

As easy as 1, 2, 3: Number sense correlates with test scores

Knowing how precisely a high school freshman can estimate the number of objects in a group gives you a good idea how well he has done in math as far back as kindergarten, researchers at The Johns Hopkins University found.

Good "number sense" at age 14 correlates with higher scores on standardized math tests throughout a child's life up to that point and weaker "number sense" at 14 predicts lower scores on those standardized tests, said Justin Halberda, assistant professor of psychological and brain sciences in the university's Krieger School of Arts and Sciences.

"We discovered that a child's ability to quickly estimate how many things are in a group significantly correlates with that child's performance in school math for every single year, reaching all the way back to when he or she was in kindergarten," Halberda said.

Halberda teamed up on the research with colleagues Michèle Mazzocco, associate professor of psychiatry and behavioral sciences in the Johns Hopkins School of Medicine and researcher at the Kennedy Krieger Institute, and Lisa Feigenson, also a Johns Hopkins assistant professor of psychological and brain sciences. The results of their investigation are scheduled for advance online publication by the journal *Nature* at <http://www.nature.com> on Sept. 7.

Though people often think of mathematics as a pinnacle intellectual achievement of humankind, research reveals that some intuition about numbers, counting and mathematical ability is basic to almost all animals. For example, creatures that gather or hunt for food keep track of the approximate number of food items they procure in order to return to the places where they get the most sustenance. Humans share this very basic "number sense," allowing them, at a glance, to estimate the number of people in a subway car or bus, Halberda says.

The Johns Hopkins team wondered whether this basic, seemingly innate number sense had any bearing on the formal mathematics that people learn in school. So the researchers asked 64 14-year-olds to look at flashing groups of yellow and blue dots on a computer screen and estimate which dots were more numerous. Though most of the children easily arrived at the correct answer when there were (for example) only 10 blue dots and 25 yellow ones, some had difficulty when the number of dots in each set was more nearly equal. Those results helped the researchers ascertain the accuracy of each child's individual "number sense."

They then examined the teenagers' record of performance in school math all the way back through kindergarten, and found that students who exhibited more acute number sense had performed at a higher level in mathematics than those who showed weaker number sense, even controlling for general intelligence and other factors.

"What this seems to mean is that the very basic number sense that we humans share with animals is related to the formal mathematics that we learn in school," Halberda concludes. "The number sense we share with the animals and the formal math we learn in school may interact and inform each other throughout our lives."

Though the team found this strong correlation between number sense and scholastic math achievement, Halberda cautions against concluding that success or failure in mathematics is genetically determined and, therefore, immutable.

"There are many factors that might affect a person's performance in school mathematics," Halberda says, "What is exciting in our result is that success in formal mathematics and simple math intuitions appear to be related."

Future directions for research include investigating the trainability of one's number sense and seeing whether early help in number sense could affect later formal math learning.

Funding for this research was provided by the National Institutes of Health.

Related Web sites: Video demonstration of study task:

<http://www.psy.jhu.edu/~labforchilddevelopment/movies/HalberdaEtAl2008,NatureTaskVideoH264,360.mov>

Rattlesnake-type poisons used by superbug bacteria to beat our defenses

Colonies of hospital superbugs can make poisons similar to those found in rattlesnake venom to attack our bodies' natural defences, scientists heard today (Monday 8 September 2008) at the Society for General Microbiology's Autumn meeting being held this week at Trinity College, Dublin.

The toxins are manufactured by communities of the hospital superbug *Pseudomonas aeruginosa* called biofilms, which are up to a thousand times more resistant to antibiotics than free-floating single bacterial cells.

"This is the first time that anyone has successfully proved that the way the bacteria grow – either as a biofilm, or living as individuals – affects the type of proteins they can secrete, and therefore how dangerous they can potentially be to our health," says Dr Martin Welch from the University of Cambridge, UK.

"Acute diseases caused by bacteria can advance at an astonishing rate and tests have associated these types of disease with free-floating bacteria. Such free-floating bugs often secrete tissue-damaging poisons and

enzymes to break down our cells, contributing to the way the disease develops, so it is natural to blame them. By contrast, chronic or long-term infections seem to be associated with biofilms, which were thought to be much less aggressive," says Dr Welch.

The research team's findings are very important to the NHS, which spends millions of pounds every year fighting chronic long-term bacterial infections which are incredibly difficult to treat.

"For example, these chronic infections by bacteria are now the major cause of death and serious disability in cystic fibrosis patients – which is the most common lethal inherited disease in the UK and affects about 8,000 people," says Dr Welch.

In cystic fibrosis the gene defect means that people are very susceptible to a particular group of opportunistic bacteria including *Pseudomonas aeruginosa*, which is one of the three major hospital superbugs. Aggressive antibiotic treatment can usually control the infection in cystic fibrosis sufferers but eventually the strain becomes completely resistant to antibiotics, leading to respiratory failure and death, often while still in their thirties.

"We think that the bacteria in a cystic fibrosis sufferer's lungs are partly living in communities called biofilms, and although medical scientists have investigated their strongly antibiotic-resistant properties, very little research has been done to investigate any active contribution the biofilms might have in causing diseases in the first place," says Dr Welch.

A widely-held view is that biofilms serve as reservoirs of bacteria that do relatively little harm; they just sit there. The main danger is thought to be from 'blooms' of free living cells which occasionally break away from the biofilm and cause periods of poor lung function in the cystic fibrosis patients. "In this scenario, it follows that bacteria in a biofilm will produce fewer disease-causing chemicals than free-living cells of the same type of bacteria, which is a prediction that we can test," says Dr Welch. "We found that, in contrast to expectation, biofilms do indeed produce harmful chemicals. However, the type of tissue-degrading enzymes and toxins made by the biofilm bacteria differ from those produced by free-floating bugs, which may help them to survive attacks by our immune systems."

In addition, the scientists discovered that the biofilm bacteria can produce a protein which their analysis suggests is similar to one of the active ingredients in rattlesnake venom. In the case of rattlesnake venom the protein causes the host cells to commit suicide and die, which is one reason why rattlesnake bites are so dangerous. The research team is currently studying the protein to see if it functions in the same way.

In addition the scientists have found evidence that the trigger for the bacteria to start producing these extra virulence factors is turned on very shortly after the biofilm begins to form. Once the scientists have fully identified the virulence factors created by the biofilm bacteria, the proteins and enzymes may be targeted to develop drugs for a variety of uses, including the treatment of hospital superbugs, cancer and cystic fibrosis.

Anti-inflammatory drugs may mask prostate cancer marker

Regular use of nonsteroidal anti-inflammatory drugs (NSAIDs), such as aspirin and ibuprofen, may reduce serum levels of the prostate biomarker, PSA (prostate specific antigen), and hence may alter the detection of prostate cancer in individuals who take these medications. That is the conclusion of a new study in the October 15, 2008 issue of *CANCER*, a peer reviewed journal of the American Cancer Society.

Chronic inflammation has been linked to many different types of malignancies, including prostate cancer. Researchers suspect that inflammation associated with prostate cancer may occur through a variety of mechanisms such as infection, hormonal changes, physical trauma, urine reflux, and dietary habits. Studies have shown that cyclooxygenase (COX) enzymes, which are inhibited by NSAIDs, play an important role in inflammation. In addition, several reviews have indicated that NSAID use is associated with a lower incidence of prostate cancer.

However, there is little data on the precise relationship between NSAID use and levels of PSA, a commonly measured marker used in prostate cancer screening. For their study, led by Dr. Singer of the University of Rochester Medical Center, researchers compared blood PSA levels and NSAID and acetaminophen consumption in a large group of men in the United States.

The investigators determined PSA levels in 1,319 men over the age of 40 years who participated in the 2001-2002 National Health and Nutrition Examination Survey (NHANES), a massive health census conducted by the Centers for Disease Control and Prevention. Individuals who used NSAIDs regularly had PSA levels that were approximately 10 percent lower compared to men who did not take these drugs.

The investigators say their study suggests that regular NSAID consumption may reduce serum PSA levels. What impact this may have on the development of prostate cancer, irrespective of PSA, is unclear.

"Given the widespread consumption of NSAIDs and the regular use of PSA for the assessment of prostate cancer risk, the potential implications of our findings may be substantial and warrant further investigation," the authors wrote.

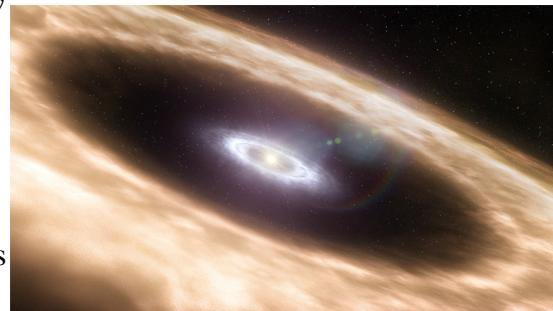
Article: "PSA levels in relation to NSAID and acetaminophen consumption: Results from the 2001-2002 National Health and Nutrition Examination Surveys." Eric A. Singer, Ganesh S. Palapattu, and Edwin van Wijngaarden. *CANCER*; Published Online: September 08, 2008 (DOI: 10.1002/cncr.23806); Print Issue Date: October 15, 2008.

MIND THE GAP

VLT instrument hints at the presence of planets in young gas discs

Astronomers have been able to study planet-forming discs around young Sun-like stars in unsurpassed detail, clearly revealing the motion and distribution of the gas in the inner parts of the disc. This result, which possibly implies the presence of giant planets, was made possible by the combination of a very clever method enabled by ESO's Very Large Telescope.

Planets could be home to other forms of life, so the study of exoplanets ranks very high in contemporary astronomy. More than 300 planets are already known to orbit stars other than the Sun, and these new worlds show an amazing diversity in their characteristics. But astronomers don't just look at systems where planets have already formed - they can also get great insights by studying the discs around young stars where planets may currently be forming. "This is like going 4.6 billion years back in time to watch how the planets of our own Solar System formed," says Klaus Pontoppidan from Caltech, who led the research.



Planet-forming disc
(Artist's impression)

ESO Press Photo 27a/08 (8 September 2008)

The image is copyright © ESO. It is released in connection with an ESO press release and may be used by the press on the condition that the source is clearly indicated in the caption.



Planet-forming Disc ESO PR Photo 27a/08

Pontoppidan and colleagues have analysed three young analogues of our Sun that are each surrounded by a disc of gas and dust from which planets could form. These three discs are just a few million years old and were known to have gaps or holes in them, indicating regions where the dust has been cleared and the possible presence of young planets.

The new results not only confirm that gas is present in the gaps in the dust, but also enable astronomers to measure how the gas is distributed in the disc and how the disc is oriented. In regions where the dust appears to have been cleared out, molecular gas is still highly abundant. This can either mean that the dust has clumped together to form planetary embryos, or that a planet has already formed and is in the process of clearing the gas in the disc.

For one of the stars, SR 21, a likely explanation is the presence of a massive giant planet orbiting at less than 3.5 times the distance between the Earth and the Sun, while for the second star, HD 135344B, a possible planet could be orbiting at 10 to 20 times the Earth-Sun distance. The observations of the third star, TW Hydrae, may also require the presence of one or two planets.

"Our observations with the CRIFRES instrument on ESO's Very Large Telescope clearly reveal that the discs around these three young, Sun-like stars are all very different and will most likely result in very different planetary systems," concludes Pontoppidan. "Nature certainly does not like to repeat herself" [1].

"These kinds of observations complement the future work of the ALMA observatory, which will be imaging these discs in great detail and on a larger scale," adds Ewine van Dishoeck, from Leiden Observatory, who works with Pontoppidan.

To study the gaps in dust discs that are the size of the Solar System around stars that are located up to 400 light-years away is a daunting challenge that requires a clever solution and the best possible instruments [2].

"Traditional imaging cannot hope to see details on the scale of planetary distances for objects located so far away," explains van Dishoeck. "Interferometry can do better but won't allow us to follow the motion of the gas."

Astronomers used a technique known as 'spectro-astrometric imaging' to give them a window into the inner regions of the discs where Earth-like planets may be forming. They were able not only to measure distances as small as one-tenth the Earth-Sun distance, but to measure the velocity of the gas at the same time [3].

"The particular configuration of the instrument and the use of adaptive optics allows astronomers to carry out observations with this technique in a very user-friendly way: as a consequence, spectro-astrometric imaging with CRIFRES can now be routinely performed," says team member Alain Smette, from ESO [4].

Notes for editors

Pontoppidan, K. M. et. al. 2008, Spectro-Astrometric Imaging of Molecular Gas Within Protoplanetary Disk Gaps, Astrophysical Journal, 684, 1323, 10 September 2008. Team members are Klaus M. Pontoppidan, Geoffrey A. Blake, and Michael J. Ireland (California Institute of Technology, Pasadena, USA), Ewine F. van Dishoeck (Leiden Observatory, The

Netherlands, and Max-Planck-Institute for Extraterrestrial Physics, Garching, Germany - MPE), Alain Smette (ESO, Chile), and Joanna Brown (MPE).

[1] The discs are about an hundred astronomical units (AU - the mean distance between the Earth and the Sun, or 149.6 million kilometres) across, but the stars are more than 200 light-years away (one light-year is 200 000 AU). To resolve structures on 1 AU scales in these systems corresponds to reading the license plate on a car at a distance of 2000 km - roughly the distance from Stockholm to Lisbon.

[2] CRIRES, the near-infrared spectrograph attached to ESO's Very Large Telescope, is fed from the telescope through an adaptive optics module which corrects for the blurring effect of the atmosphere and so makes it possible to have a very narrow slit with a high spectral dispersion: the slit width is 0.2 arcsecond and the spectral resolution is 100 000. Using spectro-astrometry, an ultimate spatial resolution of better than 1 milli-arcsecond is achieved.

[3] The core of the spectro-astrometry imaging technique relies on the ability of CRIRES to be positioned very precisely on the sky, while retaining the ability to spread the light into a spectrum so that wavelength differences of 1 part in 100 000 can be detected. More precisely, the astronomers measure the centroid in the spatial direction of a spectrally resolved emission line: effectively, astronomers take a sharp emission line - a clear fingerprint of a molecule in the gas - and use data from several slit positions to locate the sources of particular emission lines, and hence to map the distribution of the gas with much greater precision than can be achieved by straightforward imaging. The astronomers have obtained spectra of the discs centred at wavelengths of 4.715 microns at 6 different position angles.

[4] Alain Smette is the CRIRES Instrument Scientist.

Fathers need their children

'Every father, even the worst delinquent, must see his child once in a while'

Single fathers should never be prevented from seeing their children. Even in the toughest family conflicts, interaction should always continue between father and child according to sociologist Germain Dulac, a researcher at the Université de Montréal's Interdisciplinary Research Centre on Violence Against Women and Families.

"Every father, even the worst delinquent, must see his child once in a while. It's beneficial for both parties," says Dulac, who has studied the male condition for 20 years and analyzed the impact of broken relationships.

In cases of violence or incest, visits must obviously be highly supervised by social workers and other specialists. Yet preventing contact between father and child would be a mistake, Dulac insists. "Support groups have often proven that fathers turn out better if they stay in touch with their child."

What about the welfare of the child? "Sometimes, for the child, confronting their aggressor is necessary and beneficial," says Dulac.

In Quebec, it is estimated that a third of single fathers never see their children; a third see them sporadically and only a third have regular contact. How are those broken relationships dealt with? Dulac and his colleagues conducted in-depth interviews with 30 fathers of children younger than two, thanks to the collaboration of the Separated Fathers organization (www.separated-fathers.qc.ca). The majority of these men, for whom separation was extremely difficult, were quite bitter with the justice system and specifically with the mediation services.

The effects of separation?

Fifty percent of marriages don't last in Quebec. Since 1997, the Government of Quebec has offered mediation services to separating couples so they can resolve their differences in a forum outside the expensive legal system. The mediator addresses issues such as custody, allocation of assets and setting up food allowances.

An article published in the December 2007 issue of *Intervention*, the official publication of the Ordre professionnel des travailleurs sociaux du Québec, Dulac and his collaborators, Sylvain Camus, Gilles Rondeau and Éric Couteau, acknowledge that most separations occur without any major problems, however, certain fathers leave with a very heavy heart.

"Daddy loves you!" That slogan has had tremendous resonance in the media in recent years as it was seen on banners and posters in several public places. The intent was to denounce the difficulties of certain fathers who feel the system favors mothers in the event of a separation.

Did these public demonstrations serve the cause of the fathers? Yes and no," says Dulac. "I believe the public was sympathetic to these extravagant demonstrations even if they deemed them appalling at first. And elected officials are very sensitive to public opinion."

Infidelity dissected: New research on why people cheat

Probability of cheating during the course of a relationship varies between 40 and 76 percent

The probability of someone cheating during the course of a relationship varies between 40 and 76 percent. "It's very high," says Geneviève Beaulieu-Pelletier, PhD student at the Université de Montréal's Department of Psychology.

"These numbers indicate that even if we get married with the best of intentions things don't always turn out the way we plan. What interests me about infidelity is why people are willing to conduct themselves in ways that could be very damaging to them and to their relationship."

The student wanted to know if the type of commitment a person has with his or her loved ones is correlated to the desire of having extra-marital affairs. "The emotional attachment we have with others is modeled on the type of parenting received during childhood," she says.

