, searched, reformatted and stored in the same way as today's online texts.

Old texts are typically digitized by photographically scanning pages and then transforming the text using optical character recognition (OCR) software. But when ink has faded and paper has yellowed, OCR sometimes can't recognize some words — as many as one out of every five, according to the Carnegie Mellon team's tests. Without reCAPTCHA, these words must be deciphered manually at great expense.

Conventional CAPTCHAs, which were developed at Carnegie Mellon, involve letters and numbers whose shapes have been distorted or backgrounds altered so that computers can't recognize them, but humans can. To create reCAPTCHAs, the researchers use images of words from old texts that OCR systems have had trouble reading.

Helping to make old books and newspapers more accessible to a computerized world is something that the researchers find rewarding, but is only part of a larger goal. "We are demonstrating that we can take human effort — human processing power — that would otherwise be wasted and redirect it to accomplish tasks that computers cannot yet solve," von Ahn said.

For instance, he and his students have developed online games, available at www.gwap.com, that analyze photos and audio recordings — tasks beyond the capability of computers. Similarly, University of Washington biologists recently built Fold It, http://fold.it/, a game in which people compete to determine the ideal structure of a given protein.

In addition to von Ahn, authors of the new report include computer science undergraduate Benjamin Maurer, graduate students Colin McMillen and David Abraham, and Manuel Blum, professor of computer science.

Leishmaniasis parasites evade death by exploiting the immune response to sand fly bites

Cutaneous leishmaniasis, a disease characterized by painful skin ulcers, occurs when the parasite Leishmania major, or a related species, is transmitted to a mammalian host by the bite of an infected sand fly. In a new study from the National Institute of Allergy and Infectious Diseases (NIAID), part of the National Institutes of Health, scientists have discovered L. major does its damage by not only evading but also by exploiting the body's wound-healing response to sand fly bites, as reported in the August 15 issue of Science.

"This work changes the textbook picture of the lifecycle of the leishmaniasis parasite, identifying the inflammatory cell known as the neutrophil as the predominant cell involved during the initiation of infection," says NIAID Director Anthony S. Fauci, M.D.

Employing advanced microscopy techniques, which allowed real-time imaging of the skin of living mice infected with L. major, NIAID collaborators Nathan C. Peters, Ph.D., and Jackson Egen, Ph.D., found that the neutrophils—white blood cells that ingest and destroy bacteria—play a surprising role in the development of the disease.

Neutrophils were rapidly recruited out of the circulating blood and into the skin of infected mice, where they swarmed around the sand fly bite sites and efficiently engulfed the parasites. But unlike many other infectious organisms that die inside neutrophils, L. major parasites appear to have evolved in a way to evade death, actually surviving for long periods of time inside the neutrophils. Eventually the parasites escape from neutrophils and enter macrophages, another immune cell population in the skin, where they can establish long-term infection.

"Parasites transmitted by sand flies to mice lacking neutrophils have more difficulty establishing an infection and surviving. This demonstrates the importance of neutrophils at the site of an infected sand fly bite and suggests the unexpected path taken by the parasite from sand fly to neutrophil to macrophage is a critical component of this disease," says Dr. Peters.

In addition, says Dr. Egen, the study reveals how neutrophils leave locally inflamed blood vessels and move into tissues; provides new information on the movement of these immune cells within damaged tissue environments and upon contact with pathogens; and provides video images revealing active neutrophil entry into areas of damaged skin.

Colon Cancer Linked To Unequal Gene Activity

COLUMBUS, Ohio – Researchers here have discovered that a subtle difference in the activity of a pair of genes may be responsible for one of every 10 colon-cancer cases.

The work, led by researchers with the Human Cancer Genetics Program at Ohio State University's Comprehensive Cancer Center, is the first to link this particular gene conclusively as a cause of colon cancer, and it may provide clinicians with a new way to identify people who are at high risk for disease.
Albert de la Chapelle

The study was published online today at AAAS Science Express website and will appear in the journal Science in coming weeks.

An estimated 1 million cases of colon cancer arise each year worldwide, making it the second- to fourth-most-common cancer in industrialized nations. It is the third-most-common cancer and cancer killer in the United States, with 149,000 new cases and 50,000 deaths from the disease expected this year.

The gene – transforming growth factor beta receptor 1 (TGFBR1) – normally helps protect against cancer. Everyone inherits two copies of this gene, one from mom and one from dad, and both copies are usually equally active. That is, they both produce equal amounts of the RNA that is needed for making the TGFBR1 protein. But in some people, one of these two genes produces less of this than the other.

"The fact that we saw this abnormal difference in gene expression in at least 10 percent of the colon-cancer patients and in very few people without colon cancer strongly suggests that it plays an important role in this disease," says principal investigator Albert de la Chapelle, a researcher with the human cancer genetics program.

The study's findings must be verified in a larger number of patients, but they indicate that this difference in gene expression appears to increase a person's risk of colon cancer nearly nine times. "It is possible that testing for this abnormal expression may become part of clinical practice when evaluating a patient's colon-cancer risk," he says.

"Moreover, if this difference is found in patients with colon cancer, it should prompt a study of other family members who, as determined by genetic counseling, are likely to have also inherited the trait."

The study's findings must be verified in a larger number of patients, de la Chapelle notes, but they indicate that this difference in gene expression appears to increase a person's risk of colon cancer nearly nine times.

"It is possible that testing for this abnormal expression may become part of clinical practice when evaluating a patient's colon-cancer risk," he says.

Colon cancer is believed to arise as a consequence of diet and lifestyle factors and one's genetic makeup. Inherited gene changes have been implicated in about 5 percent of colon-cancer cases, but 20 to 30 percent of people diagnosed with it have a family history of the disease, suggesting that genes may play a much greater role.

This research may explain many more cases of colon cancer.

For this study, de la Chapelle and his colleagues analyzed white blood cells from 138 colon-cancer patients who had gene markers that allowed the researchers to distinguish one TGFBR1 gene from the other. In 29 of these cases, one of the two genes was at least one-third less active than the other, a level of difference that other experiments showed impairs the protein's normal function in cells.

The researchers also tested 105 noncolon-cancer patients as controls, only three of whom showed a one-third difference in expression between the two genes.

"We and others must now determine the molecular cause of the difference so that we can begin to design ways to correct it and perhaps eliminate the elevated risk of cancer," says de la Chapelle.

Funding from the National Cancer Institute, the Walter S. Mander Foundation, the Jeannik M. Littlefield-AACR Grant in Metastatic Colon Cancer Research, and the Fundación Ramón Areces supported this research.

