Bizarre-looking bat's strong bite

By Victoria Gill Science reporter, BBC News

The wrinkle-faced bat's strangely shaped skull gives it a remarkably strong bite force, say scientists.

Researchers report in the Journal of Zoology that this bizarre-looking bat has evolved a powerful bite that may give it an advantage over other bats. It allows it to eat a broader range of foods than other small fruit-eaters with weaker bites.

The tiny creature, which weighs just 17g, produces bite forces up to 20% higher than other bats of similar size.

The Centurio senex bat has a extremely short and wide skull, the shape of which has long puzzled evolutionary biologists.

The wrinkle-faced bat looks ferocious but is a "gentle" fruit-eating bat. Limited availability of soft food items may have driven the evolution of a powerful bite

"We found that relative to head size, Centurio generates the strongest bites known for any fruit-eating phyllostomid (or leaf-nosed) bat," explained lead author Elizabeth Dumont from the University of Massachusetts Amherst in the US.

They proposed that a shortage of softer fruits during "lean times" may have provided a selective pressure, driving the evolution of its oddly-shaped skull.

"The New World leaf-nosed family of bats exhibits spectacular diversity in diet," explained Professor Dumont.

" Centurio is a dedicated fruit-eater, but the family also contains insect-eaters, nectar-feeders, species that eat small vertebrates - such as lizards, frogs, rodents - and vampire bats.

"Although Centurio looks ferocious, it is a small and gentle animal."

Lightning's mirror image ... only much bigger

Scientists capture 1-second image of huge lightning flowing 40 miles upward from storm

With a very lucky shot, scientists have captured a one-second image and the electrical fingerprint of huge lightning that flowed 40 miles upward from the top of a storm. These rarely seen, highly charged meteorological events are known as gigantic jets, and they flash up to the lower levels of space, or ionosphere. While they don't occur every time there is lightning, they are substantially larger than their downward striking cousins.

"Despite poor viewing conditions as a result of a full moon and a hazy atmosphere, we were able to clearly capture the gigantic jet," said study leader Steven Cummer, an electrical and computer engineer at Duke University in North Carolina.

A paper reporting Cummer's results appears online today in the journal Nature Geoscience.

The gigantic jet observed by Steven Cummer and his team. The thunderstorm that produced this jet was over 300 kilometres away, below the visible horizon **(Image: Steven Cummer)**

Images of gigantic jets have only been recorded on five occasions since 2001. The Duke University team caught a one-second view and magnetic field measurements that are now giving scientists a much clearer understanding of these rare events.

"This confirmation of visible electric discharges extending from the top of a storm to the edge of the ionosphere provides an important new window on processes in Earth's global electrical circuit," said Brad Smull, program director in NSF's Division of Atmospheric Sciences, which funded the research.

"Our measurements show that gigantic jets are capable of transferring a substantial electrical charge to the lower ionosphere," Cummer said. "They are essentially upward lightning from thunderclouds that deliver charge just like conventional cloud-to-ground lightning. What struck us was the size of this event."

It appears from the measurements that the amount of electricity discharged by conventional lightning and gigantic jets is comparable, Cummer said. But the gigantic jets travel farther and faster than conventional lightning because thinner air between the clouds and ionosphere provides less resistance.

Whereas a conventional lightning bolt follows a six-inch channel and travels about 4.5 miles down to earth, the gigantic jet recorded by the scientists contained multiple channels and traveled about 40 miles upward.

"Given that reservoirs of electric charge in thunderstorms are the sources for both lightning and gigantic jets, and that both events involve contact between these reservoirs and a very large conducting surface, it is not surprising that their charge transfers are comparable," Cummer said.

Scientists don't know what conditions or what types of storms are conducive to gigantic jet formation.

It has been difficult in the past to obtain images of gigantic jets because they occur so quickly that cameras have to be trained on them at the precise moment they occur.

Cummer caught the gigantic jet almost by accident. The equipment had been set to capture another phenomenon known as sprites, which were first photographed in 1989.

Sprites are electrical discharges that occur above storm clouds and are colored red or blue, with jellyfish-like tendrils hanging down.

Cummer maintains a low-light video camera trained to the sky and programmed to start recording when specific meteorological conditions occur.

At the same time, other equipment constantly measures radio emissions in the same sector to capture electrical events. A special GPS system ensures that the readings from all the equipment are synchronized.

Cummer is planning to install a low-light, high-speed camera to capture gigantic jet images in color, which could provide additional information about chemical processes and temperatures inside the phenomenon.

Other Duke University team members were Jingbo Li, Feng Han, Gaopeng Lu and Nicolas Jaugey. Walter Lyons and Thomas Nelson from FMA Research, Fort Collins, Colo., also participated.

Cancer patients who are separated when diagnosed have worse survival rates

Among unmarried cancer patients, those who are separated at the time of diagnosis do not live as long as widowed, divorced, and never married patients. That is the conclusion of a new study to be published in the November 1, 2009 issue of Cancer, a peer-reviewed journal of the American Cancer Society. The authors of the study say its results suggest that the stress associated with marital separation may compromise an individual's immune system and lead to a greater susceptibility to cancer.

Research has shown that personal relationships have a significant role in physical health—specifically that good relationships are beneficial and poor relationships are deleterious. Also, many studies of cancer prognosis have found that patients who are married live longer than those who are single. However, little information is available regarding differences in survival among the various types of people who are unmarried.

To look for trends in cancer survival among patients who are separated, divorced, widowed, and never married, researchers led by Gwen Sprehn, Ph.D., of the Indiana University School of Medicine in Indianapolis analyzed data from the Surveillance Epidemiology and End Results (SEER) database, a population-based cancer registry in the United States.

The researchers assessed the 5 and 10 year survival rates of 3.79 million patients diagnosed with cancer between 1973 and 2004. They found that married patients had the highest 5 and 10 year survival rates, at 63.3 percent and 57.5 percent respectively. At the other end of the spectrum, separation carried the poorest survival outcome. Specifically, the 5 and 10 year survival rates for separated patients were 45.4 percent and 36.8 percent respectively. The 5 and 10 year survival rates of widowed patients were the next lowest, at 47.2 percent and 40.9 percent respectively; for divorced patients, the respective survival rates were 52.4 percent and 45.6 percent; and for never married patients, they were 57.3 percent and 51.7 percent.

The authors hypothesized that the stress of separation may compromise the immune system and thus create a greater vulnerability to cancer. While additional research is needed, the researchers say certain interventions might help patients today. For example, psychological interventions to reduce stress may impact the immune system and improve survival.

"Patients who are going through separation at the time of diagnosis may be a particularly vulnerable population for whom intervention could be prioritized," says Sprehn. "Identification of relationship-related stress at time of diagnosis could lead to early interventions which might favorably impact survival. Ideally, future research will study marital status in more detail over time and also address individual differences in genetic profile and biomarkers related to stress, immune, and cancer pathways in order to determine mechanisms which might underlie this possible critical period for cancer pathogenesis."

***Article**: "Decreased cancer survival in individuals separated at time of diagnosis: critical period for cancer pathophysiology?" Gwen C. Sprehn, Joanna E. Chambers, Andrew J. Saykin, Andre Konski, and Peter A. S. Johnstone. Cancer; Published Online: August 24, 2009 (DOI: 10.1002/cncr.24547); Print Issue Date: November 1, 2009.*

Higher level of testosterone in women linked to choice of risky careers

CHICAGO – The battle of the sexes rages on, this time from the trading floor. While there has long been debate about the social and biological differences between men and women, new research by the Kellogg School of Management at Northwestern University, the University of Chicago Booth School of Business and the University of Chicago's Department of Comparative Human Development explores how the hormone testosterone plays an important role in gender differences in financial risk aversion and career choice.

Prior research has shown that testosterone enhances competitiveness and dominance, reduces fear, and is associated with risky behaviors like gambling and alcohol use. However, until now, the impact of testosterone on gender differences in financial risk-taking has not been explored.