According to psychologists, people with avoidant attachment styles are individuals uncomfortable with intimacy and are therefore more likely to multiply sexual encounters and cheat. But this has never been proved scientifically, which is what Beaulieu-Pelletier attempted to do in a series of four studies.

The first study was conducted on 145 students with an average age of 23. Some 68 percent had thought about cheating and 41 percent had actually cheated. Sexual satisfaction aside, the results indicated a strong correlation between infidelity and people with an avoidant attachment style.

The second study was conducted on 270 adults with an average age of 27. About 54 percent had thought about cheating and 39 percent had actually cheated. But the correlation is the same: people with an avoidant attachment style are more likely to cheat.

"Infidelity could be a regulatory emotional strategy used by people with an avoidant attachment style. The act of cheating helps them avoid commitment phobia, distances them from their partner, and helps them keep their space and freedom."

Both these studies were followed up by two other studies that asked about the motives for infidelity. The will to distance themselves from commitment and their partner was the number one reason cited.

Her studies revealed no differences between men and women. Just as many men and women had an avoidant attachment style and the correlation with infidelity is just as strong on both sides. "Contrary to popular belief, infidelity isn't more prevalent in men," she says.

Valley networks on Mars formed during long period of episodic flooding

SANTA CRUZ, CA--A new study suggests that ancient features on the surface of Mars called valley networks were carved by recurrent floods during a long period when the martian climate may have been much like that of some arid or semiarid regions on Earth. An alternative theory that the valleys were carved by catastrophic flooding over a relatively short time is not supported by the new results.

Often cited as evidence that Mars once had a warm environment with liquid water on the surface, valley networks are distinctive features of the martian landscape. In the new study, researchers used sophisticated computer models to simulate the processes that formed these features.

"Our results argue for liquid water being stable at the surface of Mars for prolonged periods in the past," said Charles Barnhart, a graduate student in Earth and planetary sciences at the University of California, Santa Cruz.

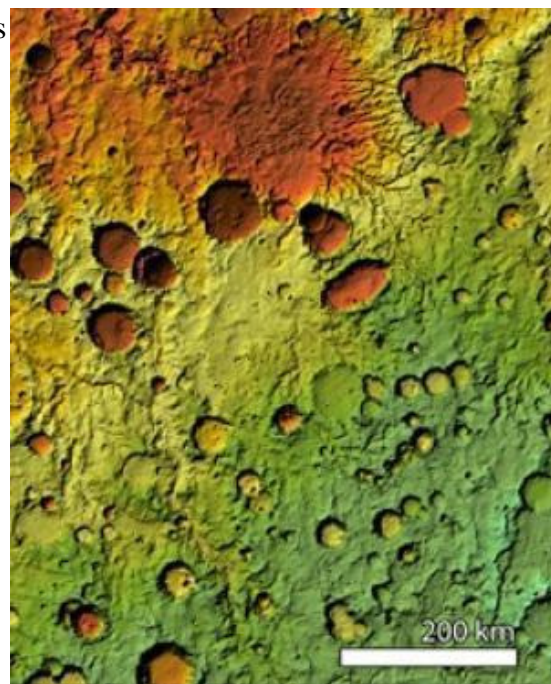
Barnhart conducted the study as a Graduate Student Research Program scholar at NASA Ames Research Center, working with NASA planetary scientist Jeffrey Moore and Alan Howard of the University of Virginia. A paper describing their findings has been accepted for publication in the *Journal of Geophysical Research--Planets* and is currently available online.

Ancient river-like features called valley networks carve the surface of Mars, as seen in the image above of the Parana Valles, which cuts across a region roughly the size of California. (Credit: Image courtesy of University of California - Santa Cruz)

"For several decades, scientists worked to determine whether or not there had ever been precipitation on Mars. Only in the last 10 years has NASA acquired high-resolution topographic data that cinched the case for massive ancient erosion from precipitation and runoff," Moore said.

Scientists estimate that the valley networks on Mars were carved out more than 3.5 billion years ago. Studies based on climate models have suggested that catastrophic events such as asteroid impacts could have created warm, wet conditions on Mars, causing massive deluges and flooding for periods of hundreds to thousands of years.

But the new study shows that those conditions would result in features not seen in the martian landscape, because water would accumulate inside craters and overflow, carving exit breaches that cut through the crater walls, Barnhart said.



"Our research finds that these catastrophic anomalies would be so humid and wet there would be breaching of the craters, which we don't see on Mars," he said. "The precipitation needs to be seasonal or periodic, so that there are periods of evaporation and infiltration. Otherwise the craters overflow."

The researchers used a landform evolution model to simulate how the surface of Mars would evolve under different climate conditions. They ran more than 70 simulations under varied conditions and performed statistical analyses to determine which yielded the best match to the observed topography of martian valleys.

The results suggest that valley networks formed on Mars during a semiarid to arid climate that persisted for tens of thousands to hundreds of thousands of years. Episodic flooding alternated with long dry periods when water could evaporate or soak into the ground. Rainfall may have been seasonal, or wet intervals may have occurred over longer cycles. But conditions that allowed for the presence of liquid water on the surface of Mars must have lasted for at least 10,000 years, Barnhart said.

"Precipitation on Mars lasted a long time--it wasn't a brief interval of massive deluges," he said.

Carbon molecule with a charge could be tomorrow's semiconductor

Blacksburg, Va. – Virginia Tech chemistry Professor Harry Dorn has developed a new area of fullerene chemistry that may be the backbone for development of molecular semiconductors and quantum computing applications.

Dorn plays with the hollow carbon molecules known as fullerenes as if they are tinker toys. First, in 1999, he figured out how to put atoms inside the 80-atom molecule, then how to do it reliably, how to change the number of atoms forming the carbon cage, and how to change the number and kinds of atoms inside the cage, resulting in a new, more sensitive MRI material and a vehicle to deliver radioactive atoms for applications in nuclear medicine.

As part of the research to place gadolinium atoms inside the carbon cage for MRI applications, Dorn created an 80-atom carbon molecule with two yttrium ions inside. Then he began to fool with the materials of the cage itself. He replaced one of the 80 atoms of carbon with an atom of nitrogen (providing Y2@C79N). This change leaves the nitrogen atom with an extra electron. Dorn discovered that the extra electron, instead of being on the nitrogen atom on the fullerene cage surface, ducks inside between the yttrium ions, forming a one-electron bond. "Basically, a very unusual one electron bond between two yttrium atoms," he said.

Discovery of this new class of stable molecules (M2@C79N) was supported by computational studies by Daniel Crawford, associate professor of chemistry at Virginia Tech, and the structure was confirmed by x-ray crystallographic studies by Alan Balch , professor of chemistry at the University of California, Davis.

This research is reported in the September 6, 2008, online issue of the Journal of the American Chemical Society (JACS), in an article by Dorn and his colleagues at Virginia Tech and UC Davis.* The article does not speculate about potential applications, but Dorn does.

"No one has done anything like this," said Dorn. "Since the article was published, we now know that we can take the electron back out of the fullerene cage."

He said the discovery could be important to the new fields of spintronics, molecular electronics, and micro to nanoscale electronics, as well as the new field of quantum computing.

"The single electron bonded-diatomic yttrium has unique spin properties that can be altered. Increasing the polarization of this spin, could be important for improving the sensitivity of MRI and NMR, he said.

But more interesting are the electronic applications. "If we replace one of the carbon atoms with boron instead of nitrogen, we would be an electron short, instead of having an extra electron. Now you have the components of a semiconductor," Dorn said.

"I don't down whether it is important yet or not," he said. "People have been working on adding a nitrogen atom to standard 60-carbon fullerene."

**The JACS article is "M2@C79N (M) Y, Tb): Isolation and Characterization of Stable Endohedral Metallofullerenes Exhibiting M-M Bonding Interactions inside Aza[80]fullerene Cages," by Tianming Zuo, Liaosa Xu, Christine M. Beavers, Marilyn M. Olmstead, Wujun Fu, Crawford, Balch, and Dorn. Zuo recently received his Ph.D. in chemistry from Virginia Tech and is now a postdoctoral associate at Clemson University. Xu and Fu are graduate students in chemistry at Virginia Tech. Beavers is a graduate student and Olmstead is a faculty member with the chemistry department at UC Davis. Corresponding authors are Balch and Dorn (albalch@ucdavis.edu; hdorn@vt.edu). See: <http://pubs.acs.org/journals/jacsat/index.html>*

Did we out-breed slow-maturing Neanderthals?

* 22:00 08 September 2008

* NewScientist.com news service

* **Debora MacKenzie**

Neanderthal women had just as much trouble in childbirth as modern women – and their kids took just as long to grow up. Christoph Zollikofer and colleagues at the University of Zürich, Switzerland, have done the first three-dimensional reconstructions of the skulls of a newborn Neanderthal from Russia, and two toddlers from Syria. They found that the newborn's cranium was the same diameter as a modern human's.

Neanderthal mothers had slightly larger birth canals, but the prominent face of Neanderthal babies made it just as hard to push out as a modern human.

This suggests that both groups had the social structures needed to help with childbirth. It also means, says Zollikofer, that a big brain at birth must have evolved in some still-undiscovered common ancestor of modern humans and Neanderthals.

Moreover, conflicting estimates of Neanderthal growth rates based on teeth had led to disagreements about whether they grew up faster than us, amid theories that a prolonged childhood allowed us to develop greater intelligence.

Better brains?

The new skull reconstructions show that Neanderthal babies grew 5 to 10% faster than modern humans. But since Neanderthals also had bigger bodies, they took about the same time to reach adulthood that we do, says Zollikofer.

"The big question is, what happened to humans 50,000 years ago," he says. Early modern humans and Neanderthals now appear to have had similarly big brains at birth, that grew at similar rates. But the brains of today's babies are smaller than both of them. "Are they more efficiently organised? Or did we trade a bit of intelligence for smaller, cheaper brains that meant we could reproduce faster," he says.

If so, Zollikofer speculates, we may have succeeded the Neanderthals not because we were smarter, but because we bred faster – more like rabbits.



Reconstruction of the birth process in Neanderthals shows that newborns had large brains like modern human newborns, probably causing the same problems during birth (Image: M. Ponce de León and C. Zollikofer, University of Zurich)

Journal reference: Proceedings of the National Academy of Sciences (DOI: 10.1073/pnas.0803917105)

US hospitals 'flunk' colon cancer

CHICAGO -- School has barely begun, but many U.S. hospitals have already received their report card in colon cancer. They flunked.

A new study from Northwestern University's Feinberg School of Medicine and the American College of Surgeons finds the majority of hospitals don't check enough lymph nodes after a patient's colon cancer surgery to determine if the disease has spread.

Checking more lymph nodes is linked to improved survival of colon cancer because it allows doctors to accurately diagnose the stage of disease and prescribe the most effective treatment.

Over the past decade, a number of oncology organizations have recommended a minimum of 12 lymph nodes be examined to determine whether colon cancer has metastasized and to accurately diagnose the stage of cancer. That critical information affects whether a patient receives chemotherapy, which is highly effective in improving survival after colon cancer has spread.

Yet, more than 60 percent of nearly 1,300 institutions in the U.S. failed to comply with the recommendation to examine 12 nodes, the Northwestern study found. The study will be published in the Sept. 9 online issue of the Journal of the National Cancer Institute.

"It's disappointing that despite so much emphasis on this particular issue, so many hospitals still aren't checking enough lymph nodes to ensure they diagnose the accurate stage of cancer," said Karl Bilimoria, M.D., lead author and a surgery resident at the Feinberg School. "Knowing the accurate stage of your disease affects your survival and treatment. That's critical."

Colon cancer is the second leading cause of cancer death in the United States.

"Every surgeon has a story about a colon cancer patient where the pathology report showed only a few lymph nodes and no cancer was found," said Bilimoria, who also is a research fellow at the American College of Surgeons. "Then the surgeon asks the pathologist to check six or eight more nodes, and one of those turns out to be positive for cancer. That completely changes the treatment plan."

In the study, Bilimoria found National Cancer Institute-designated Comprehensive Cancer centers had higher compliance with the 12- node measure than other academic hospitals, Veterans Administration hospitals and community hospitals (78 percent versus 52.4 percent, 53 percent, 33.7 percent respectively in 2004-2005.)

Hospitals have improved over the past decade, but not enough. In 1996-1997, 15 percent of hospitals were checking at least 12 nodes compared to 38 percent in 2004-2005. The hospitals that did not comply treat about 65 percent of colon cancer diagnosed in the U.S.

Patients can protect themselves by asking the surgeon ahead of time if she thinks this issue is important, and if she routinely has 12 or more nodes checked after surgery, Bilimoria advised. Then the patient can read the

post-operative pathology report and see how many lymph nodes were actually examined. If the number is lower than 12, the patient should ask his surgeon about it, Bilimoria said. More lymph nodes can be checked in the tissue that has been previously removed with the cancerous colon.

Bilimoria said hospitals need better education and cooperative efforts between pathologists and surgeons. He also recommended hospitals have a cancer committee that follows compliance with these types of quality measures.

"When there is poor adherence, they should act on it and identify why they are not meeting that standard," he said.

Essay

The Pitfalls of Linking Doctors' Pay to Performance

By SANDEEP JAUHAR, M.D

Not long ago, a colleague asked me for help in treating a patient with congestive heart failure who had just been transferred from another hospital.

When I looked over the medical chart, I noticed that the patient, in his early 60s, was receiving an intravenous antibiotic every day. No one seemed to know why. Apparently it had been started in the emergency room at the other hospital because doctors there thought he might have pneumonia.

But he did not appear to have pneumonia or any other infection. He had no fever. His white blood cell count was normal, and he wasn't coughing up sputum. His chest X-ray did show a vague marking, but that was probably just fluid in the lungs from heart failure.



Eric Larsen

I ordered the antibiotic stopped — but not in time to prevent the patient from developing a severe diarrheal infection called *C. difficile* colitis, often caused by antibiotics. He became dehydrated. His temperature spiked to alarming levels. His white blood cell count almost tripled. In the end, with different antibiotics, the infection was brought under control, but not before the patient had spent almost two weeks in the hospital.

The case illustrates a problem all too common in hospitals today: patients receiving antibiotics without solid evidence of an infection. And part of the blame lies with a program meant to improve patient care.

The program is called pay for performance, P4P for short. Employers and insurers, including Medicare, have started about 100 such initiatives across the country. The general intent is to reward doctors for providing better care.

For example, doctors receive bonuses if they prescribe ACE inhibitor drugs to patients with congestive heart failure. Hospitals get bonuses if they administer antibiotics to pneumonia patients in a timely manner.

On the surface, this seems like a good idea: reward doctors and hospitals for quality, not just quantity. But even as it gains momentum, the initiative may be having untoward consequences.

To get an inkling of the potential problems, one simply has to look at another quality-improvement program: surgical report cards. In the early 1990s, report cards were issued on surgeons performing coronary bypasses. The idea was to improve the quality of cardiac surgery by pointing out deficiencies in hospitals and surgeons; those who did not measure up would be forced to improve.

But studies showed a very different result. A 2003 report by researchers at Northwestern and Stanford demonstrated there was a significant amount of “cherry-picking” of patients in states with mandatory report cards. In a survey in New York State, 63 percent of cardiac surgeons acknowledged that because of report cards, they were accepting only relatively healthy patients for heart bypass surgery. Fifty-nine percent of cardiologists said it had become harder to find a surgeon to operate on their most severely ill patients.

Whenever you try to legislate professional behavior, there are bound to be unintended consequences. With surgical report cards, surgeons' numbers improved not only because of better performance but also because dying patients were not getting the operations they needed. Pay for performance is likely to have similar repercussions.

Consider the requirement from Medicare that antibiotics be administered to a pneumonia patient within six hours of arriving at the hospital. The trouble is that doctors often cannot diagnose pneumonia that quickly. You have to talk to and examine a patient and wait for blood tests, chest X-rays and so on.

Under P4P, there is pressure to treat even when the diagnosis isn't firm, as was the case with my patient with heart failure. So more and more antibiotics are being used in emergency rooms today, despite all-too-evident dangers like antibiotic-resistant bacteria and antibiotic-associated infections.

I recently spoke with Dr. Charles Stimler, a senior health care quality consultant, about this problem. “We’re in a difficult situation,” he said. “We’re introducing these things without thinking, without looking at the consequences. Doctors who wrote care guidelines never expected them to become performance measures.”

And the guidelines could have a chilling effect. “What about hospitals that stray from the guidelines in an effort to do even better?” Dr. Stimler asked. “Should they be punished for trying to innovate? Will they have to take a hit financially until performance measures catch up with current research?”

The incentives for physicians raise problems too. Doctors are now being encouraged to voluntarily report to Medicare on 16 quality indicators, including prescribing aspirin and beta blocker drugs to patients who have suffered heart attacks and strict cholesterol and blood pressure control for diabetics. Those who perform well receive cash bonuses.

But what to do about complex patients with multiple medical problems? Forty-eight percent of Medicare beneficiaries over 65 have at least three chronic conditions. Twenty-one percent have five or more. P4P quality measures are focused on acute illness. It isn’t at all clear that they should be applied to elderly patients with multiple disorders who may have trouble keeping track of their medications.

With P4P doling out bonuses, many doctors have expressed concern that they will feel pressured to prescribe “mandated” drugs, even to elderly patients who may not benefit, and to cherry-pick patients who can comply with pay-for-performance measures.