Contact: Darrell E. Ward, Medical Center Communications, 614-293-3737, or Darrell.Ward@osumc.edu

Trees, forests and the Eiffel tower reveal theory of design in nature

DURHAM, N.C. – What do a tree and the Eiffel Tower have in common?

According to a Duke University engineer, both are optimized for flow. In the case of trees, the flow is of water from the ground throughout the trunk, branches and leaves, and into the air. The Eiffel Tower's flow carries stresses throughout the structure without collapsing under its own weight or being downed by the wind.

For most engineers, the laws governing fluid and solid mechanics like these examples are like oil and water – they just don't mix.

However, a theory developed by Adrian Bejan, J.A. Jones Professor of Mechanical Engineering at Duke's Pratt School of Engineering and colleague Sylvie Lorente, professor of civil engineering at the University of Toulouse, France, explains how these disparate forces can co-exist within the same theory.

"We believe that the main function of the tree is to facilitate the flow of water from the ground and into the atmosphere," Bejan said. "To achieve that function, the tree is ideally designed to not only maximize the flow of water, but in order to be successful in the real world, it must also be able to withstand the stresses of the wind. It is exquisitely designed to do just that."

The constructal theory, which Bejan started describing in 1996, is based on the principle that flow systems evolve to balance and minimize imperfections, reducing friction or other forms of resistance, so that the least amount of useful energy is lost. While the tree is the most common model used by Bejan to explain the theory, other similar examples exist in nature, such as the rivers and streams that make up a delta or the intricate airways of the lungs.

Eiffel Tower **Adrian Bejan**

In their latest theoretical formulation, the engineers focused on fundamental principles to explain the "designedness" of nature, or why things are constructed the way they are. Using the constructal theory, they deduced the structure of the individual tree, as well as its root system and its place in the forest, as a microcosm of the flow of water in nature.

This new application of the constructal theory was published early online in the Journal of Theoretical Biology. Bejan and Lorente's work was supported by the Air Force Office of Scientific Research.

"The tree is a physical flow architecture that has evolved to meet two main objectives – maximum mechanical strength against wind and maximum access for water coming from the ground through the tree and into the atmosphere," Bejan said. "In the larger sense, the forest itself is a flow system with the same mechanical properties and functions as the individual tree, facilitating the flow of water across the globe."

As the branches grow out from the trunk, the ratio of their circumferences decreases in proportion to the trunk's decreasing circumference as it rises.

"Winds come in many speeds, but their ultimate effect is cutting off trunks, branches and leaves, so whatever is too long or sticks out too much is shaved off," Bejan said. "So the pattern of the tree is the result of the never-ending assault by the wind."

The resulting patterns and proportions, like the similar ones of the Eiffel Tower, are predicted by the constructal theory, Bejan said.

"If the purpose of a tree was not to transport water, it would look like the Eiffel Tower," said Bejan, half jokingly. "It looks like Mr. (French engineer Gustave) Eiffel, without knowing it, designed a structure that corresponds with our constructal theory."

Hope for arthritis vaccine 'cure'

A single injection of modified cells could halt the advance of rheumatoid arthritis, say UK scientists.

The Newcastle University team is about to start small-scale safety trials of the jab, which will hopefully stop the immune system attacking the joints. The Arthritis Research Campaign, which is funding the project, said if successful the treatment would be "revolutionary". It could be fully tested and available within five years.

Rheumatoid arthritis is one of a family of "autoimmune" diseases, in which the body's defence systems launch attacks on its own tissues.

In the case of rheumatoid arthritis, this means painful inflammation and progressive damage to the joints, eased only slightly by courses of painkillers and immune dampening drugs. The precise trigger for these attacks is not known, but the latest technique, so far tested only on cells in the laboratory, aims to "reset" the immune system back to its pre-disease state.

A sample of the body's white blood cells is taken and treated with a cocktail of steroids and vitamins which transforms a particular type of immune cell called a dendritic cell into a "tolerant" state.

These cells are then injected back into the joint of the patient.

Professor John Isaacs, who is leading the research, said: "Based on previous laboratory research we would expect that this will specifically suppress or down regulate the auto-immune response."

Small trial

So far the team does not have any data about how well the treatment works in living creatures.

The next step is an initial safety trial involving just eight patients, although this could lead to further trials with higher number of patients.

Professor Alan Silman, from the Arthritis Research Campaign, said that, if successful, the treatment could make a big difference to patients. He said: "The idea is to change these dendritic cells so that instead of being aggressive they return to their normal state. "The presumption is that they will stay this way, unless the same trigger which is thought to cause the problem in the first place is encountered again.

"It could be a revolutionary development for rheumatoid arthritis patients."

He said that the technique would be labour-intensive, requiring specialist laboratory facilities, perhaps costing many thousands of pounds per injection, but this would still cost the NHS less than decades of prescription medicines to control the symptoms of rheumatoid arthritis.

He also suggested that the same process might be applied to other auto-immune diseases such as type I diabetes, or even MS.