The new paper, "Gender differences in financial risk aversion and career choices are affected by testosterone," has been published in the Aug. 24, 2009 early edition of the Proceedings of the National Academy of Sciences (PNAS). The research was conducted by Paola Sapienza, Associate Professor, Kellogg School of Management at Northwestern University; Luigi Zingales, Robert McCormick Professor, University of Chicago Booth School of Business; and Dario Maestripieri, Professor in Comparative Human Development, University of Chicago.

"In general, women are more risk averse than men when it comes to making important financial decisions, which in turn can affect their career choices," said Sapienza. "For example, in our sample set, 36 percent of female MBA students chose high-risk financial careers such as investment banking or trading, compared to 57 percent of male students. We wanted to explore whether these gender differences are related to testosterone, which men have, on average, in higher concentrations than women."

The researchers, using an economic-based measure of risk aversion, found that higher levels of testosterone were associated with a greater appetite for risk in women, but not among men. However, in men and women with similar levels of testosterone, the gender difference in risk aversion disappeared. Additionally, the researchers reported that the link between risk aversion and testosterone predicted career choices after graduation: individuals who were high in testosterone and low in risk aversion chose riskier careers in finance.

"This is the first study showing that gender differences in financial risk aversion have a biological basis, and that differences in testosterone levels between individuals can affect important aspects of economic behavior and career decisions," said Maestripieri. "That the effects of testosterone on risk aversion are strongest for individuals with low or intermediate levels of this hormone is similar to what has been shown for the effects of testosterone on spatial cognition."

To investigate the relationship between testosterone and risk aversion, the authors measured testosterone levels in saliva samples (as well as markers of prenatal testosterone such as finger length) from approximately 500 MBA students at the University of Chicago Booth School of Business.

The uncharacteristically large sample - which was global in demographic scope - was familiar with financial risk by virtue of their education, and many pursued financial careers after business school. Also, the participants were relatively homogeneous in age, cultural and educational background, and socioeconomic status, thereby minimizing the effects of other non-biological variables.

As part of a mandatory MBA course, the students were asked to participate in a laboratory experiment to measure the relationship between risk and hormonal levels. Over two days in October 2006, the participants were asked to play a computer game that evaluated their risk aversion attitudes. They answered a series of questions that asked them to choose between accepting a guaranteed monetary award or choosing a risky lottery with a higher potential payout. Students had to choose repeatedly between the lottery and a fixed payment at increasing values. Two saliva samples were collected, once before the session and once after the test was completed, to measure hormonal changes over that time period.

As expected, more risk-prone participants chose the lottery more often, whereas more risk-averse individuals preferred the guaranteed payout. Overall, men exhibited significantly lower risk aversion than women in the study, and also had significantly higher levels of salivary testosterone than women.

"This study has significant implications for how the effects of testosterone could impact actual risk-taking in financial markets, because many of these students will go on to become major players in the financial world," said Zingales. "Furthermore, it could shed some light on gender differences in career choices. Future studies should further explore the mechanisms through which testosterone affects the brain."

Genomic study yields plausible cause of colony collapse disorder

CHAMPAIGN, Ill. - Researchers report this week that they have found a surprising but reliable marker of colony collapse disorder, a baffling malady that in 2007-2008 killed off more than a third of commercial honey bees in the U.S.

Their study, in the Proceedings of the National Academy of Sciences, is the first to identify a single, objective molecular marker of the disorder, and to propose a data-driven hypothesis to explain the mysterious

disappearance of American honey bees. The team included researchers from the University of Illinois and the U.S. Department of Agriculture.

U. of I. researchers spearheaded the honey bee genome project, which was completed in October 2006, less than a month before the first reports of colony collapse disorder (CCD) began to circulate. The new study made use of the genome and a genome-based tool, the microarray, to look for differences in gene expression in the guts of healthy honey bees and in those from hives afflicted by CCD.

Such microarray analyses normally identify only active genes – those that have been transcribed into messenger RNA in the first stage of building proteins. But Reed Johnson, a University of Illinois doctoral student in entomology and first author on the study, noticed that the microarrays were turning up large quantities of fragmented ribosomal RNA (rRNA) in the bees affected by CCD. Ribosomes are the factories in which proteins are made, but Johnson observed that this rRNA contained adenosine-rich sequences not seen in normal ribosomes. Such "polyadenylation" is believed to be a sign of ribosome degradation.

"Microarrays for other organisms also contain these mysterious pieces of ribosomal RNA, for reasons that are not yet altogether clear," said entomology and neuroscience professor Gene Robinson, a co-principal investigator on the study with entomology professor and department head May Berenbaum. But comparisons of healthy bees and bees from hives afflicted with CCD showed that the fragments were present at a much higher frequency in the CCD bees, he said.

"They are overrepresented in the CCD bees, significantly overrepresented," Berenbaum said. "The one consistent indicator of CCD across samples collected at multiple times and in multiple places was the overabundance of ribosomal fragments."

When the team looked at the pathogens of healthy bees and bees from hives affected by CCD, they saw that the CCD bees suffered "more than their share" of infections with viruses that attack the ribosome, Berenbaum said. These so-called picorna-like viruses "hijack the ribosome," she said, taking over the cellular machinery to manufacture only viral proteins. The list of picorna-like viruses that afflict honey bees is long and includes Israeli acute paralysis virus, which was once suspected of being the primary cause of CCD.

Numerous suspects have been identified in the hunt for a cause of CCD, from nutritional deficiencies to exposure to genetically modified plants or pesticides. Researchers in Spain recently pointed to a parasitic fungus, Nosema ceranae, which afflicts many CCD bees in Spain.

The loss of ribosomal function would explain many of the phenomena associated with CCD, Berenbaum said.

"If your ribosome is compromised, then you can't respond to pesticides, you can't respond to fungal infections or bacteria or inadequate nutrition because the ribosome is central to the survival of any organism. You need proteins to survive," she said.

The varroa mite, which is believed to have killed off a significant number of honey bees after it was accidentally introduced to the U.S. in 1986, is a carrier of picorna-like viruses, and is likely a significant contributor to the high viral pathogen load that afflicts U.S. bees. The mite may act as a tipping factor leading to ribosome breakdown, the researchers said.

All of these influences, along with the practice of carting bees around the country for pollination services, are significant stressors on the bees, a heavy burden that would be amplified by a loss of ribosomal function, Robinson said.

This study was supported by the USDA. Berenbaum is also an affiliate of the Institute for Genomic Biology at Illinois. Robinson directs the Neuroscience Program at Illinois and is a faculty member of IGB.

Wisconsin team grows retina cells from skin-derived stem cells

MADISON - A team of scientists from the University of Wisconsin-Madison School of Medicine and Public Health has successfully grown multiple types of retina cells from two types of stem cells — suggesting a future in which damaged retinas could be repaired by cells grown from the patient's own skin.

Even sooner, the discovery will lead to laboratory models for studying genetically linked eye conditions, screening new drugs to treat those conditions and understanding the development of the human eye.

A Waisman Center research team led by David Gamm, an assistant professor of ophthalmology and visual sciences, and Jason Meyer, a research scientist, announced their discovery in the Aug. 24 edition of the Proceedings of the National Academy of Sciences.

"This is an important step forward for us, as it not only confirms that multiple retinal cells can be derived from human iPS cells using the Wisconsin approach, but also shows how similar the process is to normal human retinal development," Gamm says. "That is quite remarkable given that the starting cell is so different from a retinal cell and the whole process takes place in a plastic dish. We continue to be amazed at how deep we can probe into these early events and find that they mimic those found in developing retinas. Perhaps this is

the way to close the gap between what we know about building a retina in mice, frogs and flies with that of humans."