And which doctor should be held responsible for meeting the quality guidelines? On average, Medicare patients see two primary-care physicians in any given year, and five specialists working in four practices. Care is widely dispersed, so it is difficult to assign responsibility to one doctor. If a doctor assumes responsibility for only a minority of her patients, then there is little financial incentive to participate in P4P. If she assumes too much responsibility, she may be unfairly blamed for any lapses in quality.

Nor is it clear that pay for performance will actually result in better care, because it may end up benefiting mainly those physicians who already meet the guidelines. If they can collect bonuses by maintaining the status quo, what is the incentive to improve?

Doctors have seldom been rewarded for excellence, at least not in any tangible way. In medical school, there were tests, board exams and lab practicals, but once you go into clinical practice, these traditional measures fall away. At first glance, pay for performance would seem to remedy this problem. But first its deep flaws must be addressed before patient care is compromised in unexpected ways.

Sandeep Jauhar, a cardiologist on Long Island, is the author of the memoir “Intern: A Doctor’s Initiation.”

Study in JAMA study links primary care shortage with salary disparities

Athens, Ga. – The nation's shortage of primary care physicians has been linked to a host of poor health outcomes, and a new study published in the Journal of the American Medical Association suggests that salary disparities play a major role in the shortage.

Dr. Mark Ebell, a professor and assistant to the provost at the University of Georgia, compared 2007 starting salary data for various physician specialties with the percentage of medical school graduates choosing those specialties. He found a strong, direct correlation between salary and the popularity of a specialty.

"Countries with the healthiest primary care systems tend to have the best health outcomes," Ebell said. "We rank behind many countries in the quality and efficiency of health care, and I think a lot of that is because we have neglected primary care."

Among his findings:

Family medicine had the lowest average salary (\$185,740) and the lowest percentage of filled residency positions among U.S. graduates (42 percent). Radiologists and orthopedic surgeons, who had an average salary of more than \$400,000, had the highest percentage of filled residency positions among U.S. graduates (88.7 percent and 93.8 percent, respectively).

The link between average salary and the popularity of a specialty is not surprising, particularly to Ebell. He conducted a similar study nearly 20 years ago and found the same relationship. Since then, however, the salary disparities have grown and the shortage of primary care physicians—which includes those who specialize in family medicine, pediatrics or general internal medicine—has become more pronounced. In the past decade alone, for example, the number of U.S. medical school graduates entering family practice residencies has dropped by 50 percent. Studies have linked a lower percentage of primary care physicians with higher infant mortality rates, higher overall death rates and more deaths from heart disease and cancer.

Ebell said he conducted the study to draw renewed attention to the role of salary disparities in the primary care shortage and to encourage policymakers to enact meaningful reforms to increase the percentage of primary care physicians.

"The problem of salary disparities is not something that anyone is going to solve locally," Ebell said. "This is something that will require reform at a national level."

He said one possible reform is expanded debt relief for students who choose primary care practices and in particular those who choose to practice in underserved areas. He notes that the average debt for a medical school graduate has quadrupled—from \$35,000 to \$140,000—in the nearly 20 years since his original study. When students graduate with the equivalent of a mortgage in debt, he said, they can't help but be drawn to high-paying specialties rather than primary care.

Changes to insurance reimbursements, which currently hurt primary care by rewarding the delivery of diagnostic tests and medical treatments over time spent communicating with patients, are also needed to reduce salary disparities, he said, and have the potential to improve quality of care by reducing unnecessary or duplicative interventions.

Ebell said the broad knowledge base of primary care can be intimidating to students, so creating information technology systems to manage information will be important. Exposing students to primary care physician role models is another way to sustain interest in primary care throughout a student's training.

"A career in primary care can be very rewarding," Ebell said, "and mentors can show students the satisfaction that comes from building relationships over time with patients."

Any River Will Do for One Spawning Fish

By HENRY FOUNTAIN

The sea lamprey can't go home again, and researchers think they know why.

Sea lampreys are anadromous, meaning they live in the open ocean for years and then migrate up a river to reproduce. Other anadromous fish, including many salmon species, return to their birth river for spawning. But a growing body of work suggests that sea lampreys don't have this homing ability.

The latest evidence comes from John Waldman, a biologist at Queens College, and colleagues and is published in *Biology Letters*. They performed genetic analysis of sea lamprey samples from rivers up and down the East Coast.

A close-up of the sucker mouth and sharp teeth of a sea lamprey. Jose Manuel Ribeiro/Reuters



If the lampreys were returning to their birth rivers, then over time the various populations would develop slight genetic differences because they would never mix. Such is the case with Atlantic salmon and other anadromous species. "But what we see with sea lamprey over and over again is that these things have no genetic differences," Dr. Waldman said. "So we infer that there is no homing going on."

The fish are parasitic — they latch on to other fish and feed off their blood for a week or two at a time. "Over time the population from one river will be dragged all over the ocean," Dr. Waldman said. So perhaps it's not surprising that they can't make it back to their birth river.

Dr. Waldman theorizes that rather than homing, the fish rely on chemical cues. Other research has shown that lamprey larvae release pheromones into the river water, so adult lampreys may detect these chemicals as a sign that the river is suitable for spawning.

Vital Signs

Aging: Lack of B12 Linked to Brain Shrinkage

By NICHOLAS BAKALAR

Failure to properly absorb vitamin B12, found in meat, milk and eggs, has been implicated in various neurological disorders. Now a British study suggests that low levels of the vitamin in older people may cause the brain to shrink.

The study, published Tuesday in *Neurology*, included 107 men and women, average age 73, who had no mental impairments. Researchers used M.R.I. scans to measure brain volume and blood tests to record vitamin B12 levels. They divided the subjects into three groups, based on their level of the vitamin, and followed them for five years with annual scans and physical and mental examinations.

The group with the lowest levels of vitamin B12 lost twice as much brain volume as those with the highest levels. The difference was significant even after controlling for initial brain size, age, sex, education, cognitive test scores and various measures of blood chemistry.

David Smith, an emeritus professor of pharmacology at Oxford and the lead author of the study, said the work established an association, but not a causal connection.

"This doesn't mean you should go out and buy vitamin B12 tablets tomorrow," he said. "We need to know the results of a clinical trial in which we're testing whether B12 does actually prevent brain shrinkage."

A Look at Nonsmokers Who Get Lung Cancer

By DENISE GRADY

An unsettling fact about lung cancer is that not even clean living can guarantee a free pass. A significant proportion of cases — 10 to 15 percent — occur in people who never smoked, and just in the United States, 16,000 to 24,000 a year die.

What causes the disease in nonsmokers is not known, though researchers suspect genetic susceptibility combined with exposure to cancer-causing substances like asbestos, radon, certain solvents and other people's tobacco smoke.

A huge new study conducted in Europe, North America and Asia, based on 2.4 million nonsmokers who had lung cancer, provides new information about just who is at risk.

Male nonsmokers are more likely than female nonsmokers to die of the disease, the study found, and the overall risk to nonsmokers is not increasing.

“Concerns have been raised that the risk was higher in women and that the risk was increasing, but this study counters those two misperceptions,” said Dr. Michael J. Thun, the lead author of the study and the head of epidemiologic research for the American Cancer Society. The study is being published online in PLoS Medicine.

Dr. Thun emphasized that although nonsmokers do have some risk, smokers are much worse off: a man who never smoked has a 1.1 in 100 risk of dying from lung cancer, but it jumps to 1 in 5 if he smokes. In women, the risk goes from 0.8 in 100 to 1 in 8. The figures vary, depending on how much a person smokes.

Today, about 59 percent of people in the United States say they never smoked, up from 44 percent in 1960. The study found that among those who never smoked, Asians living in Asia (not those in the United States) and African-Americans had higher rates of illness and death from lung cancer than did people of European descent.

A puzzling and troubling finding is relatively high rates of lung cancer among nonsmoking women in parts of Pacific Rim countries.

“A plausible hypothesis is that the cooking fumes given off by woks contain all kinds of carcinogens,” Dr. Thun said, adding that the most likely culprit was cooking oil, which vaporizes at high temperatures. But he said the problem needed more research.

New drug hope for cystic fibrosis patients

BA Festival of Science event

A new drug therapy may represent a tremendous step forward in the treatment of some 70,000 cystic fibrosis (CF) patients worldwide, Dr David Sheppard from the University of Bristol told an audience at the BA Festival of Science in Liverpool today [9 September].

Speaking at the conference, Dr Sheppard said:

“The early results with VX-770 suggest that drug therapies which target defects at the root of the disease have the potential to improve greatly the quality of life of CF patients.”

At the moment there is no cure for CF – a common single-gene disorder in the UK. The disease, which affects about 8,000 people in the UK and 70,000 people worldwide, is due to a defective gene that causes ducts and tubes in the body to become blocked by thick, sticky mucus. This mucus affects the lungs, pancreas, the intestines, the liver and the reproductive organs.

One of the most recognisable symptoms of CF is ‘salty sweat’, caused by the failure of the sweat ducts to reabsorb salt. Existing treatments only alleviate symptoms, for example, physiotherapy to clear the air passages, antibiotics for lung infections and enzymes to aid the digestion of food.

The defective gene disables or destroys a protein known as CFTR. To date around 1,500 genetic defects have been found in this protein. In general, genetic defects cause harm in two ways – some stop the protein from travelling to its correct destination in cells, whereas others prevent the protein from working properly.

Dr Sheppard's research group, supported by the Cystic Fibrosis Trust, investigates how new drugs restore function to defective CFTR proteins and EuroCareCF, of which Dr Sheppard is the coordinator, works to promote CF therapy development in Europe.

The new drug therapy (VX-770) was developed by Vertex Pharmaceuticals and will tackle the ‘functional’ defect. It has been tested on CF patients in the US who carry a genetic defect known as G551D. European trials are expected in the future. Early results are very encouraging. Patients who received 150mg twice a day saw the concentration of salt in their sweat decrease by almost 50 per cent and lung function improve by 10 per cent.

The Cystic Fibrosis Foundation funded the discovery and early development work of VX-770 in collaboration with Vertex Pharmaceuticals. To date the Foundation has invested \$79 million in the project. Results of the trials can be found here. Dr Sheppard's research group and other academic groups and companies are also working to develop new drugs that tackle defects at the root of CF.

Current life expectancy for CF patients is between 30 and 40 years of age in Western Europe and the US but is considerably lower in other parts of the world. One in 25 people in the UK is a carrier of a defective CF gene, making CF one of the most common life-shortening, childhood-onset, inherited diseases.

Please contact Dara O'Hare for further information.

Really?

The Claim: Aloe Vera Gel Can Heal Burns

By ANAHAD O'CONNOR

THE FACTS Aloe vera has been a common skin-care remedy since the Greek physician Dioscorides advocated using it for burns in the first century A.D.

But only in recent years have scientists conducted research to determine whether it lives up to its reputation. Some have found that aloe contains certain anti-inflammatory compounds and may act as an antibacterial agent. But studies on its effects on minor and moderate burns have been mixed.

In 2007, for example, a study in the journal *Burns* analyzed data from four controlled clinical trials involving a total of 371 patients, some were treated with topical aloe vera and others with placebo. Patients in the aloe vera group appeared to have slightly shorter healing times, but the evidence was not convincing, and the authors recommended further research.



Leif Parsons

In another study, scientists applied aloe vera to second-degree burns and compared it with other treatments. They found that it “hindered the healing process” when compared with a common antibacterial cream. Then in 2008, still another study looked at aloe vera applied to burns for six weeks and found that it decreased “subdermal temperature within the skin,” but did not reduce bacterial counts or speed the regeneration of skin.

THE BOTTOM LINE Inconclusive. Studies of aloe vera’s effect on burns have produced conflicting findings.

Landmark study reports breakdown in biotech patent system

Authors call for overhaul of intellectual property laws worldwide

OTTAWA – (9 September) The world's intellectual property system is broken. It's stopping lifesaving technologies from reaching the people who need them most in developed and developing countries, according to the authors of a report released in Ottawa today by an international coalition of experts.

"We found the same stumbling blocks in the traditional communities of Brazil as we did in the boardroom of a corporation that holds the patent to a gene that can determine the chance a woman will develop breast cancer," said Richard Gold, professor of intellectual property at McGill University and chair of the International Expert Group that produced the report. "Most striking is that no matter where we looked, the lack of trust played a vital role in blocking negotiations that could have benefited both sides, as well as the larger public."

The report is the result of seven years of work by Gold and his colleagues, experts in law, ethics and economics. Gold said that the authors based their report on revelations that came out of discussions with policy-makers, industry representatives, scientists and academics from around the world, as well as the outcomes of a series of case studies involving Brazil, Canada, Kenya, the United States, the European Union, Japan, Australia, and India. The authors portray a crucially important but increasingly dysfunctional industry that relies on a business model based on outdated conceptions of IP. In their report, the authors describe conclusions and recommendations based on data collected over the last seven years; the data itself will be released at an October 14 event in Washington, DC.

"The old IP approach of the biotechnology community has failed to deliver on its potential to address disease and hunger in both developing and industrialised nations. We need to do better, and the IT world has shown us part of the solution," Gold says. "Look at the way that change has swept through the IT world and brought benefits to millions."

While biotech's potential seems unlimited, so do its problems. The report finds that a fixation on patents and privately-controlled research has frequently given rise to controversy and roadblocks to innovation. Recent examples include: the \$612 million patent suit that almost shut down the world's Blackberries; Myriad Genetics' inability to introduce its breast cancer screening test in Canada and Europe; a pharmaceutical industry with an increasingly bare medicine cabinet; an ongoing failure to deliver life-saving medications to developing countries.

"For better or for worse, biotechnology is at the heart of current debates about health care, the environment, food and development," Gold said. "It offers the promise of producing plants to resist drought and nourish the world's poor, and to offer new medicines and energy sources. Biotech is at the heart of not only today's economy but its security and well-being as well."

The current crisis in biotechnology has given rise not only to economic problems but to endemic mistrust among its actors that is stifling innovation and preventing cutting-edge technologies from helping those who can most benefit. The report and case studies provide the following as illustrations:

* Findings from a study of stem cell researchers suggesting that those who patent the most, collaborate the least, based on a study of measures of success.

* The reasons for the breakdown of negotiations between a US company, which had patented human genes for breast and ovarian cancer, and Canadian health authorities. A case study reveals that talks with Canada were in crisis after Myriad delivered threatening letters to the Ontario Minister of Health from US Senator Orin Hatch and from the US Ambassador to Canada, Paul Cellucci.

* Evidence based on a Brazilian case study that ensuring property rights to indigenous practices and knowledge has served as a significant barrier to research in Brazil and has not furthered the interests of the country's traditional communities.

* Revelations from participants in discussions of Canada's legislation to allow emerging markets to produce drugs for poor countries—known as the Access to Medicines Regime. They said privately that they knew the regime would not work by the end of the negotiations, yet they publicly applauded it.

While exposing a number of systemic failures associated with biotech and IP regimes, the Expert Group reports that the best innovative activity occurs when everyone – researchers, companies, government and NGOs – works together to ensure that new ideas reach the public, but are appropriately regulated and efficiently delivered to those who need them.

At an event on Tuesday in Ottawa, organized to present the report to Canadian policymakers, the findings of the Brazilian case study were presented by Maristela Basso of the Brazilian Institute of International Trade Law & Development (IDCID).

"NGOs in Brazil help communities sue researchers and companies that use indigenous knowledge without consent, but no one is present to help communities change the legislation or enter into agreements with those same companies in advance, so that everyone can benefit," said Basso, an associate professor of international law at the University of Sao Paul School of Law. "This leaves behind a culture of mistrust. The NGOs and local community leaders often distrust industry and are therefore reluctant to negotiate. On the other hand, researchers and industry feel so overburdened by a maze of unworkable rules and procedures that they trust neither the government nor the local communities."

Basso noted that the authors of the new report make a number of concrete recommendations that would address the problems she and her colleagues had documented in their case study. Pointing to governments, the private sector and universities as crucial players, the authors call for better management of scientific knowledge and new ways to measure whether technology transfers are working. (See key recommendations below)

Chad Gaffield, president of the Social Sciences and Humanities Research Council of Canada (SSHRC), which funded the research activities that led to the report, noted the work of the same group in helping international organizations that are struggling with ways to improve access to biotech breakthroughs for poor countries. Most recently for UNITAID, an international governmental group, Gold and his colleagues have created the design for a patent pool to unblock patents so that needed fixed dose combination and pediatric antiretroviral medicines reach those suffering from HIV/AIDS.

"The end of our old way of doing business does not mean we don't need a system for protecting intellectual knowledge," Gold said. "We need an IP system that will support collaborations among researchers and partners in industry and academia worldwide so that knowledge gets to those who need it most. This means the laws may have to be changed, but more importantly, it means that we have a lot of work to do to change behaviors and build trust among all the players. How people behave – in other words, their practices – and the effect of practices on innovation is critical. Public and private institutions – patent offices, courts, universities, governments, corporations and industry groups – that manage, award, review and hold intellectual property also play an essential role in shaping the IP system."