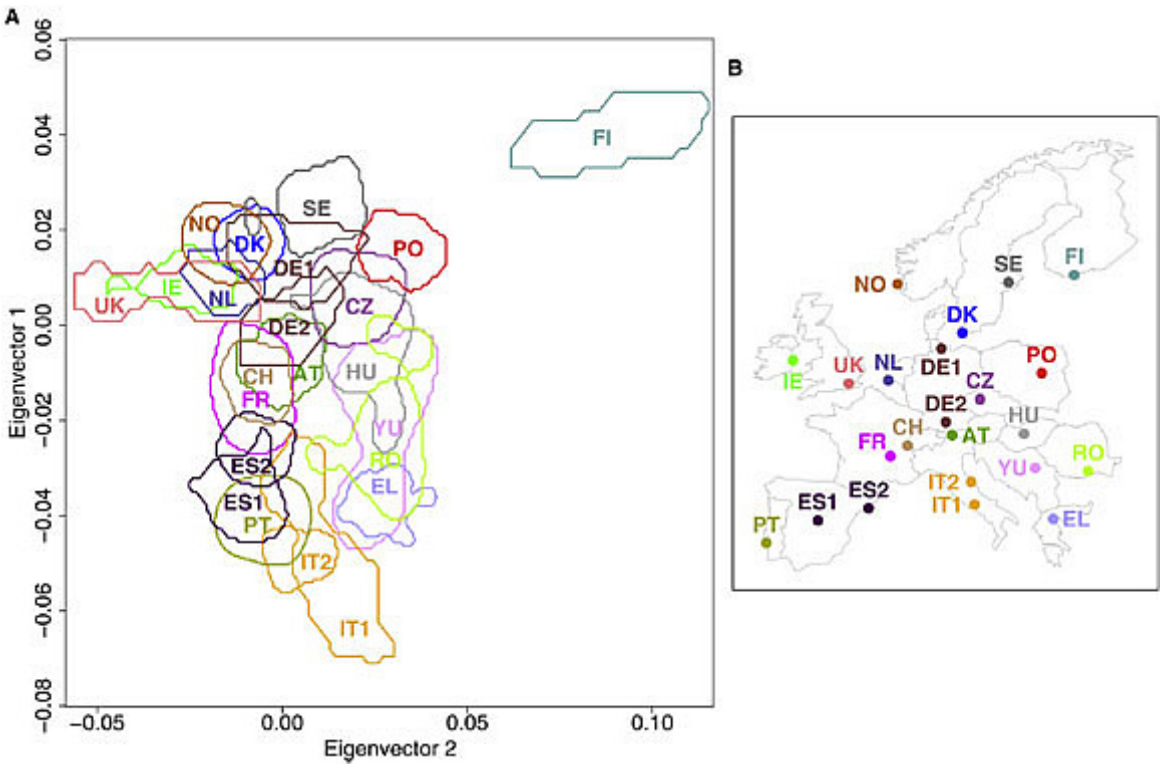
Visual Science

The Genetic Map of Europe

By NICHOLAS WADE

Biologists have constructed a genetic map of Europe showing the degree of relatedness between its various populations.

All the populations are quite similar, but the differences are sufficient that it should be possible to devise a forensic test to tell which country in Europe an individual probably comes from, said Manfred Kayser, a geneticist at the Erasmus



University Medical Center in the Netherlands.

The map shows, at right, the location in Europe where each of the sampled populations live and, at left, the genetic relationship between these 23 populations. The map was constructed by Dr. Kayser, Dr. Oscar Lao and others, and appears in an article in Current Biology published on line on August 7.

The genetic map of Europe bears a clear structural similarity to the geographic map. The major genetic differences are between populations of the north and south (the vertical axis of the map shows north-south differences, the horizontal axis those of east-west). The area assigned to each population reflects the amount of genetic variation in it.

Europe has been colonized three times in the distant past, always from the south. Some 45,000 years ago the first modern humans entered Europe from the south. The glaciers returned around 20,000 years ago and the second colonization occurred about 17,000 years ago by people returning from southern refuges. The third invasion was that of farmers bringing the new agricultural technology from the Near East around 10,000 years ago.

The pattern of genetic differences among present day Europeans probably reflects the impact of these three ancient migrations, Dr. Kayser said.

The map also identifies the existence of two genetic barriers within Europe. One is between the Finns (light blue, upper right) and other Europeans. It arose because the Finnish population was at one time very small and then expanded, bearing the atypical genetics of its few founders.

The other is between Italians (yellow, bottom center) and the rest. This may reflect the role of the Alps in impeding free flow of people between Italy and the rest of Europe.

Data for the map were generated by gene chips programmed to test and analyze 500,000 sites of common variation on the human genome, although only the 300,000 most reliable sites were used for the map. Dr. Kayser's team tested almost 2,500 people and analyzed the data by correlating the genetic variations in all the subjects. The genetic map is based on the two strongest of these sets of correlations.

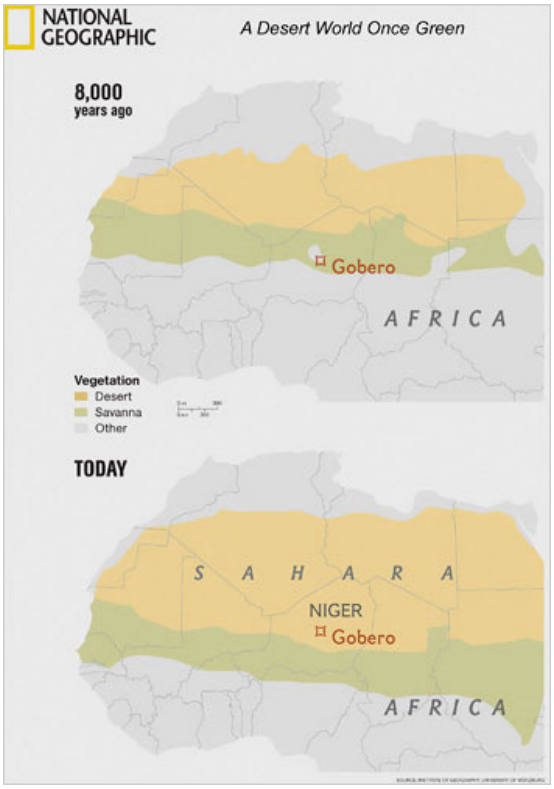
The gene chips require large amounts of DNA, more than is available in most forensic samples. Dr. Kayser hopes to identify the sites on the human genome which are most diagnostic for European origin. These sites, if reasonably few in number, could be tested for in hair and blood samples, Dr. Kayser said.

Genomic sites that carry the strongest signal of variation among populations may be those influenced by evolutionary change, Dr. Kayser said. Of the 100 strongest sites, 17 are found in the region of the genome that confers lactose tolerance, an adaptation that arose among a cattle herding culture in northern Europe some 5,000 years ago. Most people switch off the lactose digesting gene after weaning, but the cattle herders evidently gained a great survival advantage by keeping the gene switched on through adulthood.

Graves Found From Sahara's Green Period

By JOHN NOBLE WILFORD

When Paul C. Sereno went hunting for dinosaur bones in the Sahara, his career took a sharp turn from paleontology to archaeology. The expedition found what has proved to be the largest known graveyard of Stone Age people who lived there when the desert was green.



The first traces of pottery, stone tools and human skeletons were discovered eight years ago at a site in the southern Sahara, in Niger. After preliminary research, Dr. Sereno, a University of Chicago scientist who had previously uncovered remains of the dinosaur Nigersaurus there, organized an international team of archaeologists to investigate what had been a lakeside hunting and fishing settlement for the better part of 5,000 years, originating some 10,000 years ago.

In its first comprehensive report, published Thursday, the team described finding about 200 graves belonging to two successive populations. Some burials were accompanied by pottery and ivory ornaments. A girl was buried wearing a bracelet carved from a hippo tusk. A man was seated on the carapace of a turtle.

The most poignant scene was the triple burial of a petite woman lying on her side, facing two young children. The slender arms of the children reached out to the woman in an everlasting embrace. Pollen indicated that flowers had decorated the grave.