Gamm says the work built on the strong tradition of stem cell research at UW-Madison. James Thomson, a School of Medicine and Public Health faculty member and director of regenerative medicine at the Morgridge Institute for Research on the UW-Madison campus, announced that he had made human stem cells from skin, called induced pluripotent stem (iPS cells), in November 2007. Su-Chun Zhang, UW-Madison professor of anatomy and a Waisman researcher, was among the first to create neural cells from embryonic stem cells. Zhang was also part of the Gamm lab's retinal study. Meyer says the retina project began by using embryonic stem cells, but incorporated the iPS cells as they became available. Ultimately, the group was able to grow multiple types of retina cells beginning with either type of stem cell, starting with a highly enriched population of very primitive cells with the potential to become retina. This is critical, as it reduces contamination from unwanted cells early in the process. In normal human development, embryonic stem cells begin to differentiate into more specialized cell types about five days after fertilization. The retina develops from a group of cells that arise during the earliest stages of the developing nervous system. The Wisconsin team took cells from skin, turned them back into cells resembling embryonic stem cells, then triggered the development of retinal cell types.

"This is one of the most comprehensive demonstrations of a cell-based system for studying all of the key events that lead to the generation of specialized neural cells," Meyer says. "It could serve as a foundation for unlocking the mechanisms that produce human retinal cells."

Because the group was successful using the iPS cells, they expect this advance to lead to studying retinal development in detail and treating conditions that are genetically linked. For example, skin from a patient with retinitis pigmentosa could be reprogrammed into iPS cells, then retina cells, which would allow researchers to screen large numbers of potential drugs for treating or curing the condition.

Likewise, someday ophthalmologists may be able to repair damage to the retina by growing rescue or repair cells from the patient's skin. Earlier this year, scientists from the University of Washington showed that human ES cells had the potential to replace retinal cells lost during disease in mice.

"We're able to produce significant numbers of photoreceptor cells and other retinal cell types using our system, which are lost in many disorders," Meyer says. Photoreceptors are light-sensitive cells that absorb light and transmit the image as an electrical signal to the brain.

The team had similar success in creating the multiple specialized types of retina cells from embryonic stem cells, underscoring the similarities between ES and iPS cells. However, Gamm emphasizes that there are differences between these cell types as well. More work is needed to understand their potential and their limitations.

Other members of Gamm's Waisman Center research team involved in this study include Elizabeth Capowski, Lynda Wright, Kyle Wallace, Rebecca Shearer and Erin McMillan.

The research was funded by the National Institutes of Health, the Foundation Fighting Blindness, the Walsh Family Foundation, the Lincy Foundation and the Retina Research Foundation.

Lower-cost solar cells to be printed like newspaper, painted on rooftops

By Daniel J. Vargas August 10, 2009

Solar cells could soon be produced more cheaply using nanoparticle “inks” that allow them to be printed like newspaper or painted onto the sides of buildings or rooftops to absorb electricity-producing sunlight.

Brian Korgel, a University of Texas at Austin chemical engineer, is hoping to cut costs to one-tenth of their current price by replacing the standard manufacturing process for solar cells – gas-phase deposition in a vacuum chamber, which requires high temperatures and is relatively expensive.

“That’s essentially what’s needed to make solar-cell technology and photovoltaics widely adopted,” Korgel said. “The sun provides a nearly unlimited energy resource, but existing solar energy harvesting technologies are prohibitively expensive and cannot compete with fossil fuels.”

For the past two years, Korgel and his team have been working on this low-cost, nanomaterials solution to photovoltaics – or solar cell – manufacturing. Korgel is collaborating with professors Al Bard and Paul Barbara, both of the Department of Chemistry and Biochemistry, and Professor Ananth Dodabalapur of the Electrical and Computer Engineering Department. They recently showed proof-of-concept in a recent issue of Journal of the American Chemical Society.

The inks could be printed on a roll-to-roll printing process on a plastic substrate or stainless steel. And the prospect of being able to paint the “inks” onto a rooftop or building is not far-fetched.

“You’d have to paint the light-absorbing material and a few other layers as well,” Korgel said. “This is one step in the direction towards paintable solar cells.”

Korgel uses the light-absorbing nanomaterials, which are 10,000 times thinner than a strand of hair, because their microscopic size allows for new physical properties that can help enable higher-efficiency devices.

In 2002, he co-founded a company called Innovalight, based in California, which is producing inks using silicon as the basis. This time, Korgel and his team are using copper indium gallium selenide or CIGS, which is both cheaper and benign in terms of environmental impact.

"CIGS has some potential advantages over silicon," Korgel said. "It's a direct band gap semiconductor, which means that you need much less material to make a solar cell, and that's one of the biggest potential advantages."

His team has developed solar-cell prototypes with efficiencies at one percent; however, they need to be about 10 percent.

"If we get to 10 percent, then there's real potential for commercialization," Korgel said. "If it works, I think you could see it being used in three to five years."

He also said that the inks, which are semi-transparent, could help realize the prospect of having windows that double as solar cells. Korgel said his work has attracted the interest of industrial partners.

Funding for the research comes from the National Science Foundation, the Welch Foundation and the Air Force Research Laboratory. For more information on Korgel's work, go to: www.che.utexas.edu/korgel-group/

Disrupt emergency exits to boost evacuation rates

* 17:49 24 August 2009 **by Colin Barras**

Need to evacuate people quickly through a narrow opening? Put something in their way.

Physicists timed a crowd of 50 women as they exited as fast as possible through a door, and then repeated the experiment with a 20-centimetre-wide pillar placed 65 centimetres in front of the exit to the left-hand side. The obstacle improved the exit rate by an extra seven people per minute – from 2.8 people to 2.92 people per second.

Daichi Yanagisawa at the University of Tokyo, Japan, who led the research team, explains that the pillar creates a relatively uncrowded area where it's needed most – just in front of the exit.

Usually, the exit becomes clogged by people competing for the small space, and the crowd is slowed. The pillar blocks pedestrians arriving at the exit from the left so effectively that the number of people attempting to occupy the space just in front of the exit is reduced, says Yanagisawa. With reduced crowding there are fewer conflicts and the outflow rate increases.

But the positioning of the pillar is crucial, says Yanagisawa. When the researchers moved the pillar so that it stood directly in front of the exit's centre, rather than to the left, the outflow rate dropped to 2.78.

That's because there's a second factor influencing outflow rate, dubbed the turning function. As pedestrians approach the busy doorway they weave and duck to squeeze through the crowd. With every turn they lose momentum and their walking speed decreases, which reduces the rate of outflow through the exit

With the pillar offset to the left, the turning function of pedestrians approaching the exit from the left increases. Although they take longer to reach the exit, the total effect is an increase in outflow rate since those approaching from the centre or the right have a comparatively free and empty route to the exit.

But if the pillar is central, it affects the turning function of most pedestrians approaching the exit. Because more pedestrians are slowed down by the obstacle, the total outflow rate drops.

The findings could be used to design better emergency exits, says Yanagisawa. Other crowd-manipulating barriers are already used at some exits, says Ed Galea, a mathematical modeller at the University of Greenwich in the UK, whose own research has shown how a perpendicular bisector barrier at an exit can also reduce conflicts and improve the flow rate. *Journal reference: Physical Review E, in press*

Researchers Find Saying 'I'm Sorry' Influences Jurors

Apologizing for negative outcomes—a practice common even with children - may lead to more favorable verdicts for auditors in court, according to researchers at George Mason University and Oklahoma State University. The results of the study will be available in a forthcoming issue of Contemporary Accounting Research, published by the Canadian Academic Accounting Association.

Assistant accounting professors Rick Warne of Mason and Robert Cornell of OSU found that remedial tactics such as apologizing or first-person justification can result in lower frequencies of negligence verdicts in cases against auditors when compared to a control group receiving no remedial tactic. Apologies allow the accused wrongdoer to express sorrow or regret about a situation without admitting guilt. Alternatively, a first-person justification allows the accused to indicate the appropriateness of decisions given the information available when decisions were made.

"We found that apologies reduce the jurors' need to assign blame to the auditor for any negative outcomes to the client," says Warne. "It also appears that a first-person justification influences the jurors impression that the auditor's actions were reasonable and in accordance with professional standards."

The researchers administered several versions of a mock trial involving a lawsuit against an auditor whose actions had negative consequences on a client. In the scenario utilized by the researchers, the auditor performed an appropriate audit, yet the audited company eventually went into bankruptcy. The researchers examined whether a defendant making an apology, offering a justification, utilizing both techniques or remaining silent led to the most favorable verdicts.