RECOMMENDATIONS

The report released today, *Toward a New Era of Intellectual Property: From Confrontation to Negotiation*, documents a series of failed attempts to expand access to both traditional knowledge and the products of modern biotechnology. The authors, members of the International Expert Group on Biotechnology, Innovation and IP make a number of concrete recommendations to address their findings. Pointing to governments, the private sector and universities as crucial players, they call for better management of scientific knowledge and new ways to measure whether technology transfers are working. The following are among their key recommendations, by the group, which is organized under the aegis of McGill University and the non-profit

The Innovation Partnership:

Governments should:

- * Seek other ways to encourage innovation—not just through IP, but through health and environmental regulations, the judicial system and tax rules, for instance.[]
- * Work with industry to help create respected and trusted entities whose members that can be counted on to mediate disputes fairly and encourage indigenous and local communities in policy development
- * Develop Public-Private Partnerships to conduct early stage research including through the sharing of health related data to allow the sharing of risk across industry.

Patent offices should:

- * Collect standardized patent-related information, including license data as they are doing in Japan
- * Assist developing countries and NGOs in finding out which patents exist in order to enable licensing

Industry should:

- * Establish an independent, non-profit technology assessment organization to evaluate new biotechnology products from developing countries
- * Participate actively in the creation of Public-Private Partnerships and other collaborative mechanisms
- * Be transparent about patent holdings
- * Develop new business models that promote partnerships and collaborations

Universities should:

- * Develop clear principles relating to the use and dissemination of intellectual property and promote greater access and broad licensing
- * Develop measures of the success of transfer of technology based on social returns rather than on the number of patents hold
- * Enter into collaborations between developed and developing countries to ensure that developing country doctoral and post-doctoral students have opportunities to study and work at home.

About TIP

TIP is an independent non-profit consultancy with experts in developed and developing countries specializing in the understanding, use and management of intellectual property. TIP's mission is to foster innovation and creativity through the better use of intellectual property and its alternatives. <http://www.theinnovationpartnership.org/en/>

'Water bears' are first animal to survive space vacuum

* 17:50 08 September 2008

* NewScientist.com news service

* **Rachel Courtland**

Tiny invertebrates called 'water bears' can survive in the vacuum of space, a European Space Agency experiment has shown. They are the first animals known to be able to survive the harsh combination of low pressure and intense radiation found in space.

Water bears, also known as tardigrades, are known for their virtual indestructibility on Earth. The creatures can survive intense pressures, huge doses of radiation, and years of being dried out.

To further test their hardiness, Ingemar Jönsson of Sweden's Kristianstad University and colleagues launched two species of dried-up tardigrades from Kazakhstan in September 2007 aboard ESA's FOTON-M3 mission, which carried a variety of experimental payloads.

After 10 days of exposure to space, the satellite returned to Earth. The tardigrades were retrieved and rehydrated to test how they reacted to the airless conditions in space, as well as ultraviolet radiation from the Sun and charged particles from space called cosmic rays.

The vacuum itself seemed to have little effect on the creatures. But ultraviolet radiation, which can damage cellular material and DNA, did take its toll.

Water bears, similar to the one pictured here, were sent to low-Earth orbit in an ESA satellite (Courtesy: Ralph Schill)

Dried out

In one of the two species tested, 68% of specimens that were shielded from higher-energy radiation from the Sun were revived within 30 minutes of being rehydrated. Many of these tardigrades went on to lay eggs that successfully hatched.

But only a handful of animals survived full exposure to the Sun's UV light, which is more than 1000 times stronger in space than on the Earth's surface.



Before this experiment, only lichen and bacteria were known to be able to survive exposure to the combination of vacuum and space radiation.

"No animal has survived open space before," says developmental biologist Bob Goldstein of the University of North Carolina at Chapel Hill, who was not affiliated with the study. "The finding that animals survived rehydration after 10 days in open space – and then produced viable embryos as well – is really remarkable."

This ability to survive in extreme conditions "might be important when we consider the habitability of other bodies in our solar system or beyond," says astrobiologist Gerda Horneck of the German Aerospace Center. But the results say little about how the animals might develop and reproduce in harsh environments, Horneck says.

The authors aren't sure what causes the animals to be as resistant as they are to the effects of ultraviolet radiation. They speculate their hardiness might stem from the same adaptations that enable tardigrades to bounce back from being dried out. *Journal reference: Current Biology (vol 18, p R1)*

Urology Field Slowly Altered, by Women

By BARRON H. LERNER, M.D

The urology rotation during my third year of medical school might best be described as a boys' club, often characterized by infighting, one-upmanship and sexual humor. It was a little off-putting to many students, but always entertaining.

So imagine my surprise when a female medical student recently told me that she loved her urology rotation, in which she found the doctors to be especially humanistic and caring. A big part of the reason, she believed, was the growing presence of women among her teachers. It turns out that the field of urology is undergoing a gender transformation.

Urologists, who are specialists in the organs that produce urine, have always cared for women. After all, as Dr. Jennifer Gruenfelder, a urologist in Laguna Hills, Calif., reminded me in an e-mail message, "Women have kidneys and bladders and urethras and ureters, too."

Yet even as more and more women entered medicine in the late-20th century, urology continued to overwhelmingly attract male applicants. Not until 1962 did a woman — Dr. Elisabeth Pickett — become a board-certified urologist. By the mid-1980s, the United States had only 22 female urologists.

There were several explanations. For one thing, the stereotypical urology patient has always been a man, suffering from an enlarged prostate, prostate cancer or erectile dysfunction. The demanding hours of surgical fields like urology probably discouraged many female medical school graduates from applying, and the lack of female mentors and role models did the same.

Finally, when women did express interest, they were often met with little enthusiasm. In a 1997 survey of female urologists conducted by Dr. Christine L. Bradbury and colleagues at the University of Utah School of Medicine, 44 percent of respondents reported having been discouraged from entering urology because of their sex. Dr. Gruenfelder said that a female dean at her medical school had told her that applying for a specialty in urology was "a bad idea."

At the same time, some urologists eagerly supported the entrance of women into their formerly male bastion. Dr. Harriette M. Scarpero of Vanderbilt University, the president of the Society of Women in Urology, said her urology mentors were superb doctors and excellent teachers. "My choice of urology," she told me, "had as much to do with the influence of those special teachers as it did with my love of surgery."

And once the pioneers arrived, more women followed. The Society of Women in Urology has more than 300 members, and Dr. Scarpero estimates that 20 percent of urologists in training are now women. A female urologist who calls herself Dr. Keagirl has even created a Web site, [UroStream](http://urostream.blogspot.com) (<http://urostream.blogspot.com>), that discusses the "ever humorous field of urology."

But old barriers and stereotypes do not simply disappear. Dr. Kristin Kozakowski, now a pediatric urology fellow at the University of Toronto, was one of three women who made up the entire recent graduating class of urology residents at Columbia University Medical Center. Though she generally praised the professionalism of her senior male colleagues, she said she still felt awkward around them. "It is as if they still want to engage in bathroom humor but cannot do so around women," she said.

And she reports resistance from another group of males: certain patients who either thought she was a nurse or asked to see a male urologist. Dr. Gruenfelder recalls being called "babe," "sweetheart" and "honey" during her training.

Both doctors acknowledge that special issues of modesty exist when they examine male patients. It is difficult for many men to undress in the presence of a woman and then submit to an examination of their private parts.

But just as there have been male gynecologists for decades, there are now female urologists. As Dr. Kozakowski politely tells reluctant patients, "I'm the doctor who is here."

Barron H. Lerner teaches medicine and public health at Columbia University Medical Center.

Penn researchers identify natural tumor suppressor

Better understanding of early-stage cancer crucial to finding new therapies

PHILADELPHIA - Researchers from the University of Pennsylvania School of Medicine have identified a key step in the formation – and suppression – of esophageal cancers and perhaps carcinomas of the breast, head, and neck. By studying human tissue samples, they found that Fbx4, a naturally occurring enzyme, plays a key role in stopping production of another protein called Cyclin D1, which is thought to contribute to the early stages of cancer development.

When mutations block production of Fbx4, Cyclin D1 is not broken down, and subsequently contributes to cancer's advance. Fbx4 acts like a bouncer, stopping trouble before it starts by breaking down Cyclin D1 before it can affect the body.

"Cyclin D1 was identified nearly 20 years ago and after that, it became apparent that it was overexpressed in a high percentage of tumors," says J. Alan Diehl, PhD, Associate Professor of Cancer Biology at the University of Pennsylvania's Abramson Family Cancer Research Institute. "But its expression didn't correlate to mutations within Cyclin D1, so we were looking for a protein that regulates accumulation. That's Fbx4."

For this study, researchers screened 116 esophageal tumors and found 16 mutations. Their findings were published in a recent issue of *Cancer Cell*.

The actual mutations researchers found are located within a highly conserved region of Fbx4 that functions like an on switch. Mutations within that switch region inhibit activation of Fbx4, which means it can't trigger destruction of Cyclin D1.

The results are important in that they show how Cyclin D1 becomes so prevalent in tumors. Before, it was thought that Cyclin D1 was present because of a mutation somewhere in the DNA of a cell. Instead, this study shows that Cyclin D1 naturally occurs, but our bodies have created a natural defense mechanism that breaks it down before cancer develops.

"When Fbx4 is inactivated, it permits the accumulation of its target, CyclinD1," says Diehl.

While it remains important to define the cause of the initial mutations, this study provides researchers with a better understanding of the early stages of cancer which is crucial to finding a way to reverse the process.

Co-authors are Hiroshi Nakagawa and Anil K. Rustgi from the Penn Department of Genetics; Olena Barbash, Petia Zamfirova and Douglas I. Lin of the Abramson Family Cancer Research Institute; and Xiangmei Chen, Ke Yang and Fengmin Lu of Peking University Health Center. The National Institute of Health and the Leukemia & Lymphoma Society provided funding for this research. This release can be viewed at www.pennhealth.com/news.

Findings

As Barriers Disappear, Some Gender Gaps Widen

By JOHN TIERNEY

Correction Appended

When men and women take personality tests, some of the old Mars-Venus stereotypes keep reappearing. On average, women are more cooperative, nurturing, cautious and emotionally responsive. Men tend to be more competitive, assertive, reckless and emotionally flat. Clear differences appear in early childhood and never disappear.



Viktor Koen

What's not clear is the origin of these differences. Evolutionary psychologists contend that these are innate traits inherited from ancient hunters and gatherers. Another school of psychologists asserts that both sexes' personalities have been shaped by traditional social roles, and that personality differences will shrink as women spend less time nurturing children and more time in jobs outside the home.

To test these hypotheses, a series of research teams have repeatedly analyzed personality tests taken by men and women in more than 60 countries around the world. For evolutionary psychologists, the bad news is that the size of the gender gap in personality varies among cultures. For social-role psychologists, the bad news is that the variation is going in the wrong direction. It looks as if personality differences between men and women are smaller in traditional cultures like India's or Zimbabwe's than in the Netherlands or the United States. A husband and a stay-at-home wife in a patriarchal Botswanan clan seem to be more alike than a working couple in Denmark or France. The more Venus and Mars have equal rights and similar jobs, the more their personalities seem to diverge.

These findings are so counterintuitive that some researchers have argued they must be because of cross-cultural problems with the personality tests. But after crunching new data from 40,000 men and women on six continents, David P. Schmitt and his colleagues conclude that the trends are real. Dr. Schmitt, a psychologist at Bradley University in Illinois and the director of the International Sexuality Description Project, suggests that

as wealthy modern societies level external barriers between women and men, some ancient internal differences are being revived.

The biggest changes recorded by the researchers involve the personalities of men, not women. Men in traditional agricultural societies and poorer countries seem more cautious and anxious, less assertive and less competitive than men in the most progressive and rich countries of Europe and North America.

To explain these differences, Dr. Schmitt and his collaborators from Austria and Estonia point to the hardships of life in poorer countries. They note that in some other species, environmental stress tends to disproportionately affect the larger sex and mute costly secondary sexual characteristics (like male birds' displays of plumage). And, they say, there are examples of stress muting biological sex differences in humans. For instance, the average disparity in height between men and women isn't as pronounced in poor countries as it is in rich countries, because boys' growth is disproportionately stunted by stresses like malnutrition and disease.

Personality is more complicated than height, of course, and Dr. Schmitt suggests it's affected by not just the physical but also the social stresses in traditional agricultural societies. These villagers have had to adapt their personalities to rules, hierarchies and gender roles more constraining than those in modern Western countries — or in clans of hunter-gatherers.

“Humanity's jaunt into monotheism, agriculturally based economies and the monopolization of power and resources by a few men was ‘unnatural’ in many ways,” Dr. Schmitt says, alluding to evidence that hunter-gatherers were relatively egalitarian. “In some ways modern progressive cultures are returning us psychologically to our hunter-gatherer roots,” he argues. “That means high sociopolitical gender equality over all, but with men and women expressing predisposed interests in different domains. Removing the stresses of traditional agricultural societies could allow men's, and to a lesser extent women's, more ‘natural’ personality traits to emerge.”

Some critics of this hypothesis question whether the international variations in personality have more to do with the way people in different cultures interpret questions on personality tests. (For more on this debate, go to www.nytimes.com/tierneylab.) The critics would like to see more direct measures of personality traits, and so would Dr. Schmitt. But he notes that there's already an intriguing trend reported for one trait — competitiveness — based on direct measures of male and female runners.

Competitive running makes a good case study because, to mix athletic metaphors, it has offered a level playing field to women the past two decades in the United States. Similar numbers of males and females run on high school and college teams and in road races. Female runners have been competing for equal shares of prize money and receiving nearly 50 percent more scholarship aid from Division I colleges than their male counterparts, according to the N.C.A.A.

But these social changes have not shrunk a gender gap among runners analyzed by Robert Deaner, a psychologist at Grand Valley State University in Michigan, who classifies runners as relatively fast if they keep close to the pace of the world's best runners of their own sex. When Dr. Deaner looks at, say, the top 40 finishers of each sex in a race, he typically finds two to four times as many relatively fast male runners as relatively fast female runners.

This large gender gap has persisted for two decades in all kinds of races — high school and college meets, elite and nonelite road races — and it jibes with other studies reporting that male runners train harder and are more motivated by competition, Dr. Deaner says. This enduring “sex difference in competitiveness,” he concludes, “must be considered a genuine failure for the sociocultural conditions hypothesis” that the personality gap will shrink as new roles open for women.

If he and Dr. Schmitt are right, then men and women shouldn't expect to understand each other much better anytime soon. Things could get confusing if the personality gap widens further as the sexes become equal. But then, maybe it was that allure of the mysterious other that kept Mars and Venus together so long on the savanna.

This article has been revised to reflect the following correction:

Correction: September 10, 2008

The Findings column on Tuesday, about gender gaps, misidentified the educational affiliation of Robert Deaner, a psychologist who analyzed competitive runners. He is at Grand Valley State University, in Michigan — not Colgate University, where he received his bachelor's degree.

Calcium during pregnancy reduces harmful blood lead levels

ANN ARBOR, Mich.—Pregnant women who take high levels of daily calcium supplements show a marked reduction in lead levels in their blood, suggesting calcium could play a critical role in reducing fetal and infant exposure.

A new study at the University of Michigan shows that women who take 1,200 milligrams of calcium daily have up to a 31 percent reduction in lead levels.

Women who used lead-glazed ceramics and those with high bone lead levels showed the largest reductions; the average reduction was about 11 percent, said Howard Hu, chair of the Department of Environmental Health Sciences at the School of Public Health.

Hu is the principal investigator of the study and one of the senior authors on the paper, which is available online in *Environmental Health Perspectives*, the official journal of the U.S. National Institute for Environmental Health Sciences. Hu, who is also affiliated with the University of Michigan School of Medicine, said this is the first known randomized study examining calcium supplementation on lead levels in pregnant women.

"We and others have previously shown that during pregnancy, mothers can transfer lead from their bones to their unborn -- with significant adverse consequences--making maternal bone lead stores a threat even if current environmental lead exposures are low," Hu said. "This study demonstrates that dietary calcium supplementation during pregnancy may constitute a low-cost and low-risk approach for reducing this threat."

Lead exposure is a great concern for pregnant and lactating women, especially in developing countries where lead exposures have been high until recently, and for women with occupational exposure. Developing fetuses and nursing babies are exposed to lead from either current exposures to mothers or from the mobilization of maternal skeletal lead stores accumulated from prior years of exposure. Bone lead can stay in the body for decades, so even with minimal environmental exposure, the fetus or nursing infant can still be at great risk from maternal stores of lead.

Lead exposure during fetal development and infancy can cause low birth weight or slow weight gain after birth, cognitive defects such as lower intelligence scores, lower motor and visual skills, or even miscarriage. Damage from lead exposure and poisoning is usually permanent.

"The bottom line is that obstetricians and pediatricians should consider adding calcium supplementation to the prenatal vitamins normally recommended in pregnant women, particularly if their patients have a significant history of environmental or occupational lead exposure," Hu said.

The study showed that reductions in blood lead levels were more evident in the second trimester at 14 percent than in the third trimester at 8 percent. The most compliant group of women in the study (those who consumed greater than 75 percent of the assigned 1,200 milligram doses of calcium per day) showed a 24 percent decrease. Women in the most compliant group who also reported using lead glazed ceramics and had the highest bone lead levels saw the greatest reduction of 31 percent.

Researchers analyzed 557 women recruited from the Mexican Social Security Institute prenatal clinics, which treat the low to moderate income population of Mexico City. All were in their first trimester; roughly half were assigned calcium and half a placebo.

This recent study corresponds with a previous study performed by the same group of investigators showing that 1,200-milligram daily calcium supplementation during lactation reduced maternal blood lead by 15-20 percent, and breast milk lead by 5-10 percent. This is the first randomized trial to evaluate the effect of supplementation during pregnancy, when lead is more easily transferred to the fetus, Hu said.