The sun-baked dunes at the site, known as Gobero, preserve the earliest and largest Stone Age cemetery in the Sahara, Dr. Sereno's group reported in the online journal PLoS One. The findings, they wrote, open "a new window on the funerary practices, distinctive skeletal anatomy, health and diet of early hunter-fisher-gatherers, who expanded into the Sahara when climatic conditions were favorable."

The research was also described at a news conference on Thursday in Washington at the National Geographic Society, a supporter of the project.

The initial inhabitants at Gobero, the Kiffian culture, were tall hunters of wild game who also fished with harpoons carved from animal bone. Later, a more lightly built people, the Ténérians, lived there, hunting, fishing and herding cattle.

Other scientists said the discovery appeared to provide spectacular evidence that nothing, not even the arid expanse of the Sahara, was changeless. About 100 million years ago, this land was forested and occupied by dinosaurs and enormous crocodiles. Around 50,000 years ago, people moved in and left stone tools and mounds of shells, fish bones and other refuse. The lakes dried up in the last Ice Age.

Then the rains and lakes of a fecund Sahara returned about 12,000 years ago, and remained, except for one 1,000-year interval, until about 4,500 years ago. Geologists have long known that the region's basins retained mineral residue of former lakes, and other explorers have found scatterings of human artifacts from that time, as Dr. Sereno did at Gobero in 2000.

"Everywhere you turned, there were bones belonging to animals that don't live in the desert," he said. "I realized we were in the green Sahara."

Human skeletons were eroding from the dunes, including jawbones with nearly full sets of teeth and finger bones of a tiny hand pointing up from the sand.

From an analysis of the skeletons and pottery, scientists identified the two successive cultures that occupied the settlement. The Kiffians, some of whom stood up to six feet tall, both men and women, lived there during the Sahara's wettest period, between 10,000 and 8,000 years ago. They were primarily hunter-gatherers who speared huge lake perch with harpoons.

Elena A. A. Garcea, an archaeologist at the University of Cassino in Italy, identified ceramics with wavy lines and zigzag patterns as Kiffian, a culture associated with northern Africa. Pots bearing a pointillistic pattern were linked to the Ténérians, a people named for the Ténéré desert, a stretch of the Sahara known to Tuareg nomads as a "desert within a desert."

Christopher M. Stojanowski, an archaeologist at Arizona State University, said the two cultures were "biologically distinct groups." The bones and teeth showed that in contrast to the robust Kiffians, the Ténérians were typically short and lean and apparently led less rigorous lives.

The shapes of the Ténérian skulls are puzzling, researchers said, because they resemble those of Mediterranean people, not other nearby groups.

Asked if he had adjusted to the transition from dinosaur paleontology to Stone Age archaeology, Dr. Sereno said, "It's still weird for me to be digging up my own species."

Women and war: The toll of deployment on physical health

ANN ARBOR, Mich.---More than 80 percent of a sample of Air Force women deployed in Iraq and other areas around the world report suffering from persistent fatigue, fever, hair loss and difficulty concentrating, according to a University of Michigan study. The pattern of health problems reported by 1,114 women surveyed in 2006 and 2007 is similar to many symptoms of Gulf War Syndrome, the controversial condition reported by veterans of the 1991 Persian Gulf War.

"It is possible that some unknown environmental factor is the cause of current health problems and of Gulf War Syndrome," said U-M researcher Penny Pierce. "But it is also possible that these symptoms result from the stress of military deployment, especially prolonged and multiple deployments."

Pierce and U-M colleagues conducted a similar study of women veterans in 1992 following that war to assess the impact of deployment and combat exposure on physical and mental health.

An associate professor at the U-M School of Nursing and a faculty associate at the U-M Institute for Social Research (ISR), Pierce is also a colonel in the Air Force Reserve Program. With ISR psychologist Lisa Lewandowski-Romps, she presented the findings from the study Aug. 14 in Boston at the annual meeting of the American Psychological Association.

"Women now comprise approximately 15 percent of our nation's armed forces," Pierce said. "And since the Persian Gulf War, combat roles for women have expanded substantially. This study is an attempt to understand the impact of deployment and war-related stressors on the health of military women."

The Air Force women surveyed by telephone and through mailed questionnaires were drawn from a stratified, random sample and deployed at least once since March 2003 during Operation Iraqi Freedom. Half of

those sampled served in the theater of war and half served elsewhere; half had children under the age of 18 still living at home; half were active duty, a quarter in the Reserves and another quarter in the National Guard. The median age of participants was 36 years, and 45 percent were married. About 36 percent had a dependent child at the time they were sent overseas. About 70 percent were white.

Asked if they experienced any of a list of symptoms persistently in the past year, 89 percent of those surveyed reported suffering from fatigue, 85 percent from difficulty concentrating, 83 percent from fever, and 83 percent from hair loss. In addition, 35 percent reported suffering from muscle pain and stiffness, 29 percent from irritability, 26 percent from loss of energy and 25 percent from headaches.

In general, Pierce and Lewandowski found that those in the reserve and guard reported more physical symptoms than active duty personnel. Enlisted women reported more health problems than officers did.

In most cases, women serving in the theater of war were more likely to report physical health problems than were than those serving elsewhere. But in many cases, the differences were small, suggesting to Pierce that deployment-related stressors such as family separation and disruption of social support systems may play a critical role in developing stress-related physical problems.

In an earlier analysis of data from the study, presented at last year's American Psychological Association conference, Pierce and Lewandowski-Romps found that about 20 percent of the women surveyed reported at least one major symptom of post-traumatic stress disorder (PTDS).

"Deployment itself is a major stressor," she said. "The whole person is deployed---body, mind, and spirit. We don't know the precise biological mechanism, but it is generally accepted now---perhaps more so than it was in the early 1990s when Gulf War Syndrome was first reported---that persistent levels of heightened stress take a major toll on physical health. "By identifying problems early, I hope our findings will guide policy-makers and health care professions to design interventions to support service members and their families."

The study is part of an on-going research program on women veterans funded by the TriService Nursing Research Program.

For more information:*Women Veterans Project website: http://sitemaker.umich.edu/afwomen/home*
U-M Institute for Social Research: www.isr.umich.edu

Big-brained animals evolve faster

Ever since Darwin, evolutionary biologists have wondered why some lineages have diversified more than others. A classical explanation is that a higher rate of diversification reflects increased ecological opportunities that led to a rapid adaptive radiation of a clade. A textbook example is Darwin finches from Galapagos, whose ancestor colonized a competitors-free archipelago and rapidly radiated in 13 species, each one adapted to use the food resources in a different way. This and other examples have led some to think that the progenitors of the major evolutionary radiations are those that happened to be in the right place and at the right time to take advantage of ecological opportunities. However, is it possible that biological diversification not only depends on the properties of the environment an ancestral species finds itself in, but also on the features of the species itself? Now a study supports this possibility, suggesting that possessing a large brain might have facilitated the evolutionary diversification of some avian lineages.