Research in psychology, management and medicine concludes that remedial tactics are effective when expressed directly to injured parties. However, Cornell and Warne's research expands upon prior findings by examining the effects remedial tactics have on jurors who are indirectly involved and cannot directly forgive the accused.

"We know victims often respond favorably to an apology, but our findings suggest that even unharmed jurors react in a similar manner," says Cornell. "Offering an apology though is not synonymous with admitting guilt."

Approximately 30 states have some form of 'apology law' that prevents an apology from being used against a defendant as evidence in court. According to the researchers these laws encourage the use of apologies when disputes arise.

"Defense attorneys must consider several factors before having their client testify in court," says Warne. "However, we believe that most innocent parties could benefit from utilizing the apology and justification strategies when legal conflicts arise."

UCLA scientists uncover immune system's role in bone loss

Finding could lead to new therapies for osteoporosis

Got high cholesterol? You might want to consider a bone density test.

A new UCLA study sheds light on the link between high cholesterol and osteoporosis and identifies a new way that the body's immune cells play a role in bone loss.

Published Aug. 20 in the journal Clinical Immunology, the research could lead to new immune-based approaches for treating osteoporosis. Affecting 10 million Americans, the disease causes fragile bones and increases the risk of fractures, resulting in lost independence and mobility.

Scientists have long recognized the relationship between high cholesterol and osteoporosis, but pinpointing the exact mechanism connecting the two has proved elusive.

"We've known that osteoporosis patients have higher cholesterol levels, more severe clogging of the heart arteries and increased risk of stroke. We also knew that drugs that lower cholesterol reduce bone fractures, too," explained Rita Effros, professor of pathology at the David Geffen School of Medicine at UCLA. "What we didn't understand was why."

Effros suspected a clue to the mystery involved oxidation -- cell and tissue damage resulting from exposure of the fatty acids in cholesterol to molecules known as free radicals.

In the study, UCLA researchers focused on low-density lipoprotein (LDL), the so-called "bad" cholesterol. They examined how high levels of oxidized LDL affect bone and whether a type of immune cell called a T cell plays a role in the process.

Using blood samples from healthy human volunteers, the team isolated the participants' T cells and cultured them in a dish. Half of the T cells were combined with normal LDL– the rest was combined with oxidized LDL. The scientists stimulated half of the T cells to mimic an immune response and left the other half alone.

"Lo and behold, both the resting and the activated T cells started churning out a chemical that stimulates cells whose sole purpose is to destroy bone," said Effros. Called RANKL, the chemical is involved in immune response and bone physiology.

To investigate further how the immune system participates in bone loss, the scientists repeated the experiment in a mouse model. Half the animals were fed a high-fat diet starting at one month of age, while the control group ate a normal diet. At 11 months, the mice on the high-fat diet showed elevated cholesterol and thinner bones.

When Effros and her colleagues tested the T cells of the mice on the high-fat diet, they discovered that the cells acted differently than those of the mice on the normal diet.

The T cells switched on the gene that produces RANKL. The chemical also appeared in the animals' bloodstream, suggesting that the cellular activity contributed to their bone loss.

"It's normal for our T cells to produce small amounts of RANKL during an immune response," explained Effros. "But when RANKL is manufactured for long periods or at the wrong time, it results in excessive bone damage."

"That's exactly what happened to the mice on the high-fat diet," she said. "The animals' high cholesterol increased their levels of oxidized LDL, which told the T cells to keep generating RANKL. This discovery revealed to us how the immune system might play an entirely new role in bone loss."

The next step will be exploring methods to control T cell response to oxidized LDL in an effort to develop immune-based approaches to prevent or slow bone loss, Effros says.

The study was funded by the National Institute on Aging, the National Institute of Allergy and Infectious Diseases and the National Heart, Lung and Blood Institute.

Effros' coauthors were Lucia Graham, Farhad Parhami, Yin Tintut, Christina Kitchen and Linda Demer, all of UCLA.

Stopwatch found for Solar System

By Sudeep Chand Science reporter, BBC News

Scientists have found a new way to time events in the early Solar System.

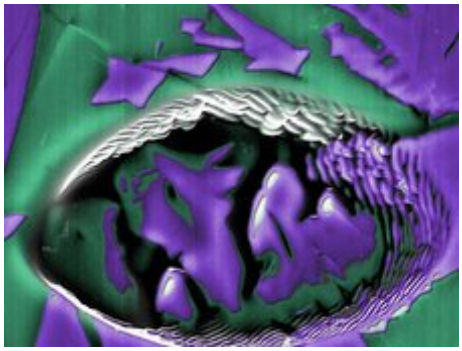
Writing in the journal Science, they describe how aluminium radioisotopes can now offer precise timing of events 4.5 billion years ago.

The study shows that the rate of decay of isotopes can now be relied upon to give accurate measures of time for that period.

It is hoped that this will give new insights into how the Solar System formed in its first five million years.

The scientists showed how aluminium radioisotopes were uniformly distributed in the region where the Solar System was formed.

As the isotopes decayed steadily across the early Solar System, this allows their use as a type of clock for that period.



Electron picture of a chondrule, part of a meteorite 4.5 billion years old

One of the scientists, Johan Villeneuve, told BBC News: "we can now use the isotopes to measure the age of different chondrules, parts of meteorites, and understand far more about the early part of our Solar System".

The findings could also shed light on the origins of the planets.

Philip Bland, from Imperial College London, described the research as "a really nice study". "With their high precision measurements, they are able to date formation times for chondrules very precisely," he said.

"And what is interesting is that they've shown that these building blocks for asteroids, and possibly for planets as well, formed over an extended period of two to three million years."

Broken hearts mend with 'patch'

By Sudeep Chand Science reporter, BBC News

A team of Israeli scientists has developed a potential way to fix the damage from heart attacks. A "patch" has been made from heart muscle that can be used to fix scarring left over from a heart attack.

Writing in the journal PNAS, the scientists describe how the technique strengthened the hearts of rats that had suffered heart attacks. The "patch" was grown in abdominal tissue first, then transplanted to damaged areas of the heart. This experiment is the first to show that such patches can actually improve the health of a heart after it has been damaged.

The scientists measured an increase in the size of the muscle in damaged areas, and improved conduction of the electrical impulses needed for the heart to pump normally.

Heart failure

Heart attacks usually cause irreversible damage to heart muscle. If people survive, then the damaged muscle can cause another serious condition called heart failure.

It is hoped that the procedure may eventually lead to treatments in humans because of its "simplicity and safety", the authors - led by Tal Dvir from Ben-Gurion University of the Negev in Beer-Sheva - wrote in Proceedings of the National Academy of Sciences (PNAS).

However, they added that "because most patients with heart attacks are old, and multiple surgery can pose a large risk to them, our strategy is not currently an option".

Ellen Mason, senior cardiac nurse at the British Heart Foundation (BHF), told BBC News: "In the last decade there has been significant research into injecting cells, including stem cells, into the heart to try and repair the damaged area. "This study was in animals, but may help scientists better understand how to repair damaged human hearts in the future." The technique is also being developed for livers and bladders.

Really?

The Claim: Some Foods Can Ease Arthritis Pain

By ANAHAD O'CONNOR

THE FACTS Patients with arthritis are often encouraged to steer clear of all sorts of foods. But few of these diets are supported by any evidence.

In one of the largest analyses of diet and various types of arthritis, researchers looked at data on more than 800 patients from 15 studies. They examined several diets popular among arthritis patients and found that the one that had the greatest effect was a Mediterranean-type diet emphasizing foods like fruits, vegetables, grains,

fish and olive oil, while limiting red meat. In 12 weeks, people on the diet reported about 15 percent less pain, but no improvement in physical function or morning stiffness. A vegetarian diet that allowed eggs and dairy products had a similar effect.