Co-authors and affiliations include: Adrienne S. Ettinger, Harvard School of Public Health and U-M SPH; Héctor Lamadrid-Figueroa, Martha M. Téllez-Rojo, and Adriana Mercado-García, Mexican National Institute of Public Health; Karen E. Peterson, Harvard SPH and U-M SPH; Joel Schwartz, Harvard SPH; Mauricio Hernández-Avila, Mexican National Institute of Public Health and Mexican Ministry of Health

The study is available at: <http://www.ehponline.org/docs/2008/11868/abstract.html>

For more on Hu, visit: <http://www.ns.umich.edu/htdocs/public/experts/ExpDisplay.php?ExpID=1188>

<http://www.sph.umich.edu/isr/faculty/profile.cfm?uniquename=howardhu>

Searching in space and minds: IU research suggests underlying link

BLOOMINGTON, Ind. -- New research from Indiana University has found evidence that how we look for things, such as our car keys or umbrella, could be related to how we search for more abstract needs, such as words in memory or solutions to problems.

"Common underlying search mechanisms may exist that drive our behavior in many different domains," said IU cognitive scientist Peter Todd. "If how people search in space is similar to how they search in their minds, it's a very exciting prospect to try to find the deep, underlying roots of human behavior that may be common to varied domains."

Lead author Thomas Hills worked with Todd and fellow IU cognitive scientist Robert Goldstone in designing experiments to explore the search processes their study participants used in both spatial and abstract settings. The studies revolved around two search modes -- exploitation, where seekers stay with a place or task until they have gotten appreciable benefit from it, and exploration, where seekers move quickly from one place or one task to another, looking for a new set of resources to exploit. They then examined whether an initial search, in this case for resources in space, primed the mode used in the subsequent, more abstract search.

"We asked the question -- are the same mechanisms that let simpler organisms search in space for food related to how we search for things in our mind, for concepts or ideas," Todd said. "Our conclusion is that they seem to be linked at some level, which is what our priming experiment suggests."

Some people might be more inclined to one search mode or the other, having a lesser ability to focus on a given task or difficulty letting go of an idea. An extreme form of the exploratory cognitive style would be someone with attention deficit hyperactivity disorder. An extreme form of the exploitive cognitive style would be someone with obsessive compulsive disorder.

These new findings, published in the latest issue of "Psychological Science," have possible implications related to other recent work on brain chemistry and cognitive disorders. Exploratory foraging -- actual or abstract -- appears to be linked to decreases in the brain chemical dopamine. Many problems related to attention -- including ADHD, drug addiction, some forms of autism and schizophrenia -- have been linked to such a dopamine deficit. The authors suggest that computer foraging, such as that used for their experiments, could reveal individual differences in underlying cognitive search style, and could even be used to manipulate that style. If that were possible, it could perhaps lead to therapies for such cognitive disorders.

Modern tools -- a computerized search game and board game -- used to examine ancient cognitive search processes

The scientists had a group of volunteers use icons to "forage" in a computerized world, moving around until they stumbled upon a hidden supply of resources (akin to food or water), then deciding if and when to move on, and in which direction. The scientists tracked their movements.

The volunteers explored two very different worlds. Some foraged in a "clumpy" world, which had fewer but richer supplies of resources. Others explored a "diffuse" environment, which had many more, but much smaller, supplies. The idea was to "prime" the optimal foraging strategy for each world. Those in a diffuse world would in theory do better giving up on any one spot quickly and moving on, and navigating to avoid any retracing. Those in a clumpy world would do better to stay put in one area for an extended period, exploiting the rich lodes of resources before returning to the exploratory mode.

The volunteers then participated in a more abstract, intellectual search task -- a computerized game akin to Scrabble. They received a set of letters and had to search their memory for as many words as they could make with those letters. As with the board game, they could also choose to trade in all their letters for a new set whenever they wanted to.

The researchers found that the human brain appears capable of using exploration or exploitation search modes depending on the demands of the task, but it also has a tendency through "priming" to continue searching in the same way even if in a different domain, such as when switching from a spatial to an abstract task.

They also found that individuals were consistent in their cognitive style -- the most persevering foragers for resources in space were also the most persevering Scrabble players. Everybody should be able to switch back and forth, Todd said, but the people who have a tendency to use one mode more in one task have a similar tendency to use that mode more in other tasks.

The study was supported by the National Institutes of Health, U.S. Department of Education, National Science Foundation and Indiana University.

For a copy of the study, contact Catherine West at cwest@psychologicalscience.org or visit

<http://www.psychologicalscience.org/media/>.

Friendly Invaders

By CARL ZIMMER

New Zealand is home to 2,065 native plants found nowhere else on Earth. They range from magnificent towering kauri trees to tiny flowers that form tightly packed mounds called vegetable sheep.

When Europeans began arriving in New Zealand, they brought with them alien plants — crops, garden plants and stowaway weeds. Today, 22,000 non-native plants grow in New Zealand. Most of them can survive only with the loving care of gardeners and farmers. But 2,069 have become naturalized: they have spread out across the islands on their own. There are more naturalized invasive plant species in New Zealand than native species.

It sounds like the makings of an ecological disaster: an epidemic of invasive species that wipes out the delicate native species in its path. But in a paper published in August in *The Proceedings of the National Academy of Sciences*, Dov Sax, an ecologist at Brown University, and Steven D. Gaines, a marine biologist at the University of California, Santa Barbara, point out that the invasion has not led to a mass extinction of native plants. The number of documented extinctions of native New Zealand plant species is a grand total of three.

Exotic species receive lots of attention and create lots of worry. Some scientists consider biological invasions among the top two or three forces driving species into extinction. But Dr. Sax, Dr. Gaines and several other researchers argue that attitudes about exotic species are too simplistic. While some invasions are indeed devastating, they often do not set off extinctions. They can even spur the evolution of new diversity.

“I hate the ‘exotics are evil’ bit, because it’s so unscientific,” Dr. Sax said.

Dr. Sax and his colleagues are at odds with many other experts on invasive species. Their critics argue that the speed with which species are being moved around the planet, combined with other kinds of stress on the environment, is having a major impact.

There is little doubt that some invasive species have driven native species extinct. But Dr. Sax argues that they are far more likely to be predators than competitors.



John Kleber

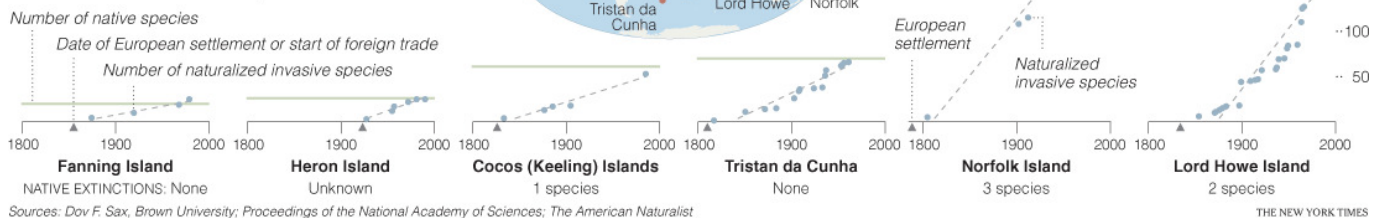
In their new paper, Dr. Sax and Dr. Gaines analyze all of the documented extinctions of vertebrates that have been linked to invasive species. Four-fifths of those extinctions were because of introduced predators like foxes, cats and rats. The Nile perch was introduced into Lake Victoria in 1954 for food. It then began wiping out native fish by eating them.

“If you can eat something, you can eat it everywhere it lives,” Dr. Sax said.

But Dr. Sax and Dr. Gaines argue that competition from exotic species shows little sign of causing

Tracking the Spread of Exotic Species

A historical analysis of six islands measured the pace at which invasive plants had become naturalized over time, beginning with European settlement. The total diversity of the islands has doubled and may continue to rise.



extinctions. This finding is at odds with traditional concepts of ecology, Dr. Sax said. Ecosystems have often been seen as having a certain number of niches that species can occupy. Once an ecosystem’s niches are full, new species can take them over only if old species become extinct.

But as real ecosystems take on exotic species, they do not show any sign of being saturated, Dr. Sax said. In their paper, Dr. Sax and Dr. Gaines analyze the rise of exotic species on six islands and island chains. Invasive plants have become naturalized at a steady pace over the last two centuries, with no sign of slowing down. In fact, the total diversity of these islands has doubled.

Fish also show this pattern, said James Brown of the University of New Mexico. He said that whenever he visits a river where exotic fish have been introduced, “I ask, ‘Have you seen any extinctions of the natives?’ ” “The first response you get is, ‘Not yet,’ as if the extinction of the natives is an inevitable consequence. There’s this article of faith that the net effect is negative.”

Dr. Brown does not think that faith is warranted. In Hawaii, for example, 40 new species of freshwater fish have become established, and the 5 native species are still present. Dr. Brown and his colleagues acknowledge that invasive species can push native species out of much of their original habitat. But they argue that native species are not becoming extinct, because they compete better than the invasive species in certain refuges.

These scientists also point out that exotics can actually spur the evolution of new diversity. A North American plant called saltmarsh cordgrass was introduced into England in the 19th century, where it interbred with the native small cordgrass. Their hybrid offspring could not reproduce with either original species, producing a new species called common cordgrass.

Long before humans moved plants around, many plants hybridized into new species by this process. “Something like a third of the plant species you see around you formed that way,” Dr. Sax said.

Biological invasions also set off bursts of natural selection. House sparrows, for example, have moved to North America from Europe and have spread across the whole continent. “Natural selection will start to change them,” Dr. Sax said. “If you give that process enough time, they will become new species.”

“The natives themselves are also likely to adapt,” Dr. Sax added. Some of the fastest rates of evolution ever documented have taken place in native species adapting to exotics. Some populations of soapberry bugs in Florida, for example, have shifted from feeding on a native plant, the balloon vine, to the goldenrain tree, introduced from Asia by landscapers in the 1950s. In five decades, the smaller goldenrain seeds have driven the evolution of smaller mouthparts in the bugs, along with a host of other changes.

In Australia, the introduction of cane toads in the 1930s has also spurred evolution in native animals. “Now that you have cane toads in Australia, there’s a strong advantage for snakes that can eat them,” said Mark Vellend, of the University of British Columbia. Cane toads are protected by powerful toxins in their skin that can kill predators that try to eat them. But in parts of the country where the toads now live, black snakes are resistant to the toxins in their skin. In the parts where the toad has yet to reach, the snakes are still vulnerable.

Dr. Brown argues that huge negative effects of invasions are not documented in the fossil record, either. “You see over and over and over again that this is never the case,” he said. Species have invaded new habitats when passageways between oceans have opened up or when continents have collided. “The overall pattern almost always is that there’s some net increase in diversity,” Dr. Brown said. “That seems to be because these communities of species don’t completely fill all the niches. The exotics can fit in there.”

In a recent paper in the journal *Science*, Peter Roopnarine of the California Academy of Sciences and Geerat Vermeij of the University of California, Davis, looked at the history of invasions among species of mollusks, a group that includes mussels, clams and whelks. About 3.5 million years ago, the mollusks of the North Pacific staged a major invasion of the North Atlantic. Before then, the Arctic Ocean had created a barrier, because the mussels could not survive in the dark, nutrient-poor water under the ice.

A period of global warming made the Arctic less forbidding. Yet the migration did not lead to a significant drop in the diversity of the Atlantic native mussels. Instead, the Atlantic’s diversity rose. Along with the extra exotic species, new species may have arisen through hybridization.

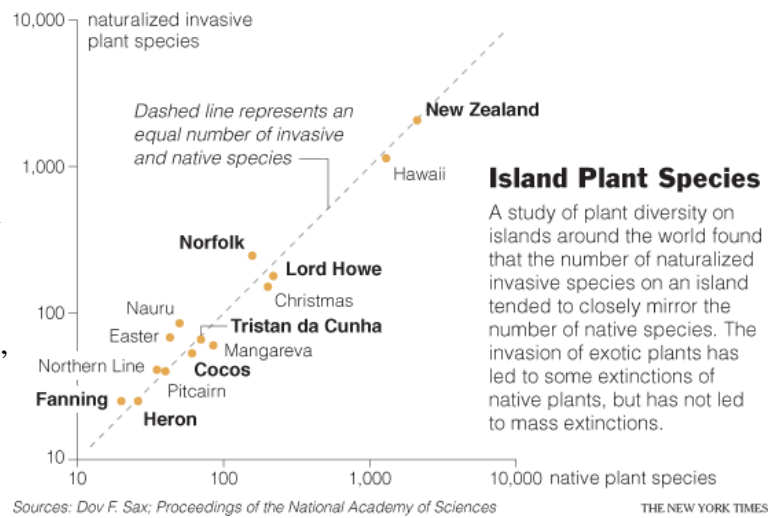
The Arctic Ocean is now warming again, this time because of human activity. Computer projections indicate it will become ice-free at least part of the year by 2050. Dr. Roopnarine and Dr. Vermeij predicted that today’s mollusks would make the same transoceanic journey they did 3.5 million years ago. They also expect the invasion to increase, rather than decrease, diversity.

But critics, including Anthony Ricciardi of McGill University in Montreal, argue that today’s biological invasions are fundamentally different from those of the past.

“What’s happening now is a major form of global change,” Dr. Ricciardi said. “Invasions and extinctions have always been around, but under human influence species are being transported faster than ever before and to remote areas they could never reach. You couldn’t get 35 European mammals in New Zealand by natural mechanisms. They couldn’t jump from one end of the world to another by themselves.”

It is estimated that humans move 7,000 species a day. In the process, species are being thrown together in combinations that have never been seen before. “We’re seeing the assembly of new food webs,” said Phil Cassey of the University of Birmingham in England. Those new combinations may allow biological invasions to drive species extinct in unexpected ways.

Botulism, for example, is killing tens of thousands of birds around the Great Lakes. Studies indicate that two invasive species triggered the outbreak. The quagga mussel, introduced from Ukraine, filters the water for food, making it clearer. The sunlight that penetrates the lakes allows algae to bloom, and dead algae trigger an explosion of oxygen-consuming bacteria. As the oxygen level drops, the botulism-causing bacteria can multiply. The quagga mussels take up the bacteria, and they in turn are eaten by another invasive species: a fish known as the round goby. When birds eat round gobies, they become infected and die.



“If you pour on more species, you don’t just increase the probability that one is going to arrive that’s going to have a high impact,” Dr. Ricciardi said. “You also get the possibility of some species that triggers a change in the rules of existence.”

Dr. Ricciardi argues that biological invasions are different today for another reason: they are occurring as humans are putting other kinds of stress on ecosystems. “Invasions will interact with climate change and habitat loss,” he said. “. We’re going to see some unanticipated synergies.”

Both sides agree, however, that decisions about invasive species should be based on more than just a tally of positive and negative effects on diversity. Invasive weeds can make it harder to raise crops and graze livestock, for example. The Asian long-horned beetle is infesting forests across the United States and is expected to harm millions of acres of hardwood trees. Zebra mussels have clogged water supply systems in the Midwestern United States. Exotic species can also harm humans’ health. “West Nile virus, influenza — these things are invasions,” Dr. Ricciardi said.

On the other hand, some invasive species are quite important. In the United States, many crops are pollinated by honeybees originally introduced from Europe.

“It’s not that this is all good or all bad, and I’m not sure science should be the arbiter,” Dr. Brown said. “Placing values on these things is the job of society as a whole.”

Observatory

Marijuana Ingredient May Fight Bacteria

By HENRY FOUNTAIN

Marijuana may be something of a wonder drug — though perhaps not in the way you might think.

Researchers in Italy and Britain have found that the main active ingredient in marijuana — tetrahydrocannabinol, or THC — and related compounds show promise as antibacterial agents, particularly against microbial strains that are already resistant to several classes of drugs.

It has been known for decades that Cannabis sativa has antibacterial properties. Experiments in the 1950s tested various marijuana preparations against skin and other infections, but researchers at the time had little understanding of marijuana’s chemical makeup.

The current research, by Giovanni Appendino of the University of the Eastern Piedmont and colleagues and published in The Journal of Natural Products, looked at the antibacterial activity of the five most common cannabinoids. All were effective against several common multiresistant bacterial strains, although, perhaps understandably, the researchers suggested that the nonpsychotropic cannabinoids might prove more promising for eventual use.

The researchers say they do not know how the cannabinoids work or whether they would be effective, as systemic antibiotics would require much more research and trials. But the compounds may prove useful sooner as a topical agent against methicillin-resistant Staphylococcus aureus, or MRSA, to prevent the microbes from colonizing on the skin.

Study tracks 'pathways to terror'

By Jonathan Amos Science reporter, BBC News

Scientists believe they have a clearer idea of what makes a terrorist after interviewing a group of Islamic extremists in Pakistan. The project constructed psychological "profiles" to describe how Jihadists were led into their violence. It quashes the idea that these people are "zombies", mindlessly following the orders of others; or mentally ill. The picture that emerges is of largely intelligent people finding direction in the networks of associates they keep.

"One of the most frightening things about terrorists is that they are remarkably normal and often reasonably well educated, and certainly no indication of mental disturbance in the way they deal with the world," said Professor David Canter, director of Liverpool University's Centre for Investigative Psychology.