Over 20 years ago, Jeff Wyles, Allan Wilson, and Joseph Kunkel proposed that big brains might favor adaptive evolutionary diversification in animals by facilitating the behavioral changes needed to use new resources or environments, a theory known as the behavioral drive hypothesis. When these authors formulated their hypothesis, evidence that the size of the brain limits the cognitive capacity of animals were scanty. Since then, however, a substantial body of evidence has confirmed that animals with larger brains, relative to their body size, have more developed skills for changing their behavior through learning and innovation, facilitating the invasion of novel environments and the use of novel resources.

Parrots have a big brain and are also one of the most evolutionarily diversified bird clades.

Despite the progress, the role of the brain in the adaptive diversification of animals has remained controversial, mostly due to the difficulties to demonstrate that big-brained animals evolve faster. Now, ecologist Daniel Sol of CREAF-Autonomous University of Barcelona and evolutionary biologist Trevor Price of the University of Chicago, provide evidence for such a role in birds in an article in the August issue of The American Naturalist. Analyzing body size measures of 7,209 species (representing 75% of all avian species), they found that avian families that have experienced the greatest diversification in body size tend to be those with brains larger than expected for their body size. These include the Picidae (woodpeckers), Bucerotidae (hornbills), Psittacidae (parrots), Strigidae (owls), Menuridae (lyrebirds) and Corvidae (crows).

Brain size can promote morphological diversification because it facilitates range expansions and speciation, yet the analyses indicate that the brain-diversification association is statistically independent of geographic

range and species richness. "The most likely alternative," Daniel Sol states, "is that big brains enhance the rate of evolutionary diversification by facilitating changes in behavior, which would place new selection pressures on populations and favor adaptive divergence." Thus, in species with high cognitive styles, behavior might be, along with environmental factors, a major driving force for evolution.

Penn study finds way to prevent protein clumping characteristic of Parkinson's disease

PHILADELPHIA - Researchers at the University of Pennsylvania School of Medicine have identified a protein from a most unlikely source -- baker's yeast -- that might protect against Parkinson's disease. More than a million Americans suffer from Parkinson's disease, and no treatments are available that fundamentally alter the course of the condition. By introducing the yeast protein Hsp104 into animal models of Parkinson's disease, researchers prevented protein clumping that leads to nerve cell death characteristic of the disorder.

"Yeast express a protein called Hsp104, which is able to reverse protein aggregation," says James Shorter, PhD, Assistant Professor of Biochemistry and Biophysics. "However, for reasons that are unclear, Hsp104 is not found in mammals. We wondered if introducing Hsp104 into mammals could help with diseases connected with protein aggregation." These findings will be published in the September 2008 issue of The Journal of Clinical Investigation and appeared online August 14, 2008

Clinicians do not fully understand the process and cause of Parkinson's disease. However, researchers believe that a protein called alpha-synuclein misfolds and clumps in many forms of the disease, and that this process is intimately tied to the selective death of dopamine-producing neurons that results in Parkinson's disease.

In this study, researchers found that Hsp104 could partially reverse alpha-synuclein aggregation in test-tube experiments. Remarkably, rats expressing Hsp104 showed lower levels of alpha-synuclein aggregation and alpha-synuclein-induced toxicity of neurons. This result is significant because the rat model used recreates the selective loss of dopamine-producing nerve cells in the region of the brain affected in Parkinson's disease, say the investigators. "This study represents an important preliminary step," says Shorter. "One thing we'd like to do next is to treat an animal model which already has considerable quantities of alpha-synuclein aggregates to see if Hsp104 can actually reverse the process in the rat brain."

Co-authors in addition to Shorter are Christophe Lo Bianco of the Wallenberg Neurosciences Center in Lund, Sweden and the Brain Mind Institute in Lausanne, Switzerland; Etienne Regulier, Hilal Lasheul, and Patrick Aebischer, also of the Brain Mind Institute; Takeshi Iwatsubo at the University of Tokyo; and Susan Lindquist of the Whitehead Institute for Biomedical Research, Cambridge, MA. The Michael J. Fox Foundation, European Molecular Biology Organization, Swedish Parkinson's Foundation, Swiss National Science Foundation, American Heart Association, University of Pennsylvania Institute on Aging, and the National Institute of Health Director's New Innovator Award provided funding for this research.
This release and a related image can be viewed at www.pennhealth.com/news.

Arsenic-munching bacteria found

By Jennifer Carpenter Science reporter, BBC News

In the warm, bubbling pools of Mono Lake in California, scientists have isolated a bacterium that fuels itself on arsenic.

Microbial biofilms form in rocky pools, fed by hot springs containing arsenic

Combining light and arsenic, these bacteria make their food and multiply using a chemical that is toxic to most other life forms.

The researchers think using arsenic as an energy source was a process used by ancient bacteria. Their findings are reported in the journal Science.

Ronald Oremland of the US Geological Survey explained that these bacteria are photosynthetic, using sunlight - like plants - to turn carbon dioxide into food. What is different about them is that instead of using water in this process, they use arsenic. The US-based researchers isolated the bacterium from the lake, which lies at the foot of the Sierra Nevada.

Colour film

"These lakes are fed by hydrothermal waters that leach out arsenic-containing minerals from the surrounding rocks," Dr Oremland told BBC News.

The researchers noticed that the bacteria had colonised small, hot pools, forming colourful "biofilms".

"We suspected that these bacteria were using arsenic to make a living, so we scraped the biofilms off the rock and studied them under laboratory conditions."

By first withholding light, then arsenic, the team showed that the bacteria required both to grow.

This the first time an organism has been found that can use arsenic to photosynthesise under anaerobic conditions, Dr Oremland believes. He suspects that this is an ancient ability in bacteria.

"We think that bacteria were photosynthesising before oxygen was present in the atmosphere," he said.

Primordial niche

Understanding how arsenic is metabolised by bacteria could help scientists comprehend its damaging effects inside human cells.

Worldwide, 144 million people are exposed to toxic levels of arsenic in their drinking water.

It enters the body's cells by diffusion; and once inside, it disrupts how they function by binding to their machinery, inactivating it, and disrupting the way energy is transported. Long-term exposure can lead to skin disease and kidney and bladder cancer, and it is thought to stunt the intellectual development of children.