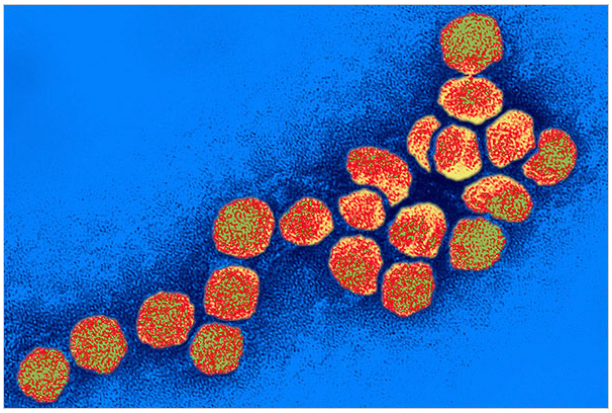
In other studies, patients who were given daily capsules of fish oil to take along with their antirheumatic medications saw greater benefits for swollen and tender joints than patients given a placebo, apparently because of the oil's anti-inflammatory properties.

Meanwhile, vegetables in the nightshade family, like potatoes and tomatoes, have long been said to contribute to arthritis pain. Some researchers have speculated that a group of compounds in the vegetables called alkaloids might worsen inflammation in sensitive people. But so far no solid studies have demonstrated this. Experts say a diet in which suspect foods are gradually removed should help patients identify any problematic foods.

THE BOTTOM LINE There is some evidence that certain diets may help with arthritis symptoms.

A Virus's Debut in a Doctor's Syringe

By KENT SEPKOWITZ, M.D.



Ten years ago this week, New York found itself at the center of a major public health drama: in Queens, a mysterious illness was attacking older men who liked to garden.

The minute-by-minute excitement resembled that of the recent pandemonium caused by swine flu, but with an important difference: in those first late-summer days of 1999, the cause of the outbreak was unknown. It was not until Sept. 24, after three people had died, that the culprit was identified. It was the mosquito-borne West Nile virus, and investigators grimly declared that it had never been seen in the United States.

Well, not quite. America's first cases of West Nile were actually seen in the 1950s, on the Upper East Side of Manhattan. But these cases occurred among people with terminal cancer. And the vector was not mosquitoes but the syringe of a researcher at what is now Memorial Sloan-Kettering Cancer Center.

DISEASE An image of West Nile virus, which a researcher in New York injected into people with advanced cancer as part of an experiment in the 1950s. **Science VU/C.D.C./Getty Images**

Sixty years ago, radiation and chemotherapy for cancer were in their infancy; if the surgeon could not cut a tumor out, things were just about hopeless. So the researcher, Dr. Chester M. Southam, was studying viruses for their cancer-killing potential. Studies had shown that a pathogen called the Russian spring-summer encephalitis virus could eradicate tumors in mice. Because that virus was considered too dangerous for people, Southam searched for something milder, settling on the newly discovered West Nile virus.

The work was done in two bedded rooms separated from the rest of the hospital by an old-fashioned screen door. Dr. Donald Armstrong, attending physician emeritus at Memorial Sloan-Kettering who was a trainee at the time, said the screens were placed to minimize the possibility that a rogue mosquito would transmit virus to other patients or staff members. Southam injected West Nile virus into more than 100 people with advanced cancer and few treatment options, then reported his findings in journals. The work generated substantial excitement. "Deep Cancers Temporarily Shrunk by Rare Nerve Virus From Africa," The New York Times reported on April 15, 1952.

"Nerve virus" indeed: Southam had selected West Nile because he thought it would be harmless. In naturally occurring cases from Africa, it had caused only slight fever. But in New York, things turned out quite differently. Eleven percent became ill, and a few quite ill, with symptoms of what we now consider classic West Nile encephalitis: fever, weakness, confusion and even seizures. Virus was isolated from the cerebrospinal fluid of one patient, while in others it was cultured from blood more than three weeks after inoculation.

In one type of cancer, lymphoma, tumors did shrink in 3 of 8 injected patients, compared with just a few responses in the 100 with other types of cancer. But five of the same eight lymphoma patients developed severe West Nile disease, including encephalitis — a rate far higher than in everyone else.

So Southam moved on. Intrigued by the body's ability to destroy infection, he wondered whether it might be trained to control tumors. For the rest of his career, he worked in the novel field of immune therapy, now one of the most exciting areas in cancer therapeutics. His West Nile work, meanwhile, spawned its own field.

Current approaches are more sophisticated than the old days behind the screen door. For example, some investigators booby-trap a virus, then send it off to deliver its toxic package to the cancer cell. In others

approaches, a virus is injected to provoke a general immune response. And in still others, the virus does what Southam had predicted: kills a tumor directly.

But rather than being revered as the father of viral therapy or as a patriarch in the field of immunotherapy, Southam became notorious for something entirely different. His enthusiasm for understanding how the immune system might be kick-started to control cancer nearly cost him his career. To study the immune response to cancer, he injected live tumor cells into people without malignancy; he selected 53 prisoners in the Ohio State Penitentiary and, years later, 22 elderly, dying patients in Brooklyn.

A 2004 essay by Dr. Barron H. Lerner in The New England Journal of Medicine recounted the “enormous controversy” that followed the Brooklyn episode. In a case brought by the state attorney general before the Board of Regents of the State University of New York in 1964, Southam was found to have committed “fraud or deceit” and unprofessional conduct. (Despite or because of this, he was soon elected president of the American Association for Cancer Research.)

The case became a flashpoint in the national debate about proper protection of human volunteers. Not that the idea was new to him: in one West Nile article, he noted that “all patients were volunteers and were informed of the experimental nature and the infectious nature of the virus inoculation.”

Southam died in 2002, at 82. As it turned out, his greatest contribution to medicine was not his groundbreaking work in viral or immune therapies of cancer. Rather, he occupies the unenviable position of having focused public attention on the ethical problems related to clinical research — and, as such, was pivotal in the creation of our current system, in which highest priority goes not to the acquisition of medical knowledge but to the safety of human volunteers.

Dr. Kent Sepkowitz is vice chairman of medicine at Memorial Sloan-Kettering Cancer Center.

Not Exactly Rocket Science

Holding heavy objects makes us see things as more important

Posted on: August 25, 2009 12:00 PM, **by Ed Yong**

Gravity affects not just our bodies and our behaviours, but our very thoughts. That's the fascinating conclusion of a new study which shows that simply holding a heavy object can affect the way we think. A simple heavy clipboard can makes issues seem weightier - when holding one, volunteers think of situations as more important and they invest more mental effort in dealing with abstract issues.

In a variety of languages, from English to Dutch to Chinese, importance is often described by words pertaining to weight. We speak of 'heavy news, 'weighty matters' and 'light entertainment'. We weigh up the value of evidence, we lend weight to arguments with facts, and our opinions carry weight if we wield influence and authority. These are more than just quirks of language - they reflect real links that our minds make between weight and importance.

Nils Jostmann from the University of Amsterdam demonstrated the link between weight and importance through a quartet of experiments. In each one, a different set of volunteers held a clipboard that either weighed 1.5 pounds or 2.3 pounds.

The extra 0.8 pounds were enough to make volunteers think that a foreign currency was worth more money. Forty volunteers were asked to guess the conversion rates between euros and six other currencies, indicating their estimate by marking a straight line. Those who held the heavier clipboard valued the currencies more generously, even though a separate questionnaire showed that they felt the same about the euro.

Money, of course, does have its own weight, so for his next trick, Jostmann wanted to stay entirely within the abstract realm. He considered justice - an area that is free of weight but hardly free of importance. Jostmann showed 50 volunteers a scenario where a university committee was denying students the opportunity to voice their opinions on a study grant. It was a potentially weighty issue, but more so to the students who held the heavy clipboard. They felt it was more important that the university listened to the students' opinions.

Jostmann also showed that people are less likely to take matters lightly if they're holding something heavier. In his third task, he asked 49 recruits to rate the mayor of Amsterdam in terms of his competence, likeability, powerlessness, trustworthiness, intelligence, corruption, importance and charisma. They also had to give their opinion about Amsterdam itself - whether it was a great city and how much they enjoyed being in it. The weight of the clipboards didn't affect the evaluations of either the mayor or the city. However, the two sets of scores were more strongly correlated among the volunteers who held the heavier board.