Important networks

Professor Canter's group conducted a series of interviews with 49 terrorists - people convicted of bombing and killings. The work was done outside of the UK because of the refusal of the British authorities to facilitate the research at home. The team used an interview technique known as the "repertory grid" - a method that allows an individual to express their understanding of themselves and the world around them by indicating who is important in their lives. This approach might, for example, involve asking interviewees to order cards printed with names of friends and associates.

The description of a terrorist this technique throws up is far removed from the caricatures often seen in the Western media.

"The work on pathways into terrorism indicates that it comes out of a social process; it comes out of a series of contacts that terrorists have with other individuals," Professor Canter told BBC News.

"These may be friends and associates; they may be members of their family. But more typically, they will be some sort of person they look up to, who may be a senior individual within a terrorist organisation, or maybe a teacher that they feel provides them with some feelings of self-worth and significance if they will take part in violent activity."

The professor said there were two main pathways into terror - through attachment to particular social groups who are on the fringes of terrorism; and through strong ideals or spiritual beliefs. These two routes could be further subdivided.

Reversing pathways

The research supports substantial anecdotal evidence which challenges simplistic notions of a rapid radicalisation. Mohamed Atta, the leader of the 9/11 hijackers, was a talented graduate studying in Germany - but chose to effectively withdraw from the rest of society around him as he met others who shared his worldview.

In the same way, the ringleader of the 7 July London suicide bombers, Mohammad Sidique Khan, left behind a life as a youth worker as his political views, contacts and experiences led him, over a number of years, to turn to violence.

But the research also suggested that many terrorists were open to changing their ways. Many individuals were clearly "malleable". Some interviewees who became involved in terrorist groups often realised their leaders were no better than those they perceived to have wronged them, the Liverpool researcher said.

And, he added, the study had lessons for how the authorities should work to block off the pathways to a life of violence.

"At the broader level, everything has to be done to undermine the idea that individuals think of themselves solely in terms of any particular group or sub-group - be that fundamental Muslims or supporters of a football club. Once people only think of themselves in those terms, then that sets the seeds for conflict."

For this reason, he said, there were dangers presented by the idea of faith schools, particularly the strict style that preached separatism, such as a number of Pakistan's Islamic madrassas.

British authorities, who have had a number of major successes in breaking conspiracies since 2001, have launched initiatives to de-radicalise jihadists - although there are disagreements over how best to turn people around.

Professor Canter was speaking at the British Association Science Festival in Liverpool.

UT Southwestern: Killing bacteria isn't enough to restore immune function after infection

DALLAS – A bacterial molecule that initially signals to animals that they have been invaded must be wiped out by a special enzyme before an infected animal can regain full health, researchers at UT Southwestern Medical Center have found.

Using a genetically engineered mouse model, the team found that simply eradicating the infection-causing bug isn't enough to restore an animal's immune function. Lipopolysaccharide, or LPS, the dominant bacterial "signal" molecule that heralds the invasion, must also be inactivated. The findings are to appear online Sept. 11 in *Cell Host & Microbe*.

"We think this is the first evidence that killing the causative agent of a bacterial infection isn't enough for an animal to recover fully," said Dr. Robert Munford, professor of internal medicine and microbiology, and senior author of the study. "You've got to get rid of this molecule that the host is responding to or else its immune system remains suppressed."

By sensing and responding to LPS, animals mobilize their defenses to attack and kill the bacteria. This immune response also causes inflammation in the host. For a few days after the infection begins, however, an animal's ability to sense the bacteria is turned down, presumably to prevent further inflammation. In the current study, the researchers found that mice didn't recover from this "tolerant" period unless the LPS was inactivated by acyloxyacyl hydrolase, an enzyme discovered in 1983 by Dr. Munford and Dr. Catherine Hall, now an assistant professor of internal medicine at UT Southwestern.

Dr. Mingfang Lu, instructor of internal medicine and lead author of the current study, said the team also found that prolonged tolerance was immunosuppressive, reducing the animal's ability to stave off another bacterial infection.

Dr. Lu said that how long an animal remains in this tolerant state varies from animal to animal. "But mice that can't make the enzyme acyloxyacyl hydrolase seem to stay tolerant forever, leaving them unable to fight additional infections," she said.

For the study, researchers injected LPS or a common bacterium that makes LPS into the abdomens of two types of mice: ones that could produce the acyloxyacyl hydrolase enzyme and ones that could not. Two weeks later they injected the mice with a deadly strain of *Escherichia coli* – which can cause loss of water and salts,

damage to blood vessels, and bleeding in humans – to gauge how prolonged tolerance influences the animal's internal defense mechanisms.

Though almost all of the mice with the enzyme survived, 90 percent of those without the enzyme died. "Being tolerant, or unable to respond normally, made them more susceptible to the E coli we injected them with," Dr. Lu said.

Dr. Munford said they don't have any evidence that this finding is applicable to humans, who also make the enzyme, but it is possible.

"One theory is that there is variability among humans in the production of acyloxyacyl hydrolase," he said. "We don't know this yet, but if it's true, then the presence or absence of the enzyme might contribute to the length of immunosuppression after serious bacterial infections. It might even be reversible if we could provide the enzyme or figure out a way for people to make more of it."

The team's next step is to investigate further how LPS continues to stimulate the host's immune cells for such long periods of time if it does not get degraded. They also hope to use this animal model to understand better on a molecular scale exactly what happens during post-infection immunosuppression.

Other UT Southwestern researchers involved in the study were Dr. Alan Varley, assistant professor of internal medicine, and John Hardwick, former research associate in internal medicine. Shoichiro Ohta, a researcher from Saga Medical School in Japan, also contributed to the study. The work was supported by the National Institute of Allergy and Infectious Diseases.

The Double Firing Burst

Brightest gamma-ray burst provides wealth of information on how stars explode

Astronomers from around the world combined data from ground- and space-based telescopes to paint a detailed portrait of the brightest explosion ever seen. The observations reveal that the jets of the gamma-ray burst called GRB 080319B were aimed almost directly at the Earth.

GRB 080319B was so intense that, despite happening halfway across the Universe, it could have been seen briefly with the unaided eye (ESO 08/08). In a paper to appear in the 11 September issue of *Nature*, Judith Racusin of Penn State University, Pennsylvania (USA), and a team of 92 co-authors report observations across the electromagnetic spectrum that began 30 minutes before the explosion and followed it for months afterwards.

The gamma-ray burst GRB 080319B was so intense that, despite happening halfway across the Universe, it could have been seen briefly with the unaided eye. It also appears that the jets were aimed almost directly at the Earth.

"We conclude that the burst's extraordinary brightness arose from a jet that shot material almost directly towards Earth at almost the speed of light - the difference is only 1 part in 20,000," says Guido Chincarini, a member of the team.

Gamma-ray bursts are the Universe's most luminous explosions. Most occur when massive stars run out of fuel. As a star collapses, it creates a black hole or neutron star that, through processes not fully understood, drives powerful gas jets outward. As the jets shoot into space, they strike gas previously shed by the star and heat it, thereby generating bright afterglows.

The team believes the jet directed toward Earth contained an ultra-fast component just 0.4 degrees across (this is slightly smaller than the apparent size of the Full Moon). This jet is contained within another slightly less energetic jet about 20 times wider.

The broad component is more typical of other bursts. "Perhaps every gamma-ray burst has a narrow jet, but astronomers miss it most of the time," says team member Stefano Covino. "We happened to view this monster down the barrel of the very narrow and energetic jet, and the chance for this nearly head-on alignment to occur is only about once a decade," added his colleague Cristiano Guidorzi.

GRB 080319B was detected by the NASA/STFC/ASI Swift satellite towards the constellation of Boötes, the "Herdsman". A host of ground-based telescopes reacted promptly to study this new object in the sky, including ESO's Very Large Telescope, which was the first to provide the distance of the object, 7.5 billion light-years. The visible light from the burst was detected by a handful of wide-field cameras worldwide that are mounted on telescopes constantly monitoring a large fraction of the sky. One of these was the TORTORA camera mounted on the 0.6-m REM telescope at ESO's La Silla Observatory (ESO 26/07).

TORTORA's rapid imaging provides the most detailed look yet at the visible light associated with the initial blast of a gamma-ray burst. "We've been waiting a long time for this one," says TORTORA senior scientist



The Double Firing Burst
(Artist's impression)

ESO PR Photo 28/08 (10 September 2008)

This image is copyright of ESO. It is released in connection with an ESO press release and may be used by the press on the condition that the source is clearly indicated in the caption.



Grigory Beskin of Russia's Special Astrophysical Observatory. The data collected simultaneously by TORTORA and the Swift satellite allowed astronomers to explain the properties of this burst.

Notes Read more on this illuminating blast in the additional story.

Racusin, J. L. et al. 2008, Broadband observations of the naked-eye gamma-ray burst GRB 080319B, Nature, 11 September 2008.

The TORTORA camera is mounted on the Italian REM telescope at ESO's La Silla Observatory in Chile. It was built and is being operated by a collaboration between Italy's Bologna State University and Brera Observatory and Russia's Special Astrophysical Observatory and Institute of Precise Instrumentation. The REM team is composed of G. Chincarini, E. Molinari, F.M. Zerbi, L.A. Antonelli, S. Covino, P. Conconi, L. Nicastro, E. Palazzi, M. Stefanon, V. Testa, G. Tosti, F. Vitali, A. Monfardini, F. D'Alessio, P. D'Avanzo, D. Fugazza, G. Malaspina, S.D. Vergani, S. Campana, P. Goldoni, D. Guetta, N. Masetti, E.J.A. Meurs, L. Norci, E. Pian, A. Fernandez-Soto, L. Stella, G. Tagliaferri, G. Ihle, L. Gonzalez, A. Pizarro, P. Sinclair, and J. Valenzuela.

The TORTORA team comprises G. Beskin, S. Karpov, S. Bondar, A. Guarnieri (TORTORA Italian PI), C. Bartolini, G. Greco, A. Piccioni, D. Nanni, F. Terra, and E. Molinari.

Swift is managed by NASA's Goddard Space Flight Center. It was built and is being operated in collaboration with Penn State, the Los Alamos National Laboratory, and General Dynamics in the U.S.; Brera Observatory and the Italian Space Agency in Italy; the University of Leicester and Mullard Space Science Laboratory in the United Kingdom; plus partners in Germany and Japan.

Aberrations in region of chromosome 1q21.1 associated with broad range of disorders in children

Levels of impairment also vary

Researchers have discovered a submicroscopic aberration in a particular region of human chromosome 1q21.1 that appears to be associated with a variety of developmental disorders in children. The aberration can manifest itself as unexplained mild or moderate mental retardation, growth retardation, learning disabilities, seizures, autism, heart defects, other congenital abnormalities, cataracts, small head size, unusual facial features, hand deformities, or skeletal problems. Some people who have the aberration are only slightly affected or apparently unaffected, others are more seriously impaired.

The multinational research was led by Dr. Heather C. Mefford, acting assistant professor of pediatrics at the University of Washington, and Dr. Andrew J. Sharp of the University of Geneva Medical School in Switzerland. Mefford practices medical genetics at Children's Hospital and Regional Medical Center in Seattle and the UW Medical Center Medical Genetics Clinic.

The results will be published in the Sept. 11 New England Journal of Medicine in an article titled, "Recurrent Rearrangements of Chromosome 1q21.1 and Variable Pediatric Phenotypes." The results are discussed in an accompanying editorial by David H. Ledbetter of Emory University in Atlanta.

Deletions and duplications of major sections of the human genome have long been known to cause disease or make a person susceptible to disease. Recent technological advances, called cytogenetic arrays, are enabling scientists to test large numbers of people to determine the presence or absence of submicroscopic imbalances in small sections of their chromosomes.

Using these new advances, the researchers checked for the presence of microdeletions and microduplications in a specific region of chromosome 1q21.1 in groups of patients with unexplained mental retardation, autism, or congenital abnormalities, and compared their findings with similar testing of a group from the general population. In these 4,737 controls from the general population, no microdeletions were found. Two controls had one small duplication at the far end of the region under study, and only one had duplication of the entire region.

The authors explained that the genomic structure of 1q21.1 is extremely complex. There are still 15 assembly gaps, or 700 kb of missing sequence in 1q21.1, in the most recent map of the human genome.

These gaps, the researchers noted, might contain as yet unknown genes that contribute to the differences in the types of developmental abnormalities that occur in children with the deletion. Supposedly unaffected deletion carriers might in fact have more subtle disorders that could be found during further clinical evaluations. For example, an examination of one apparently unaffected carrier revealed mild cataracts and a heart defect that were previously undetected.

Studies by other groups of researchers have also found a connection between 1q21.1 deletions and schizophrenia in some people, and parts missing in the reproductive tract in other people. These results, the authors of the Sept. 11 New England Journal of Medicine article noted, confirm the association of 1q21.1 rearrangements with a broad spectrum of disorders, and also further dispel the notion that such rearrangements will necessarily follow the one-gene, one-disease model.

The authors recognize that the diversity of disorders and the lack of a distinct syndrome accompanying 1q21.1 rearrangements will complicate genetic diagnosing and counseling. They suggest that clinicians caring

for patients who have unexplained developmental abnormalities consider the identification of a 1q21.1 rearrangement in a patient a significant clinical finding and probably an influential genetic factor contributing to the patient's disorder. Evaluating the patient's family members may reveal apparently unaffected or mildly affected relatives carrying the same rearrangement. Keeping in mind the many possible repercussions of having this rearrangement in the chromosome, the authors suggest that young carriers should be monitored over the long term for the emergence of learning disabilities, autism, schizophrenia, or other neuropsychiatric disorders.

This study, the authors said, adds 1q21.1 as a chromosomal locus to the growing list of structural variants that might eventually be included in genetic screening panels for people with developmental delays or neuropsychiatric diagnoses.

"Counseling in the prenatal setting," the researchers wrote, "will present the greatest challenge: although the likelihood of an abnormal outcome is high in a person with a 1q21.1 rearrangement, current knowledge does not allow us to predict which abnormality will occur in any given person."

This research was supported by grants from the National Institutes of Health, South Carolina Department of Disabilities and Special Needs, Wellcome Trust, Andre and Cyprien Foundation, University Hospitals of Geneva, European Union, Irish Health Research Board, Dutch Foundation for Brain Research, Oxford Partnership Comprehensive Biomedical Research Centre, Cambridge Biomedical Research Centre, United Kingdom Department of Health's National Institute for Health Research Biomedical Research Centres, National Genetics Reference Laboratory Wessex, Research Foundation - Flanders, and Howard Hughes Medical Institute.

In spiders, size matters: Small males are more often meals

Female spiders are voracious predators and consume a wide range of prey, which sometimes includes their mates. A number of hypotheses have been proposed for why females eat males before or after mating. Researchers Shawn Wilder and Ann Rypstra from Miami University in Ohio found, in a study published in the September issue of the *American Naturalist*, that the answer may be simpler than previously thought. Males are more likely to be eaten if they are much smaller than females, which likely affects how easy they are to catch. In one species of spider, *Hogna helluo*, large males were never consumed while small males were consumed 80% of the time. This result was also confirmed when Wilder and Rypstra examined published data from a wide range of spider species. Males are more likely to be eaten in species where males are small relative to females.



A female wolf spider, Hogna helluo, consuming a male.

Much research on sexual cannibalism has focused on a few extreme cases involving sexual selection and sperm competition. However, by looking at data on a wide range of spiders, Wilder and Rypstra discovered that the size of the male relative to the female (often referred to as sexual size dimorphism) determines how often sexual cannibalism occurs in a species. "We were surprised to find that such a simple characteristic such as how small males are relative to females has such a large effect on the frequency of sexual cannibalism," states Shawn Wilder. In many cases, sexual cannibalism may not be a complex balancing act of costs and benefits for males and females but rather a case of a hungry female eating a male when he is small enough to catch. In an interesting twist, evolution does not appear to be driving this relationship. For example, females would not become larger to consume more males because each male would then be a smaller meal to the larger female and males would not become smaller to be eaten more often because they would not get to mate as often. Rather, sexual cannibalism may be a byproduct of the evolution of large females and small males in a predatory species. *Shawn M. Wilder and Ann L. Rypstra, "Sexual size dimorphism predicts the frequency of sexual cannibalism within and among species of spiders" American Naturalist (2008) 172: 431?*

How lager yeasts came in from the cold, twice

* 21:01 10 September 2008

* NewScientist.com news service

* **Andy Coghlan**

Yeast strains used today to brew lager have two genetic ancestors, not one as previously thought. The discovery may explain the origins of the two major categories of lager today, described in the trade as the "Saaz" beers such as Pilsner and Budweiser, and the "Frohberg" beers such as Orangeboom and Heineken.

It turns out that both probably owe their origins to laws in 16th-century Bavaria that banned brewing in the summer because scorching heat ruined the ale that was brewed before the emergence of lager.



Forced to produce their beer in the winter, brewers accidentally created conditions favouring the emergence of a hybrid yeast better suited to the cold. Researchers already knew that *Saccharomyces pastorianus*, now used to brew lager, is a hybrid produced through marriage between two yeast strains.

Brewing's founder

One was *S. cerevisiae*, the "brewer's yeast" on which the brewing industry is founded because it ferments sugars into alcohol so efficiently. The other was *S. bayanus*, a yeast strain seldom used alone in brewing because it ferments sugar into alcohol far less efficiently.