The most arsenic-contaminated regions are in India, Pakistan, and China, where soluble arsenic in ground waters is above the World Health Organization's (WHO) suggested maximum safe level of 10 parts per billion.

Asthma in boys may be just a phase, but for girls it may be there to stay

Boys may be more apt than girls to have childhood asthma, but, when compared to girls, they are also more likely to grow out of it in adolescence and have a decreased incidence of asthma in the post-pubertal years. This indicates that there may be a buried mechanism in asthma development, according to a prospective study that analyzed airway responsiveness (AR) in more than 1,000 children with mild to moderate asthma over a period of about nine years.

"We wanted to investigate what was behind the observed sex differences in asthma rates and AR," says lead researcher, Kelan G. Tantisira, M.D., M.P.H., of Brigham and Women's Hospital and Harvard Medical School. "This is the first study to prospectively examine the natural history of sex differences in asthma in this manner."

Their results appeared in the second issue for August of the American Journal of Respiratory and Critical Care Medicine, published by the American Thoracic Society.

Dr. Tantisira and colleagues used data from the ongoing Childhood Asthma Management Program (CAMP) that enrolled 1041 children from 5 to 12 years of age with mild to moderate persistent asthma and performed annual spirometric testing with methacholine challenges to quantify their AR.

After an average of 8.6 years and each individual had undergone eight to nine annual methacholine challenges, the researchers were able to identify a clear pattern: when it came to the amount of methacholine it took to provoke airway constriction, the girls' reactivity did not change markedly over the years. In contrast, boys became increasingly tolerant over time to larger and larger doses of methacholine, suggesting a possible decrease in disease severity. By the age of 16, it took more than twice as much methacholine to provoke a 20 percent constriction in the boys' airway on average as it did with the girls.

What's more, by age 18, only 14 percent of the girls did not demonstrate any significant degree of airways responsiveness, compared to 27 percent of boys.

"While our results were not unexpected, they do point to intriguing potential mechanisms, to explain the gender differences in asthma incidence and severity. Especially intriguing is that the differences in gender begin at the time of transition into early puberty." said Dr. Tantisira.

This study into the natural history and sex differences in asthma marks the beginning of what many hope will be a long investigation into the subject.

"It will be of great interest to follow these children over time to see what happens with AR and severity of asthma in adulthood," wrote Jorrit Gerritson, M.D., Ph.D., in an accompanying editorial.

This is precisely Dr. Tantisira's next step: Dr. Tantisira and colleagues now have 12 years of data for the cohort, and is looking into investigating the characteristics of the individuals who attained clinically "normal" AR during follow-up. "Most of the original cohort has now reached adulthood," said Dr. Tantisira. "We are now able to perform a secondary analysis with an emphasis on those who have reached clinical 'normalcy.'"

Go online to find your future spouse

You're now more likely to find your true love on the internet than at work or at a party, in the US at least - especially if you're over 45.

That's according to a Harris Interactive online survey of more than 10,000 people who married in the US during an 18-month period in 2006 and 2007. "Wanting to get married and not going online will soon be seen as equivalent to trying to find an address by driving around randomly, rather than using a map," says Galen Buckwalter of eHarmony, the online matchmaking company in Pasadena, California, that sponsored the survey.

Nineteen per cent of the couples met online, according to the survey, compared with 17 per cent who met at work and 17 per cent who met through friends. In contrast, a similar poll of almost 5000 couples who married between September 2004 and August 2005 found that 14 per cent met online, compared with 20 per cent at work and 17 per cent through friends.

In the current survey, 31 per cent of married couples aged 45 to 54 met online, against 18 per cent of 20 to 44-year-olds. Younger people may find it easier to meet potential partners through other avenues, such as college.

As online dating spreads, so will techniques to help people gauge the attractiveness of potential mates, says Andrew Fiore, who studies online dating at the University of California, Berkeley. "People aren't that great at describing themselves accurately, so expect more experiential online dating activities and games that help you get to know someone," he says.

Caltech engineers build mini drug-producing biofactories in yeast

PASADENA, Calif.-- Researchers at the California Institute of Technology have developed a novel way to churn out large quantities of drugs, including antiplaque toothpaste additives, antibiotics, nicotine, and even morphine, using mini biofactories--in yeast.

A paper describing the research, now available online, will be featured as the cover article of the September issue of Nature Chemical Biology.

Christina D. Smolke, an assistant professor of chemical engineering at Caltech, along with graduate student Kristy Hawkins, genetically modified common baker's yeast (Saccharomyces cerevisiae) so that it contained the genes for several plant enzymes. The enzymes allow the yeast to produce a chemical called reticuline, which is a precursor for many different classes of benzylisoquinoline alkaloid (BIA) molecules. The BIA molecules are a large group of chemically intricate compounds, such as morphine, nicotine, and codeine, which are naturally produced by plants.

BIA molecules exhibit a wide variety of pharmacological activities, including antispasmodic effects, pain relief, and hair growth acceleration. Other BIAs have shown anticancer, antioxidant, antimalarial, and anti-HIV potential.

"There are estimated to be thousands of members in the BIA family, and having a source for obtaining large quantities of specific BIA molecules is critical to gaining access to the diverse functional activities provided by these molecules," says Smolke, whose lab focuses on using biology as a technology for the synthesis of new chemicals, materials, and products. However, the natural plant sources of BIAs accumulate only a small number of the molecules, usually "end products" like morphine and codeine that, while valuable, can't be turned into other compounds, thus limiting the availability of useful new products.

To their reticuline-producing yeast, Smolke and Hawkins added the genes for other enzymes, from both plants and humans, which allowed the yeast to efficiently generate large quantities of the precursors for sanguinarine, a toothpaste additive with antiplaque properties; berberine, an antibiotic; and morphine.

The researchers are now in the process of engineering their yeast so that they will turn these precursor molecules into the final, pharmacologically useful molecules. "But even the intermediate molecules that we are producing can exhibit important and valuable activities, and a related area of research will be to examine more closely the pharmacological activities of these metabolites and derivatives now that pure sources can be obtained," says Smolke, who estimates that her system could be used for the large-scale manufacture of BIA compounds in one to three years.

Smolke and Hawkins also plan to extend their research to the production of BIAs that don't normally exist in nature.

"If one thinks of these molecules as encoding functions that are of interest to us, the ability to produce nonnatural alkaloids will provide access to more diverse functions and activities. By expanding to nonnatural alkaloids, we can search for molecules that provide enhanced activities, new activities, and not be limited by the activities that have been selected for in nature," says Smolke.

"Our work has the potential to result in new therapeutic drugs for a broad range of diseases. This work also provides an exciting example of the increased complexity with which we are engineering biological systems to address global societal challenges," she says.