Jostmann thinks that the extra weight made people invest that little bit more mental effort in awarding their scores - hence the more consistent rankings across the mayor- and city-based questions. This result, I feel, is a bit more tenuous. Jostmann argues the case that satisfaction with the mayor is an indirect measure of satisfaction with the city, so the two scores should match to some extent. That seems reasonable, but it hasn't been demonstrated, which makes interpreting the study a bit more difficult.

In the final task, 40 visitors were asked to say whether they agreed with six statements about the construction of a controversial new subway that was big news at the time. The list included three arguments that previous volunteers had deemed as weak (e.g. the building of the subway is a sign of courage to handle large-scale projects) and three arguments that were stronger (e.g. the subway will make the city more accessible).

In all cases, the volunteers agreed more with the strong arguments but especially so if they held the heavier clipboards. This group were also more confident in their opinions and were more likely to be clearly in favour of the subway or against it, rather than dawdling on the fence. Again, the results suggest that under the influence of the weightier board, people make stronger and more polarised judgments, and they do so more confidently.

The effects of the clipboards were small but statistically significant - unlikely to have arisen by chance. The boards didn't affect the moods of the volunteers, and with a weight of just 2.3 pounds, no one felt that the heavier board was actually burdensome to hold.

Instead, Jostmann reasons that the link between weight and importance is rooted in our early childhood experiences, when we rapidly learn that heavy objects require more effort to deal with, not just in terms of strength but planning too. Our brain relies on these concrete physical experiences when it represents more abstract concepts, like importance. The two are then joined, so that physical experiences can affect abstract thought.

This is far from the first study that has supported this "theory of embodied cognition". Jostmann's explanation can also account for why thinking clean thoughts can soften moral judgments and why immoral thoughts trigger a need for physical cleanliness. It's why warming our hands can make us socially warmer, why social exclusion literally feels cold.

***Update**: Just realised that I've been totally scooped by Vaughan at Mind Hacks. Go over there for another take.*

An aside: I love academia. The paper says, "Being hit by a heavy object generally has more profound consequences than being hit by a light object." I will remember this the next time I'm hit by a heavy object. Instead of a primal scream, I will opt for a more dignified, "Lo. I am struck. The consequences are most profound."

Reference: Jostmann, N., Lakens, D., & Schubert, T. (2009). Weight as an Embodiment of Importance Psychological Science DOI: 10.1111/j.1467-9280.2009.02426.x

Diving Deep for a Living Fossil

By WILLIAM J. BROAD

For 33 years, Peter A. Rona has pursued an ancient, elusive animal, repeatedly plunging down more than two miles to the muddy seabed of the North Atlantic to search out, and if possible, pry loose his quarry.

Like Ahab, he has failed time and again. Despite access to the world's best equipment for deep exploration, he has always come back empty-handed, the creature eluding his grip.

The animal is no white whale. And Dr. Rona is no unhinged Captain Ahab, but rather a distinguished oceanographer at Rutgers University. And he has now succeeded in making an intellectual splash with a new research report, written with a team of a dozen colleagues.

They have gathered enough evidence to prove that his scientific prey - an organism a bit larger than a poker chip - represents one of the world's oldest living fossils, perhaps the oldest. The ancestors of the creature, Paleodictyon nodosum, go back to the dawn of complex life. And the creature itself, known from fossils, was once thought to have gone extinct some 50 million years ago.

Has the long pursuit frustrated him? "No," Dr. Rona replied as he displayed traces of the animal in sedimentary rocks some 50 million years old. "It's science. It's detective work. It's about racking up one clue after another."

Still, in an interview at Rutgers, Dr. Rona said he looked forward to eventually capturing one of the creatures alive. "I think it's likely," he said, "if we can do the dives." Dr. Rona, an authority on the deep sea, likes nothing better than to cram himself into a tiny submersible and fall into the abyss.

It takes more than two hours to descend to the creature's abode, which lies more than two miles down. The environmental stability of that world - including its crushing pressures and icy darkness - means that some of its most famous inhabitants have survived for eons as evolutionary throwbacks, their bodies undergoing little change. For instance, sea lilies, marine animals with feathery arms, date back more than 400 million years.

Dr. Rona has found that P. nodosum thrives in restricted areas of Atlantic seabed. Its only visible feature consists of tiny holes arranged in six-sided patterns that look curiously like the hearts of Chinese checkers boards. He has photographed thousands of the hexagons and found that large ones have 200 or 300 holes.

Dr. Rona's inability to catch the creature itself means that even though scientists have given it the fossil's name, they still vigorously debate what it is. The main question is whether the hexagonal patterns are burrows or body parts, vacant residences or animal remains.

Other deep sea sleuths who share Dr. Rona's fascination with P. nodosum can be found at Yale and the Woods Hole Oceanographic Institution on Cape Cod, as well as institutions in France, Canada and the United Kingdom.

"He's got the drive of curiosity," said Adolf Seilacher, a paleontologist at Yale and co-author of the new paper who first contacted Dr. Rona three decades ago to discuss the creature. "Real scientists, naturalists, are extremely curious."

Dr. Seilacher added that P. nodosum was a most unusual animal, especially because the many holes at the surface of its abode link up below in a labyrinth of subsurface tunnels.

The creature that created this trace fossil, Paleodictyon nodosum, tens of millions of years ago may still be alive in the deep Atlantic. **The Stephen Low Company and Rutgers University**

"It's not just any fossil but a demonstration of a very complex way of life," he said in an interview. "It's a building plan, a behavior that makes this animal erect this gallery system. It's a lifestyle that is very, very old."

Dr. Seilacher said the earliest forms of Paleodictyon dated to the explosion of complex life in the Cambrian period some 500 million years ago. The animals began existence in shallow waters, he added, and gradually expanded into the dark habitats of the deep sea.

Dr. Rona became fascinated by the abyss in a roundabout way. His first love was rocks and mountains. In 1957, he received a master's degree in geology from Yale and went to work for Standard Oil, exploring the American Southwest for promising sites.

But in 1958, while visiting his family in Manhattan over the Christmas holidays, he came upon groups of oceanographers and research ships, their vessels moored to West Side piers. The famous scientists, in New York for a meeting, spoke of a vast new world.

By the early 1970s, armed with a doctorate in marine geology and geophysics from Yale, Dr. Rona was exploring the deep Atlantic for the National Oceanographic and Atmospheric Administration. He used dredges, cameras and echo sounders that mapped the seabed.

In 1976, he stumbled on the living fossil.

Dr. Rona and his colleagues were towing a giant camera sled, its strobe lights firing every few seconds, lighting up the seabed and recording the images on big reels of 35-millimeter film. Weeks later, back in his Florida office, Dr. Rona examined the freshly developed film.

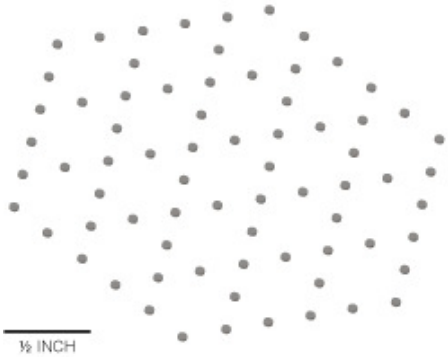
His head began to spin.

What were all the holes? And what made the patterns?

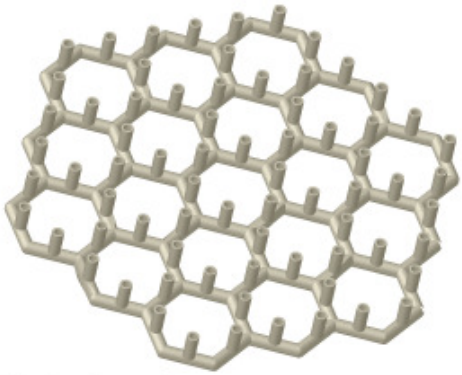
At first, Dr. Rona assumed the film developers were pulling a prank. Then, as a magnifying glass drove home the reality of the holes, he got paranoid and weighed the possibility that the patterns represented the footprints of alien creatures from outer space that were colonizing the remote seabed. Fortunately, he let that idea drop, and began interviewing the best marine biologists he could find, first in Florida, then in Washington at the Smithsonian Institution. He struck out. No one had a clue.