Now an analysis of the forensic ancestry of lager yeast has established that this same marriage happened independently at least twice, not once as previously thought, giving rise to two broad families of lager beer.

Although both probably emerged during the Middle Ages in central Europe, their point of origin cannot be traced exactly. "We can't say for sure when, where or by whom they were isolated," says Gavin Sherlock of Stanford University, who conducted the study with colleague Barbara Dunn.

They discovered the double emergence of an ancestor after analysing 17 samples of lager yeast originally archived between 1883 and 1976. They found that the yeasts broadly fell into two groups. Those in Group 1 were used to brew the "Saaz"-type beers. Those in Group 2 were used to brew the "Frohberg" lagers.

Family differences

Sherlock and Dunn report that although the two types of hybrids shared the same parentage, they differed from one another considerably.

The Group 1 yeasts, for example, were true hybrids, with one set of genes from each parent. The Group 2 yeasts had an extra copy of *S. cerevisiae*, making them "triploid" hybrids.

Very little genetic material from *S. bayanus* has been lost from either hybrid, probably because its capacity to produce energy at low temperatures from mitochondria turned out to be an indispensable asset in the cold beer cellars of 16th-century Bavaria. By contrast, *S. cerevisiae* had jettisoned much of its genetic material in the Group 1 yeasts, maybe to reduce unnecessary energy expenditure.

In Group 2 yeasts, however, *S. cerevisiae* remained more intact, maybe because two copies of the genome were available to cushion losses of individual genes.

The researchers also noticed that both yeasts contained multiple copies of genes beneficial to brewing, such as those that ferment maltose. Likewise, genes that mar the process had been lost.

Sherlock doubts whether the analysis will lead to ways of engineering new flavours and properties into beers. "The *pastorianus* strains, being hybrids, are sterile, so you can't do genetics on them in a straightforward way," he says. "Rather, beer makers have been doing this via natural selection over the past several centuries, selecting those strains for further use that produced the beers they most enjoyed drinking."

Journal reference: Genome Research DOI: 10.1101/gr.076075.108

Dinosaurs' 'superiority' challenged by their crocodile cousins

Good luck, not general 'superiority,' was the primary factor in the rise of the dinosaurs according to new research from the University of Bristol

In a paper published today in *Science*, Steve Brusatte and Professor Mike Benton challenge the general consensus among scientists that there must have been something special about dinosaurs that helped them rise to prominence.

Dinosaurs epitomize both success and failure. Failure because they went extinct suddenly 65 million years ago; success because they dominated terrestrial ecosystems for well over 100 million years evolving into a wide array of species that reached tremendous sizes.

But why were the dinosaurs able to become so successful, so diverse, so large? Many scientists argue that they must have had some feature or characteristic that helped them out-compete other vertebrate groups, including crocodiles and close crocodile cousins.

Mr Brusatte and Professor Benton are the first to look at the overall picture of the evolution of dinosaurs and their closest competitors during the Triassic period (251 to 199 million years ago). First, they identified the most likely 'competitors' to early dinosaurs: the crurotarsan archosaurs, a large group of animals that are closely related to crocodiles, which form one half of the group Archosauria, the other half being dinosaurs (and their descendants, the birds).

Unlike today's crocodiles, Triassic crurotarsans were amazingly diverse. There were enormous quadrupedal predators, slender bipedal predators, swift bipedal omnivores, fish-eaters, root-grubbers, and low-to-mid-browsing herbivores. Many of these crurotarsans look nothing like crocodiles, but instead are eerily similar to dinosaurs and, in fact, have been mistaken for dinosaur ancestors, or even true dinosaurs, in the past.

Crurotarsans and dinosaurs clearly shared many niches in the Late Triassic, looked very similar, and were thus very likely to be competing for similar resources.

The researchers examined the evolutionary pattern of dinosaurs and crurotarsans in the Late Triassic. Using a very large dataset of anatomical characters – nearly 500 features of the skeleton – and a new family tree of the entire archosaur group they measured evolutionary rates and morphological disparity (a measurement of the range of different body plans and lifestyles that a group has).

They found no difference in the rates at which dinosaurs and crurotarsans were evolving. This was surprising as, if dinosaurs were truly 'superior' or 'out-competing' crurotarsans in the Triassic, they should be expected to evolve faster. Instead, crurotarsans were keeping pace.

The results for the second measure, morphological disparity, were even more remarkable. Crurotarsans had a much higher disparity than dinosaurs in the Triassic. In other words, crurotarsans were exploring a larger range of body types, diets, and lifestyles. This greatly contrasts with the classic image of dinosaur superiority since their greatest competitors, the crurotarsans, were doing so much more.



*A montage of the skulls of several crurotarsan archosaurs, the "crocodile-line" archosaurs that were the main competitors of dinosaurs during the Late Triassic period (230-200 million years ago). Dinosaurs and crurotarsans shared many of the same ecological niches, and some crurotarsans looked remarkably similar to dinosaurs. However, by the end of the Triassic period most crurotarsans were extinct, save for a few lineages of crocodiles, while dinosaurs weathered the storm and began a 135-million-year reign of dominance. Top (l-r): The rauisuchians *Batrachotomus* and *Postosuchus*; middle: the phytosaur *Nicrosaurus* and the aetosaur *Aetosaurus*; bottom: the poposauroid *Lotosaurus* and the ornithosuchid *Riojasuchus*. Steve Brusatte*

To these surprising results can be added two other, previously known, findings: crurotarsans were more abundant (more individuals, more fossils, more species) than dinosaurs in many Triassic ecosystems, and crurotarsans were in some cases more diverse (greater number of species). Putting all this together, it is very difficult to argue that dinosaurs were 'superior' to crurotarsans, or that they were out-competing crurotarsans.

Steve Brusatte, who conducted the research while an MSc student in Bristol University's Department of Earth Sciences, said: "If we were standing in the Late Triassic, 210 million years ago or so, and had to bet on which group would eventually dominate ecosystems, all reasonable gamblers would go with the crurotarsans. There was no sign that dinosaurs were eventually going to succeed so why did they? The answer is two mass extinction events: the dinosaurs not only got lucky, but they got lucky twice.

"They first weathered the storm during the Carnian-Norian event 228 million years ago, but so did the crurotarsans. In contrast, many other potential competitor groups went extinct. Then dinosaurs weathered a second, much bigger, storm 200 million years ago. This was the end Triassic extinction event, which was a sudden and catastrophic extinction caused by rapid climate change, possibly facilitated by an asteroid impact. Strangely, and suddenly, all crurotarsans except for a few lineages of crocodiles went extinct. On the other hand, the dinosaurs did not. They survived and then radiated in the Early Jurassic, and very quickly established themselves as the dominant vertebrate group on land across the world.

"Why did crurotarsans go extinct and not dinosaurs? We don't know the answer to that, but we suspect that it was nothing more than luck, plain and simple."

The paper is co-authored by Dr Marcello Ruta, Research Fellow and Graeme Lloyd, a PhD student, both in Bristol's Department of Earth Sciences.

Key enzyme for regulating heart attack damage found, Stanford scientists report

STANFORD, Calif. - Marauding molecules cause the tissue damage that underlies heart attacks, sunburn, Alzheimer's and hangovers. But scientists at the Stanford University School of Medicine say they may have found ways to combat the carnage after discovering an important cog in the body's molecular detoxification machinery.

The culprit molecules are oxygen byproducts called free radicals. These highly unstable molecules start chain reactions of cellular damage - an escalating storm that ravages healthy tissue.

"We've found a totally new pathway for reducing the damage caused by free radicals, such as the damage that happens during a heart attack," said Daria Mochly-Rosen, PhD, professor of chemical and systems biology and the senior author of a study reporting the new findings. The research will appear in the Sept. 12 issue of *Science*.

Before the study, scientists knew that heart muscle could be preconditioned to resist heart attack damage - for instance, moderate drinkers tend to have smaller, less severe heart attacks than teetotalers. But scientists didn't understand how pre-conditioning worked.

To figure out how alcohol protects heart muscle from free-radical damage, Mochly-Rosen's team tested alcohol pretreatment in a rat heart-attack model. They compared the enzymes activated during the attacks to those switched on with no alcohol. Enzymes are the "doers" of the cellular machinery, catalyzing all of the biochemical reactions that form the basis of life.

Surprisingly, the treatment activated aldehyde dehydrogenase 2 (ALDH2), an obscure alcohol-processing enzyme. Alcohol pretreatment increased the enzyme's activity during heart attack by 20 percent, leading to a 27 percent drop in the associated damage.

"Although this enzyme was discovered a long time ago, my research group knew nothing about the enzyme except that it helps remove alcohol when people drink," said Mochly-Rosen, who is also the senior associate dean for research in the School of Medicine and the George D. Smith Professor in Translational Medicine.

ALDH2 wasn't one of the well-studied antioxidant players that the scientists expected to find fighting free-radical damage. The enzyme neutralizes an aldehyde molecule, a toxic byproduct of the ethanol in alcoholic beverages. But aldehydes are also formed in the body when free radicals react with fat molecules.

The body's cells contain a lot of fat, Mochly-Rosen noted. "It's very easy for free radicals to find fat and oxidize it to aldehydes."

Inside cells, the accumulating aldehydes permanently bind and damage cellular machinery and DNA. Such damage occurs in many diseases, from heart attack and Parkinson's to sun-induced aging of the skin.

After learning of ALDH2's novel role in reducing the damage, the researchers searched for a molecule that could make the enzyme function even better. They enlisted the Stanford High Throughput Bioscience Center, directed by David Solow-Cordero, PhD, to find a molecule that heightened the enzyme's activity.

The winner of this contest was a tiny molecule that reduced heart attack damage by 60 percent in the rat model. The molecule, Alda-1, has a surprising mode of action: it protects ALDH2 itself from aldehyde attack. The enzyme, it turns out, was being hobbled by the very chemical it removes.

Because Alda-1 is small, it should be easy to adapt for pharmacological use, Mochly-Rosen said. She expects the new molecule to have many possible drug applications.

"It has a huge potential use," she said. So far, Alda-1 has been tested only in the rat model, but Mochly-Rosen's lab is investigating other possible applications, such as fighting neurodegenerative disease and sun damage on the skin. The team also hopes to interest drug companies in human trials.

In addition to its lofty medical applications, Alda-1 could also have a much lowlier use: fighting hangovers. Many nasty hangover symptoms are due to aldehyde buildup.

The tiny molecule may also improve alcohol tolerance and reduce susceptibility to free-radical diseases in people with a common ALDH2 mutation. The mutation affects 40 percent of people of Asian descent and causes an intolerance for alcohol.

Mochly-Rosen's Stanford team included Che-Hong Chen, PhD, a senior scientist and a key contributor; postdoctoral scholars Grant Budas, PhD, and Eric Churchill, PhD; and senior scientist Marie-Helene Disatnik, PhD. Thomas Hurley of the University of Indiana School of Medicine collaborated with the Stanford scientists.

The research was funded by the National Institute on Alcohol Abuse and Alcoholism and also received support from Stanford's SPARK program, which helps mature nascent medical technologies with the goal of transferring them to commercial entities to benefit society.

Ancient genetic imprint unites the tribes of India

* 11:19 11 September 2008

* NewScientist.com news service

* **Anil Ananthaswamy**

The first humans to arrive on the Indian subcontinent from Africa about 65,000 years ago left a genetic imprint that can still be found in the tribes of India.

Anthropologists have long argued over the genetic makeup of the country's population, because of its complex history of migrations and movement. The first humans to people the sub-continent came from Africa, following the so-called southern route, along the tropical coast of the Indian Ocean.

"Whether the original inhabitants of India were replaced by more modern immigrants or contributed to the contemporary gene pool has been debated," says Michael Bamshad of the University of Washington in Seattle, who has studied the genetic diversity of India.

One way researchers have used to figure this out is to use linguistic groups. The tribes speaking Indo-European languages, for instance, are known to be descendants of the people who migrated into India relatively

recently from Central Asia and the Caucasus. It was also thought that the Austro-Asiatic speakers were direct descendants of the original settlers.

Mothers of India

To determine which groups can trace their ancestry to the founding population of India, Vadlamudi Raghavendra Rao of the Anthropological Survey of India in Kolkata and his colleagues analysed 2768 samples of mitochondrial DNA taken from 24 tribes all over India. Mitochondrial DNA is inherited from the mother, so can be used to trace the maternal lineage of a population.

The researchers looked for a particular set of mutations in the mitochondrial genome called the M2 haplogroup. This set of genetic markers is unique to India and is a sub-lineage of the M haplogroup that identifies the first humans who arrived in India from Africa 65,000 years ago.

The analysis showed that the M2 lineage began in India about 50,000 years ago, about 15,000 years after modern humans arrived. The team also found that the M2 lineage and its branches made up nearly 10% of the mitochondrial DNA of the studied tribes.

"We found these 'footprints' in all the tribal populations," says Rao. "We analysed the most primitive tribes, spread over the south, central and east India and found the signatures of earliest antiquity."

Unifying genes

Significantly, the M2 lineage cuts across major linguistic barriers. The new study shows that both the Dravidian and Austro-Asiatic language groups share these same genetic markers.

According to team member Satish Kumar, the M2 haplogroup can also be found, albeit with reduced frequency, among members of the so-called higher castes of India, such as the Brahmins (priests) and the Kshatriyas (warriors). Upper castes are thought to be the outcome of the arrival over time of a more technologically advanced people that marginalised the indigenous population, starting about 10,000 years ago.

Even these new migrants assimilated into India and to some extent mixed with the population, as the presence of M2 genes in the group attests.

"The early settler component is not restricted to one particular language family, or one particular population," says Kumar.

Rao agrees. "Biologically, there are no castes and tribes, there are only communities," he says.

Journal reference: BMC Evolutionary Biology (DOI: 10.1186/1471-2148-8-230)

Food

Ancient Figs May Be First Cultivated Crops

by Christopher Joyce

[Listen](#)

All Things Considered, June 2, 2006 · The discovery of figs in an 11,400-year-old house near the ancient city of Jericho may be evidence that cultivated crops came centuries before the first farmers planted cereal grains.

Archeologists in Israel discovered the figs in an excavated house in a village called Gilgal 1. The fruits were mutant figs -- growing on a rare kind of tree that isn't pollinated by insects and won't reproduce unless someone takes a cutting and plants it.



Figs Courtesy Jonathan Reif

An ancient fig (left), appears next to an Iranian commercial variety (center), and a common variety of Turkish fig (right).

The ancient fig's color was altered to prepare it to be photographed in magnified form.

According to Harvard anthropologist Ofer Bar-Yosef, generations of people must have lived around wild fig trees until people figured out how to grow these mutants.

"It's generally women who do the gathering in hunting-and-gathering societies," Bar-Yosef says. "And you know years of experience would tell them exactly how the plants behaved...."

Writing in the journal *Science*, Bar-Yosef and colleagues in Israel say these figs may now be the first cultivated crops. But he suspects the transition to domesticated crops -- whether barley, oats or figs -- was a slow process.

"The facts that the figs were already domesticated means that humans were enjoying this practice of cutting branches and sticking them into the ground to be the new trees," Bar-Yosef says. "You don't get plants like figs domesticated if you don't start planting it systematically again and again."



Fig remains from the Gilgal I archeological site Courtesy Jonathan Reif

Fig remains were found at the Gilgal I archeological site in the Jordan Valley, not far from Jericho.

Correction: In the broadcast version of this story, an archeological site in the lower Jordan Valley was incorrectly identified as being in Israel. The site is in the occupied West Bank.

Stem cell regeneration repairs congenital heart defect

Potential therapy for inherited conditions

ROCHESTER, Minn. -- Mayo Clinic investigators have demonstrated that stem cells can be used to regenerate heart tissue to treat dilated cardiomyopathy, a congenital defect. Publication of the discovery was expedited by the editors of Stem Cells and appeared online in the "express" section of the journal's Web site at <http://stemcells.alphamedpress.org/>.

The study expands on the use of embryonic stem cells to regenerate tissue and repair damage after heart attacks and demonstrates that stem cells also can repair the inherited causes of heart failure.

"We've shown in this transgenic animal model that embryonic stem cells may offer an option in repairing genetic heart problems," says Satsuki Yamada, M.D., Ph.D., cardiovascular researcher and first author of the study. "Close evaluation of genetic variations among individuals to identify optimal disease targets and customize stem cells for therapy opens a new era of personalized regenerative medicine," adds Andre Terzic, M.D., Ph.D., Mayo Clinic cardiologist and senior author and principal investigator.

How They Did It

The team reproduced prominent features of human malignant heart failure in a series of genetically altered mice. Specifically, the "knockout" of a critical heart-protective protein known as the KATP channel compromised heart contractions and caused ventricular dilation or heart enlargement. The condition, including poor survival, is typical of patients with heritable dilated cardiomyopathy.

Researchers transplanted 200,000 embryonic stem cells into the wall of the left ventricle of the knockout mice. After one month the treatment improved heart performance, synchronized electrical impulses and stopped heart deterioration, ultimately saving the animal's life. Stem cells had grafted into the heart and formed new cardiac tissue. Additionally, the stem cell transplantation restarted cell cycle activity and halved the fibrosis that had been developing after the initial damage. Stem cell therapy also increased stamina and removed fluid buildup in the body, so characteristic in heart failure.

The researchers say their findings show that stem cells can achieve functional repair in non-ischemic (cases other than blood-flow blockages) genetic cardiomyopathy. Further testing is underway.