The research was supported by the Center for Biological Circuit Design at Caltech and the National Institutes of Health.

Potatoes may hold key to Alzheimer's treatment

A virus that commonly infects potatoes bears a striking resemblance to one of the key proteins implicated in Alzheimer's disease (AD), and researchers have used that to develop antibodies that may slow or prevent the onset of AD.

Studies in mice have demonstrated that vaccinations with the amyloid beta protein (believed to be a major AD contributor) to produce Aβ antibodies can slow disease progression and improve cognitive function, possibly by promoting the destruction of amyloid plaques. Some early human trials have likewise been promising, but had to be halted due to the risk of autoimmune encephalitis.

Necrotic ringspots on a potato tuber (cultivar Nicola) due to Potato virus Y infection.

One way to make Alzheimer's vaccinations safer would be to use a closely-related, but not human, protein as the vaccine, much like cowpox virus is used for smallpox immunizations.

In the August 15 Journal of Biological Chemistry, Robert Friedland and colleagues used this concept on an amyloid-like protein found in potato virus (PVY). They injected PVY into mice followed by monthly boosters for four months. The researchers found that the mice produced strong levels of antibodies that could attach to amyloid beta protein both in both solution and in tissue samples of Alzheimer's patients. And although the levels were lower, mice also developed Aβ antibodies if given injections of PVY-infected potato leaf as opposed to purified PVY.

Friedland and colleagues note that potato virus is a fairly common infection that poses no risk to humans (many people have probably eaten PVY infected potatoes). While tests of PVY antibodies will ultimately determine how useful they can be, they may be a promising lead to treating this debilitating disease.

From the JBC article: "Antibodies to Potato Virus Y Bind the Amyloid Beta Peptide" by Robert P. Friedland, Jonathan M. Tedesco, Andrea Wilson, Craig Atwood, Mark Smith, George Perry and Michael Zagorski.

Experiments could lead to new treatments for neuroblastoma

Deadly cancer primarily strikes infants, kills more than 50 percent of victims

GALVESTON, Texas — Neuroblastoma is one of the most devastating diagnoses a child can receive. The cancer's victims average 2 years old when the disease is detected, most often by a parent feeling a lump in a child's abdomen. By then, the disease has often reached an advanced stage, and advanced neuroblastoma kills more than 50 percent of the children in whom it develops, despite aggressive treatment with surgery, chemotherapy and radiation.

Now, though, University of Texas Medical Branch at Galveston researchers believe they've found a critical weakness in the deadly cancer — one that could lead to the development of a lifesaving therapy. In a paper published this week in the "Proceedings of the National Academy of Sciences," a team led by associate professor of surgery Dr. Dai H. Chung describes cell-culture and animal experiments that demonstrate how shutting down a single biochemical signaling connection dramatically suppresses neuroblastoma tumor formation and slows the cancer's spread.

Their investigation centered on an intercellular signaling molecule known as gastrin-releasing peptide, or GRP, and the receptor molecule with which it docks on the cell's surface. GRP activates the production of gastrin, a hormone that among other things controls the release of gastric acid in the stomach; GRP is also produced by neuroblastoma cells and acts to accelerate their proliferation, a discovery made earlier by the UTMB group.

"We had previously demonstrated that GRP stimulates the growth of this particular cancer," said Chung. "This time we wanted to demonstrate the opposite effects by targeting GRP receptors in neuroblastoma, to see if we could make the cancer regress."

To "target" GRP, the researchers took a line of aggressive human neuroblastoma cells and added short-hairpin RNAs, tiny bits of genetic material specifically designed to keep cells from making particular proteins — in this case GRP receptor molecules. Experiments with the GRP-receptor-silenced human neuroblastoma cells revealed that they grew much less quickly than unaltered neuroblastoma cells, and showed less activity on a biochemical signaling pathway that is associated with abnormal cell proliferation.

The scientists then cultured the customized cells in soft agar, a gelatin-like material that gave them no surface to which they could attach themselves. Most cells need be solidly anchored to multiply and form colonies, but neuroblastoma cells (like other cancer cells) thrive in soft agar suspension

"In order for cells in a soft agar colony to proliferate and grow without adhering to a surface, they have to possess malignant properties, as in the original neuroblastoma cells," Chung said. "However, our GRP receptor-silenced neuroblastoma cells behaved like nonmalignant cells — their growth was significantly inhibited, and they formed fewer new colonies."

To further test what effect blocking GRP/GRP receptor binding would have on neuroblastoma in experimental animals, the researchers injected their GRP receptor-silenced neuroblastoma cells into immune-deficient mice. "We wanted to see how these neuroblastoma cells would behave, whether they would grow and/or metastasize to the liver," Chung said. "But instead, tumor growth was significantly attenuated." In control group mice, by contrast, "the cancer cells that expressed the GRP receptors behaved as we expected with rapid growth as well as aggressive liver metastases. The implication is that the metastatic behavior of this cancer is driven by GRP and its receptor."

Although researchers are discussing the use of short-hairpin RNA and other RNA interference techniques as potential therapies for patients with neuroblastoma and other cancers, Chung said, a compound that blocks the GRP receptor has already been approved by the FDA for adult use.

"With the publication of our data, we would like to propose an application involving a number of institutions to move forward with a phase 1 clinical trial using this FDA-approved GRP receptor antagonist for neuroblastoma," Chung said. "We hope to demonstrate the safety of targeting GRP receptors for effective inhibition of neuroblastoma growth and metastasis. This is just such a tragic disease, and with all the advances we're making, we ought to be able to make a dent in it."

Other authors of the PNAS paper, "Gastrin-releasing peptide receptor silencing suppresses the tumorigenesis and metastatic potential of neuroblastoma," were UTMB professor B. Mark Evers, research scientist Jingbo Qiao, research associate JungHee Kang, graduate student Titilope Ishola and instructor Piotr Rychahou. Funding was provided by the National Institutes of Health.

Survivors of 1918 flu pandemic protected with a lifetime immunity to virus

New research has discovered that infection and natural exposure to the 1918 influenza virus made survivors immune to the disease for the remaining of their lives. Antibodies produced by cells isolated from these survivors served as an effective therapy to protect mice from the highly lethal 1918 infection. The study entitled "Neutralizing antibodies derived from the B cells of 1918 influenza pandemic survivors," was released for advanced online publication by the journal Nature. Researchers at Mount Sinai School of Medicine's Department of Microbiology contributed to the research findings. An estimated 50 million people were killed by the 1918 flu pandemic worldwide.