Intricate Traces of an Elusive Creature

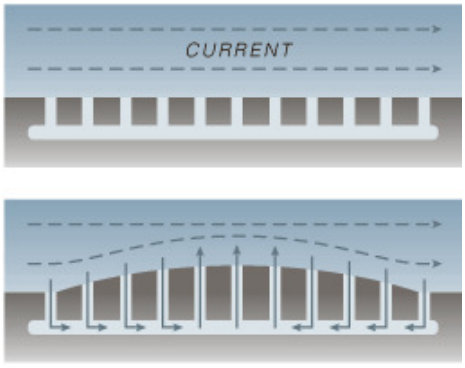
In 1976, scientists discovered thousands of hexagonal patterns in sediment along the Mid-Atlantic ridge. Further exploration has shown they were made by Paleodictyon nodosum, a living fossil thought to have gone extinct some 50 million years ago.



Signature in the sediment
Many species make holes in sediment, but P. nodosum forms a distinctive pattern of tiny holes arranged in a hexagonal grid. The pattern is typically one to three inches wide with a slight upward bulge.



Under the surface
Casts of specimens have shown that the holes are hollow columns, connected under the sediment by a labyrinth of tubes. The tubes might be burrows tended by the animal, or the hollow left after the animal's body dies and decays.



Models of the tube system
Lab experiments have shown that flat tube structures do not circulate water, but raised structures like those created by P. nodosum circulate water and might trap or nourish micro-organisms for later consumption.

Sources: Deep-Sea Research Part II; Peter A. Rona

THE NEW YORK TIMES

In 1978, Dr. Rona and a colleague, George F. Merrill, published a paper that ruled out many possibilities and called the mystery animals "invertebrates of uncertain identity."

The breakthrough came soon thereafter. Dr. Seilacher, then at the Institute of Geology and Paleontology at the University of Tübingen, in Germany, wrote Dr. Rona to say the organism bore "perfect identity" with the fossil P. nodosum. He called the link "beyond any doubt."

In his letter, Dr. Seilacher suggested that the two scientists collaborate to study the creature. "I would love to participate in this adventure," he wrote.

Nothing happened. The Atlantic site was too remote, too costly to scrutinize.

In 1985, all that changed. Nearby, Dr. Rona and his colleagues discovered a riot of hot springs and bizarre life, including millions of shrimp. Suddenly, governments around the globe found the wherewithal to send oceanographers racing to the middle of the North Atlantic to explore the teeming springs.

Dr. Rona's creatures lay less than a mile way. Piggybacking on high-priority missions, he managed to visit the muddy site repeatedly, making submersible dives in 1990, 1991, 1993, 2001 and 2003. On the latter dive, he and Dr. Seilacher went down together.

Their collaboration made them improbable movie stars. In 2003, IMAX released "Volcanoes of the Deep Sea," featuring their hunt for the living fossil.

Repeatedly, Dr. Rona tried to capture living specimens. He would have a hollow plastic tube lowered over a hexagonal spot and scoop up a thick core of seabed mud. But detailed inspections of the muck never revealed anything of significance — no body parts, no biological fibers, no DNA.

The 2003 dive of Dr. Rona and Dr. Seilacher did, however, produce hard evidence that finally linked the animal to P. nodosum. The robot arm of the submersible Alvin directed a hose that squirted water at a hexagonal array of holes, slowly removing layers of mud. The delicate operation quickly revealed a hexagonal array of subsurface tunnels identical to those of the fossil. "For me," Dr. Rona recalled, "it was a eureka moment."

In May, the team's new paper appeared in the online version of Deep-Sea Research, Part II, an oceanographic journal published twice monthly. The printed article is due out in September.

The paper - more than a dozen pages filled with dense type, figures and photographs - reviews the evidence of more than three decades and concludes that the hexagonal forms "are identical" with P. nodosum, backing the conclusion Dr. Seilacher reached long ago.

The paper seeks no consensus on the question of whether the holes and subsurface networks represent burrows or body parts. Dr. Seilacher, who backs the burrow idea, sees the tunnels as a kind of farm where an unknown type of worm or other organism raises micro-organisms to eat.

Dr. Rona sees the holes as body parts, perhaps from a type of compressed sponge. The lack of biological clues, he said in the interview, may arise because microbial predators eat the remains after the creatures die.

The reason the team had captured no living specimens, he added, may lie in the great age and number of empty abodes, or bodies. Dr. Rona said the area's light sedimentation meant fresh-looking holes "can persist on the seafloor for hundreds of years."

Neither man will give in to the other on the subject of what the holes represent - despite their collaboration of more than three decades. "Disagreement is necessary in science," Dr. Seilacher said. "It's good because it forces you to find new arguments and more arguments."

Dr. Rona seems eager to find new evidence and arguments. He talks excitedly of new dives to the inky world of Paleodictyon as well as the possibility of setting up a remote camera on the seabed that would try to catch a glimpse of the ancient survivor as it grows and interacts with its dark environment.

"It's an exceptional window into the past," he said of the creature. "Now we need to solve the mystery of what it is. We need to recover a specimen."

Long-term tamoxifen use increases risk of an aggressive, hard to treat type of second breast cancer

Study finds a more than four-fold increased risk of ER negative second cancers

SEATTLE – While long-term tamoxifen use among breast cancer survivors decreases their risk of developing the most common, less aggressive type of second breast cancer, such use is associated with a more than four-fold increased risk of a more aggressive, difficult-to-treat type of cancer in the breast opposite, or contralateral, to the initial tumor. These findings by Christopher Li, M.D., Ph.D., and colleagues at Fred Hutchinson Cancer Research Center were published online Aug. 25 in the journal Cancer Research.

Hormonal therapy with drugs like tamoxifen is one of the most common treatments for breast cancer because it has been shown to reduce the risk of dying from the disease but, as this study suggests, it does have risks.

Comparing breast-cancer patients who received the estrogen-blocking drug tamoxifen to those who did not, the researchers found that while the drug was associated with a 60 percent reduction in estrogen receptor-positive, or ER positive, second breast cancer – the more common type, which is responsive to estrogen-blocking therapy – it also appeared to increase the risk of ER negative second cancer by 440 percent. "This is of concern, given the poorer prognosis of ER-negative tumors, which are also more difficult to treat," said Li, an associate member of the Hutchinson Center's Public Health Sciences Division.

These findings confirm preliminary research by Li and colleagues, published in 2001, which was the first to suggest a link between long-term tamoxifen use and an increased risk of ER-negative second cancers. "The earlier study had a number of limitations. For example, we did not have information on the duration of tamoxifen therapy the women received," Li said. "The current study is larger, is based on much more detailed data, and is the first study specifically designed to determine whether tamoxifen use among breast cancer survivors influences their risk of different types of second breast cancers," Li said.

This new study assessed history of tamoxifen use among 1,103 breast cancer survivors from the Seattle-Puget Sound region who were initially diagnosed with ER positive breast cancer between the ages of 40 and 79. Of these, 369 of the women went on to develop a second breast cancer. Nearly all of the women in the study who took adjuvant hormonal therapy used tamoxifen specifically. Detailed information about tamoxifen use was ascertained from telephone interviews and medical record reviews.

While the study confirmed a strong association between long-term tamoxifen therapy and an increased risk of ER-negative second cancer, it does not suggest that breast cancer survivors should stop taking hormone therapy to prevent a second cancer, Li said.

"It is clear that estrogen-blocking drugs like tamoxifen have important clinical benefits and have led to major improvements in breast cancer survival rates. However, these therapies have risks, and an increased risk of ER negative second cancer may be one of them. Still, the benefits of this therapy are well established and doctors should continue to recommend hormonal therapy for breast cancer patients who can benefit from it," Li said.