Others members of the multidisciplinary team are: Timothy Nelson, M.D., Ph.D.; Ruben Crespo-Diaz; Carmen Perez-Terzic, M.D., Ph.D.; Xiao-Ke Liu, M.D., Ph.D.; and Atta Behfar, M.D., Ph.D., of Mayo Clinic; Takashi Miki, M.D., Chiba University, Japan; and Susumu Seino, M.D., Kobe University, Japan.

The research was supported by the National Institutes of Health, the American Heart Association, the Marriott Foundation, the Ted Nash Long Life Foundation, the Ralph Wilson Medical Research Foundation, and the Japanese Ministry of Education, Science, Sports, Culture and Technology.

The pepperoni pizza hypothesis

Posted On: September 11, 2008 - 5:10pm

CHICAGO -- What's the worst that could happen after eating a slice of pepperoni pizza? A little heartburn, for most people.

But for up to a million women in the U.S., enjoying that piece of pizza has painful consequences. They have a chronic bladder condition that causes pelvic pain. Spicy food -- as well as citrus, caffeine, tomatoes and alcohol-- can cause a flare in their symptoms and intensify the pain. Researchers had long believed the spike in their symptoms was triggered when digesting the foods produced chemicals in the urine that irritated the bladder.

A surprising new discovery from Northwestern University's Feinberg School of Medicine reveals the symptoms -- pain and an urgent need to frequently urinate -- are actually being provoked a surprise perpetrator. It's the colon, irritated by the spicy food, that's responsible. The finding provides an explanation for how the body actually "hears" pelvic pain.

The discovery also opens up new treatment possibilities for "painful bladder syndrome," or interstitial cystitis, a condition that primarily affects women (only 10 percent of sufferers are men.) During a flare up, the pelvic pain is so intense some women inject anesthetic lidocaine directly into their bladders to get relief. Patients typically also feel an urgent need to urinate up to 50 times a day and are afraid to leave their homes in case they can't find a bathroom.

"This disease has a devastating effect on people's lives," said David Klumpp, principal investigator and assistant professor of urology at the Feinberg School. "It affects people's relationships with family and friends." Klumpp said some women who suffer from this become so depressed, they attempt suicide.

Klumpp conducted the study with postdoctoral fellow Charles Rudick. The paper is published in the September issue of Nature Clinical Practice Urology.

The Northwestern researchers discovered the colon's central role in the pain is caused by the wiring of pelvic organ nerves. Nerves from this region -- the bladder, colon and prostate -- are bunched together like telephone wires and plug into the same region of the spinal cord near the tailbone.

People with interstitial cystitis have bladder nerves that are constantly transmitting pain signals to the spinal cord: a steady beep, beep, beep.

But when the colon is irritated by pepperoni pizza or another type of food, colon nerves also send a pain signal to the same area on the spinal chord. This new signal is the tipping point. It ratchets up the pain message to a chorus of BEEPEEPBEEPBEEP!

"It was known that there was cross talk between organs, but until now no one had applied the idea to how pain signals affect this real world disease, how the convergence of these two information streams could make these bladder symptoms worse," said Klumpp, who also is an assistant professor of microbiology-immunology at the Feinberg School.

The findings suggest the bladder pain can be treated rectally with an anesthetic in a suppository or gel. Another possibility is an anesthetic patch applied to pelvic skin. Studies in back pain show anesthetic patches applied to the skin can reduce back pain, Klumpp said.

"We imagine a similar kind of patch might be used to relieve pelvic pain, which might be the best solution of all," he noted.

How They "Caught" The Colon

For the study, Klumpp and Rudnick created a model of a mouse that mimicked an inflamed bladder with pelvic pain. Then they injected lidocaine into the bladder. The pain vanished. Next they injected lidocaine into the uterus. There was no diminishment of the pain. Lastly, they tried lidocaine in the colon.

"In the colon it knocked down pain just as effectively as if we put it in the bladder. We thought if the colon can suppress bladder-associated pain, maybe it can make it worse in the way that foods irritate bladder symptoms," Klumpp explained.

So, Klumpp injected a small dose of red pepper into the colon of a normal mouse. The injection didn't provoke any pain. But then he injected a small dose into a mouse with pelvic pain. The pelvic pain worsened.

"We likened it to what happens to humans," Klumpp said. "Pepperoni pizza does nothing to most people other than heartburn, but when you give it to a person with an inflamed bladder, that will cause their symptoms to flare because the nerves from the bladder and bowel are converging on the same part of the spinal cord."

Measuring Pelvic Pain In A Mouse

When pain emanates from a visceral organ, the pain message is delivered to the spinal cord and bounces out to the corresponding skin surface, called the dermatome. To measure pelvic pain in the mice, Kumpp prodded their pelvic skin with nylon filaments of varying thickness and stiffness, beginning with one that was as thin as a human hair. The more pelvic pain the mouse was experiencing, the more sensitive its pelvic skin to even the finest filament.

US army is breaking rules to make terrorists talk

* 11 September 2008

THE US military is training psychiatrists to interrogate terrorism suspects, in defiance of internationally agreed codes of conduct which bar doctors from involvement in interrogation.

"It undermines the notion of psychiatrists as healers, and undermines trust in the profession," says Jonathan Marks, a professor of bioethics and law at Pennsylvania State University, University Park. From documents obtained through the Freedom of Information Act he discovered that five US army psychiatrists had been trained between July 2006 and October 2007 (The New England Journal of Medicine, vol 359, p 1090).

The American Psychiatric Association, the American Medical Association and the World Medical Association all have policies condemning the use of psychiatric advice in "softening up" detainees.

Stroking reveals pleasure nerve

By Jenny Carpenter

Science reporter, BBC News

A new touch-sensitive nerve fibre responsible for the sense of pleasure experienced during stroking has been described at a UK conference today.

The nerves tap into a human's reward pathways, and could help explain why we enjoy grooming and a good hug, a neuroscientist has explained.

His team used a stroking machine to reveal the optimal speed and pressure for the most enjoyable caress.

The research was presented at the British Association Science Festival.

Mothers stroke their children, monkeys groom group members, and we all enjoy a massage, but what is it about stroking and rubbing that we find so enjoyable?

"People groom because it feels good," said Professor Francis McGlone, a cognitive neuroscientist at Unilever R&D, but went on to explain that little is known about how we experience the pleasure of touch.

In order to isolate the touch-sensitive nerves responsible for the pleasure experienced during stroking, Professor McGlone designed a "rotary tactile stimulator" - a high-tech stroking machine.

"We have built some very sophisticated equipment, so the stimulus [of stroking] is very repeatable.

"We stroke the skin [of the forearm, foreleg, and face] with a brush at different velocities, and then asked the volunteers to rate how they liked it," he explained.

He also inserted microelectrodes through the skin, into a nerve, to record the neural signals running from the skin to the brain.

"It is like tapping a single phone-line and listening for the chatter that comes down that line," he told the conference.

Feel-good chemicals

By comparing how the neural signals corresponded with how much the volunteers enjoyed the stroking, he was able to pin down people's pleasure to one set of nerves called "C-fibres".

He thinks that the stroking movements are activating C-fibres, which are wired into the rewards systems in the brain, causing the release of feel-good hormones.

Professor McGlone points out that these touch nerves are not responsible for the pleasure experienced from rubbing sexual organs, nor are they found in a person's palms or soles.

"Experiencing pleasure when grappling with tools or walking, would make both task difficult to do with any accuracy," he suggested.

The Liverpool-based researcher showed that stroking speeds of about 5cm per second, while applying 2g of pressure per square cm is optimal, and gave the volunteers most pleasure.

He explained that the pleasure messages are conveyed from the skin to the brain, by similar types of nerve fibres as those that transmit the sensation of pain.

"This is interesting as we often rub a pain to try to alleviate it," he said.

This could explain why the pain experienced by people exposed to a painful thermal stimulus, lessens when the region of the stimulus is simultaneously stroked.

Stroking could be used to treat chronic pain, he suggests.

Saturn magnetises its moon Titan

* 20:08 11 September 2008

* NewScientist.com news service

* **Rachel Courtland**

Saturn's moon Titan is temporarily magnetised by encounters with its host planet, a recent Cassini flyby shows. The new find could help researchers understand the ultimate fate of Titan's atmosphere. It may also help reveal whether Titan hides a salty ocean beneath its surface.

Titan's atmosphere is a thick soup of nitrogen, as well as hydrocarbons like methane. It is thought to be very similar to the early Earth.

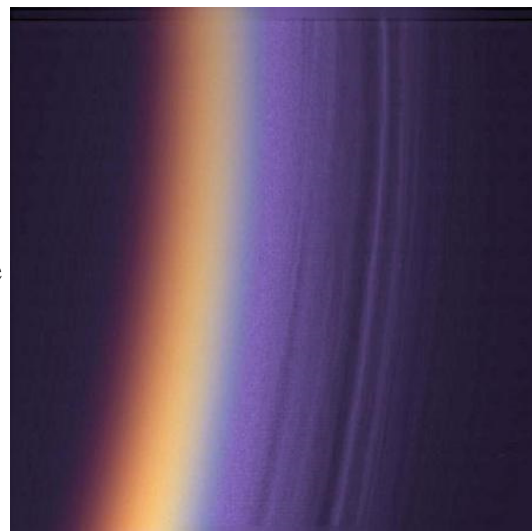
But researchers don't know how much of its atmosphere is gradually escaping into space. Like Mars, Titan seems to lack a strong intrinsic magnetic field that would protect its atmosphere from being stripped away by the solar wind – a stream of charged particles from the Sun.

It does, however, spend 95% of its time within Saturn's magnetosphere, an oblong region of ionised gas, or plasma, surrounding the Ringed Planet. The plasma is made up of material jettisoned from the moon Enceladus, which spews icy geysers into space.

Saturn's magnetosphere may help shield Titan from the solar wind. But it also strongly influences the magnetic fields in the moon's atmosphere, making it difficult to discern whether Titan has its own intrinsic field.

So researchers have been hoping to study Titan when its orbit takes it outside of the magnetosphere, whose boundary flaps around in space.

Cassini imaged the many layers of Titan's upper atmosphere in this ultraviolet image, which has been adjusted to look like true colour (Image: NASA/JPL/SSI)



Magnetic memory

After 31 close fly-bys of the moon, the Cassini spacecraft finally flew through Titan's upper atmosphere at a time when the moon had edged out of the influence of Saturn's magnetic field.

The encounter, which took place on 13 June 2007, showed that Titan's atmosphere actually retains a memory of the magnetic field of the plasma that surrounds Saturn. This memory might last for as long as 3 hours.

"It's surprising that it stays there that long," says team member Andrew Coates of University College London. "Over long time scales, this could really help us understand how planetary atmospheres evolve."

Titan's temporary emergence fully exposes the moon to the solar wind. But the temporary magnetisation of the moon's atmosphere, which produces a draped sheath of magnetic field lines, might protect it from substantial losses.

Inner ocean

The new work could help advance future efforts to discern the interior magnetic field of Titan, says Christopher Russell of the University of California, Los Angeles, who was not associated with the study.

Such an investigation might begin as early as August 2009, when Saturn will reach equinox in its orbit around the Sun, and its rings will appear edge-on to Earth observers.

The solar wind will then stream into the planet from a different angle. And that will reverse the direction of the magnetic fields induced in Titan's atmosphere by Saturn's magnetosphere, Russell told *New Scientist*.

By subtracting flyby data taken then from older data, researchers might be able to determine the strength of Titan's intrinsic magnetic field – assuming Cassini's extended mission lasts for another year.

This could reveal more information about the composition of Titan's interior. It might, for example, reveal whether Titan hides a salty, electrically conducting ocean beneath its icy surface – a possibility suggested by recent measurements of the moon's spin rate. *Journal reference: Science (vol 321, p 1475)*

How genes pick our mates for us

* 18:12 12 September 2008

* *NewScientist.com* news service

* **Ewen Callaway**

When picking a husband or wife, American couples seek out new immune genes, while Africans stick to the ones they've got.

New research shows that American couples of European ancestry go for mates with versions of immune genes that recognise pathogens dissimilar from those their own genes recognise. These genes are part of the major histocompatibility complex, and the more MHC genes a person has, the greater variety of pathogens his or her immune system recognises.

Previous work in fish, lizards and birds has suggested that animals seek out mates with different MHC genes than their own. Yet studies in humans have painted a far blurrier picture of MHC-driven mating preferences.

One study concluded that Hutterites, who live communally, wed people with different versions of the genes, while another found that women prefer the scent of sweaty T-shirts worn by men with similar MHC genes. However, an additional sweaty T-shirt experiment using slightly different methods showed just the opposite trend.

"It seems that body odours can reveal someone's immune genetics, and so through the smell we could be able to distinguish the MHC genes from different potential mates," says Raphaëlle Chaix, a human population geneticist at the National Centre for Scientific Research in Paris, France.

No more T-shirts

Instead of smelly T-shirts, Chaix and colleague Peter Donnelly of the University of Oxford studied previously gathered genetic data on 30 Caucasian couples from Utah and 30 Yoruba couples from Nigeria. The researchers analysed about 9000 genetic differences within the MHC genes, as well as more than 3 million differences dotted across the rest of their genomes.

This suggests that the American couples are selecting mates, in large part, based on MHC genes.

Not so for Yoruba couples, who seemed to pick mates with MHC genes no more different than would be expected for any two people picked at random from the population.

No pressure

One explanation for the different findings could be diversity. Overall, Yoruba people had more differences in their MHC genes than Americans, so there could be less evolutionary pressure to find a mate with new genes.

Culture may also play more of a role in mate choice for Africans. Among Yoruba, marriages between distantly related couples from socially connected clans could be more common than marriage between completely unrelated men and women.

"We can think that maybe two lineages will prefer to exchange their wives," says Chaix. "In several generations, you can create in such a way a pattern where husband and wife are more similar than random individuals." *Journal reference: PLoS Genetics (DOI: 10.1371/journal.pgen.1000184.g001)*

Kimmirut site suggests early European contact

Hare fur yarn, wooden tally sticks may mean visitors arrived 1,000 years ago

JANE GEORGE

Vikings - or perhaps other Europeans - may have set up housekeeping and traded with Inuit 1,000 years ago near today's community of Kimmirut.

That's the picture of the past emerging from ancient artifacts found near Kimmirut, where someone collected Arctic hare fur and spun the fur into yarn and someone else carved notches into a wooden stick to record trading transactions.

Dorset Inuit probably didn't make the yarn and tally sticks because yarn and wood weren't part of Inuit culture at that time, said Patricia Sutherland, an archeologist with the Canadian Museum of Civilization.

Other artifacts from the area, such as a small wooden carving of a mask, missing its nose, also suggest face-to-face contacts with Europeans.

That's because, although the mask is carved in a Dorset Inuit manner, it shows a long and possibly bearded face with straight and heavy eyebrows, wearing what may be Viking headgear.



Analysis on ancient yarn spun from Arctic hare fur, which was found near Pond Inlet, shows the yarn may pre-date the arrival of the Vikings. Similar yarn and cordage has been found near Kimmirut as well as in Greenland. Photo

Courtesy Of Patricia Sutherland

To Sutherland, these artifacts all seem to point to prolonged contact in south Baffin between Inuit and Vikings, or some other mariners, from 1000 AD to 1450 AD or even earlier.

The dating of microscopically identified rat droppings found near Kimmirut may hold the key to learning more about the timing and origin of contact with Europeans, Sutherland said.

If there were rats in south Baffin, it shows European ships were also in the area because "rats aren't found in the Arctic."

Further analysis of the rat droppings is expected to provide even more information about exactly where these ships called, Sutherland said.

Many scholars already believe Baffin Island was Helluland, the name the Vikings' sagas gave to the land of rocks and glaciers they found west of Greenland.

But uncertainty about the age and origin of artifacts attributed to Vikings continues to raise questions about the nature of the contact between Inuit and mariners and whether Greenlandic Vikings were the first travelers that Dorset Inuit met.

Dating of some yarn and other artifacts, presumed to be left by Vikings on Baffin Island, have produced an age that predates the Vikings by several hundred years.

So, as Sutherland said, if you believe that spinning was not an indigenous technique that was used in Arctic North America, then you have to consider the possibility that as "remote as it may seem," these finds may represent evidence of contact with Europeans prior to the Vikings' arrival in Greenland.

Artifacts, stored in collections at the Canadian Museum of Civilization, first drew Sutherland to two old sites near Kimmirut in 2000.

When Sutherland learned that yarn, found near Kimmirut during earlier archeological digs, came from Arctic hare, she started to wonder about the nature of the contact between Inuit and Vikings - also known as Norse.

Because if they were weaving local fur, then maybe they were living there.

"Were the Norse spending more time in Arctic Canada than we previously thought?" And could someone have visited Baffin Island before the Vikings?

For the past five summers, Sutherland has conducted new excavations for the CMC's Helluland project on Cape Tanfield, assisted by local youth.

Cape Tanfield has many Dorset Inuit sites, which were occupied over many generations, as well as some "unusual" architecture.

But Sutherland said she not "prepared to say at this time that it's European."

Unlike L'Anse-aux-meadows in Newfoundland where remnants of Viking houses have been found, Kimmirut sites contain a mix of cultures over time, which makes understanding them more challenging, Sutherland says.

If the community wants to promote and preserve its rich heritage, Cape Tanfield could be nominated as a national historic site, Sutherland suggests.