"Ninety years after survivors encountered the 1918 pandemic influenza virus, we collected antibody-producing B cells from them, and successfully isolated B cells that produce antibodies that block the viral infection," said contributing author Dr. Christopher Basler, PhD, Associate Professor of Microbiology at Mount Sinai School of Medicine. "The antibodies produced by these cells demonstrated remarkable power to block 1918 flu virus infection in mice, proving that, even nine decades after infection with this virus, survivors retain protection from it."

"The fact that you can isolate these anti-1918 memory B cells so long after infection will hopefully provide the impetus to further study the mechanisms behind long lived immunity," said Dr. Osvaldo Martinez, post-doctoral fellow at Mount Sinai School of Medicine.

For this study, 32 individuals who were born before 1918 and lived through the influenza pandemic were recruited by Dr. Eric Altschuler at the University of Medicine and Dentistry of New Jersey to donate blood which was tested by Dr. Basler's lab for the presence of antibodies that recognize the 1918 virus. Dr. James Crowe and colleagues at Vanderbilt University produced antibodies from these individuals' blood cells and provided these to Dr. Basler's lab where the potent neutralizing activity against 1918 virus was demonstrated. Antibodies were also provided to Dr. Terrence Tumpey at the CDC to test in mice the strength of the antibodies derived from the 1918 survivors.

"Our findings show that survivors of the pandemic have highly effective, virus neutralizing antibodies to this powerful virus, and humans can sustain circulating B memory cells to viruses for up to 9 decades after exposure," said Dr. Tshidi Tsibane, post-doctoral fellow, Department of Microbiology, Mount Sinai School of Medicine. "These findings could serve as potential therapy for another 1918-like virus."

Vanderbilt University, Mount Sinai School of Medicine, University of Medicine and Dentistry of New Jersey, Centers for Disease Control and Prevention and The Scripps Research Institute collaborated on this research study.

Monash team learns from nature to split water

An international team of researchers led by Monash University has used chemicals found in plants to replicate a key process in photosynthesis paving the way to a new approach that uses sunlight to split water into hydrogen and oxygen. The breakthrough could revolutionise the renewable energy industry by making hydrogen – touted as the clean, green fuel of the future – cheaper and easier to produce on a commercial scale.

Professor Leone Spiccia, Mr Robin Brimblecombe and Dr Annette Koo from Monash University teamed with Dr Gerhard Swiegers at the CSIRO and Professor Charles Dismukes at Princeton University to develop a system comprising a coating that can be impregnated with a form of manganese, a chemical essential to sustaining photosynthesis in plant life.

"We have copied nature, taking the elements and mechanisms found in plant life that have evolved over 3 billion years and recreated one of those processes in the laboratory," Professor Spiccia said. "A manganese cluster is central to a plant's ability to use water, carbon dioxide and sunlight to make carbohydrates and oxygen. Man-made mimics of this cluster were developed by Professor Charles Dismukes some time ago, and we've taken it a step further, harnessing the ability of these molecules to convert water into its component elements, oxygen and hydrogen," Professor Spiccia said. "The breakthrough came when we coated a proton conductor, called Nafion, onto an anode to form a polymer membrane just a few micrometres thick, which acts as a host for the manganese clusters."

"Normally insoluble in water, when we bound the catalyst within the pores of the Nafion membrane, it was stabilised against decomposition and, importantly, water could reach the catalyst where it was oxidised on exposure to light." This process of "oxidizing" water generates protons and electrons, which can be converted into hydrogen gas instead of carbohydrates as in plants. "Whilst man has been able to split water into hydrogen and oxygen for years, we have been able to do the same thing for the first time using just sunlight, an electrical potential of 1.2 volts and the very chemical that nature has selected for this purpose," Professor Spiccia said

Testing revealed the catalyst assembly was still active after three days of continuous use, producing oxygen and hydrogen gas in the presence of water, an electrical potential and visible light.

Professor Spiccia said the efficiency of the system needed to be improved, but this breakthrough had huge potential. "We need to continue to learn from nature so that we can better master this process. Hydrogen has long been considered the ideal clean green fuel, energy-rich and carbon-neutral. The production of hydrogen using nothing but water and sunlight offers the possibility of an abundant, renewable, green source of energy for the future for communities across the world."

The research is published this month in the scientific journal Angewandte Chemie, International Edition.

World's farmers turn to raw sewage for irrigation

* 00:01 18 August 2008

* NewScientist.com news service

*** Fred Pearce**

The future may not smell too rosy – it may lie in sewage. As cities and industries suck up ever more of the world's scarce water resources, agriculture is destined to rely increasingly on recycling the contents of urban sewers, according to a new international study of "wastewater agriculture".

The good news – for farmers at least – is that the irrigation water from sewers comes with free fertiliser in the form of the nitrates and phosphates bound up in human faeces. The bad news is that this coprological cornucopia is filling vegetables sold in city markets with heavy metals, pathogenic bacteria and worms.

An estimated one fifth of the world's food is growing in urban areas, with perishables like vegetables to the fore. But a 50-city study by the International Water Management Institute (IWMI) – a World Bank-backed research agency based in Sri Lanka – finds that often the only source of the essential irrigation water to grow many of those crops is city sewage.

A market near you?

Half of urban fields are irrigated with sewage, suggesting that a tenth of the world's food is already grown this way. IWMI's director Colin Chartres warned this week: "This figure is bound to increase as growing cities coincide with escalating food shortages to create a squeeze on agricultural water supply."

Theoretically, irrigating food crops with untreated wastewater is banned in many countries, one reason why there is virtually no research on the practice. But "while it may be theoretically forbidden, it is unofficially tolerated", says the report's authors, who found that city authorities in Faisalabad in Pakistan auction untreated sewage to farmers during droughts.

Some countries, including Israel, Mexico and Tunisia, treat sewage before delivering it to farmers, which removes bacteria and lumps, at least. But this is rare. In the Ghanaian capital Accra, 200,000 people buy vegetables grown on urban fields irrigated with tanker loads of wastewater that is untreated because the city's sewage treatment works long since ceased to function.

Toxic build-up

"I am worried about the toxins, especially heavy metals, accumulating in foods like root crops," says Chartres. "But often there is simply no other water. In many ways it is a great use of the waste and the nutrients it contains." He says the best answer is not to ban the practice, but to improve it.

"Even without expensive infrastructure, common sense measures can make wastewater irrigation safer." Storing the wastewater in ponds allows solids to settle out, including the eggs of intestinal worms. And farmers should wash vegetables in clean water before selling them to markets.

The bottom line is that increasing numbers of people will starve, and many more will lose their livelihoods, without the benefits of recycled sewage.