Hormone therapy for prostate cancer patients with heart conditions linked to increased death risk

Men with coronary artery disease-induced congestive heart failure or heart attack who receive hormone therapy before or along with radiation therapy for treatment of prostate cancer have an associated increased risk of death, according to a study in the August 26 issue of JAMA.

Patients with localized prostate cancer have several options available for treatment, including the use of brachytherapy (treatment in which radioactive seeds are implanted in the prostate), both as monotherapy and in conjunction with external beam radiation therapy, according to background information in the article. Neoadjuvant (treatment that is given before or with the primary treatment) hormonal therapy (HT) is used as a means for prostate gland cytoreduction (decrease in number of cells, as in a tumor) in order to eliminate pubic arch (an arch formed by the pubic bones) interference and improve the ability to perform brachytherapy. Previous research has suggested that "hormonal therapy when added to radiation therapy (RT) for treating unfavorable-risk prostate cancer leads to an increase in survival except possibly in men with moderate to severe comorbidity [co-existing illnesses]. However, it is unknown which comorbid conditions eliminate this survival benefit," the authors write.

Akash Nanda, M.D., Ph.D., of Brigham & Women's Hospital–Dana-Farber Cancer Institute, Boston, and colleagues assessed whether neoadjuvant HT use in men with prostate cancer treated with brachytherapy affects the risk of all-cause death of men with known coronary artery disease–induced conditions, including congestive heart failure and heart attack. The study included 5,077 men (median [midpoint] age, 69.5 years) with localized or locally advanced prostate cancer who were treated with or without a median of 4 months of neoadjuvant HT followed by RT between 1997 and 2006 and were followed up until July 2008.

During the study period, 419 men died. Of those, 200 had no underlying comorbidity, 176 had one coronary artery disease risk factor, and 43 had a history of known coronary artery disease resulting in congestive heart failure or heart attack. Analyses of the data indicated that "when considering comorbidity groups separately, neoadjuvant HT use was not associated with an increased risk of all-cause mortality in men with no comorbidity (9.6 percent vs. 6.7 percent) or a single coronary artery disease risk factor (10.7 percent vs. 7.0 percent) after median follow-ups of 5.0 years and 4.4 years, respectively," the researchers write.

However, for men with coronary artery disease–induced congestive heart failure or heart attack, after a median follow-up of 5.1 years, neoadjuvant HT use was associated with nearly twice the risk of all-cause mortality (26.3 percent vs. 11.2 percent).

"It is also important to note that the population of men in whom the use of neoadjuvant HT may be detrimental was limited to 5 percent (256 of 5,077) in this community-based study cohort. This latter point may

explain why there has been a survival benefit observed in the major randomized trials comparing HT plus external beam radiation therapy to external beam radiation therapy alone," the authors write.

"The clinical significance of this finding is that for men with favorable-risk prostate cancer and a history of congestive heart failure or myocardial infarction who require neoadjuvant HT solely to eliminate pubic arch interference, alternative strategies such as active surveillance or treatment with external beam radiation therapy or prostatectomy should be considered. However, for men with unfavorable–risk prostate cancer who require HT in addition to radiation therapy to take advantage of its survival benefit, appropriate medical evaluation prior to initiation should facilitate clinicians in balancing the relative risks against the benefits of HT use."
(JAMA. 2009;302[8]:866-873. Available pre-embargo to the media at www.jamamedia.org)

Unlocking the body's defenses against cancer

Scientists have discovered a way of allowing healthy cells to take charge of cancerous cells and stop them developing into tumours in what could provide a new approach to treating early-stage cancers.

University of Manchester researchers found that a special type of the chemicals known as 'kinase inhibitors' opened up communication channels on the surface of cells that enabled healthy cells to 'talk' to the cancer cells.

"When we added the chemicals to a mixture of healthy and cancerous cells in a flask the diseased cells stopped multiplying and began acting like normal cells again," said Dr Ian Hampson, who carried out the research with wife Dr Lynne Hampson.

"Further tests revealed that the chemicals helped the cancer cells form connections with surrounding healthy cells that allowed these normal cells to take charge of the mechanism by which cancer cells divide and grow out of control."

Cell division occurs naturally and continuously in human organs and tissue as part of the body's normal repair processes to combat wear and tear but in cancer the cells divide in an uncontrolled way.

Dr Hampson says the findings, published in the British Journal of Cancer, are all the more exciting because the chemicals, which were developed with colleagues at the University of Salford, appear to be relatively non-toxic and the positive effect on the cancer cells persists even when the chemicals are withdrawn.

"When the chemicals were added to a culture containing just cancer cells they had little effect," said Dr Hampson, who is based in Manchester's School of Cancer and Imaging Sciences. "It was only when we added the chemicals to a mixture of cancer cells and normal cells – similar to how you would find them in the body – that growth was suppressed.

"Intriguingly, the connections that allowed the healthy cells to communicate with the cancer cells stayed open even when the kinase inhibitors were removed indicating that a potential drug based on these chemicals could be given as a short course of treatment.

"Furthermore, the chemicals are non-poisonous and do not actually kill cells like conventional cancer therapies, such as chemotherapy and radiotherapy, so if we were able to develop a drug it is likely to have far fewer side-effects."

The team say the next stage of their research will be to find out exactly how the chemicals are able to increase the number of connections between cancer and normal cells. Once this is known, it should be possible to produce a drug based on these chemicals that could hopefully be used in humans.

Dr Lynne Hampson added: "We are currently applying for funding to carry out further research into the biochemistry of how these chemicals cause the effect we have observed. We also intend to investigate the use of different types of cell cultures to assess the potency and range of activity of these agents."
The research was funded by the Association for International Cancer Research, The Humane Research Trust, The Caring Cancer Research Trust, Kidscan and the Cancer Prevention Research Trust.

Ant has given up sex completely, report Texas researchers

AUSTIN, Texas—The complete asexuality of a widespread fungus-gardening ant, the only ant species in the world known to have dispensed with males entirely, has been confirmed by a team of Texas and Brazilian researchers.

Most social insects - the wasps, ants and bees - are relatively used to daily life without males. Their colonies are well run by swarms of sterile sisters lorded over by an egg-laying queen. But, eventually, all social insect species have the ability to produce a crop of males who go forth in the world to fertilize new queens and propagate.

Queens of the ant Mycocepurus smithii reproduce without fertilization and males appear to be completely absent, report Christian Rabeling, Ulrich Mueller and their Brazilian colleagues in PLoS ONE this week.

"Animals that are completely asexual are relatively rare, which makes this is a very interesting ant," says Rabeling, an ecology, evolution and behavior graduate student at The University of Texas at Austin. "Asexual species don't mix their genes through recombination, so you expect harmful mutations to accumulate over time

and for the species to go extinct more quickly than others. They don't generally persist for very long over evolutionary time."

Previous studies of the ants from Puerto Rico and Panama have pointed toward the ants being completely asexual. One study in particular, by Mueller and former graduate student Anna Himler (now at Arizona State University), showed that the ants reproduced in the lab without males, and that no amount of stress induced the production of males.

Scientists believed that specimens of male ants previously collected in Brazil in the 1960s could be males of M. smithii. If males of the species existed, it would suggest that—at least from time to time—the ants reproduce sexually.

Rabeling analyzed the males in question and discovered that they belonged to another closely related (sexually reproducing) species of fungus-farmer, Mycocepurus obsoletus, thus establishing that no males are known to exist for M. smithii. He also dissected reproducing M. smithii queens from Brazil and found that their sperm storage organs were empty.

Taken together with the previous studies of the ants, Rabeling and his colleagues have concluded that the species is very likely to be totally asexual across its entire range, from Northern Mexico through Central America to Brazil, including some Caribbean islands.

As for the age of the species, the scientists estimate the ants could have first evolved within the last one to two million years, a very young species given that the fungus-farming ants evolved 50 million years ago.

Rabeling says he is using genetic markers to study the evolution and systematics of the fungus-gardening ants and this will help determine the date of the appearance and genetic mechanism of asexual reproduction more precisely in the near future.

New Research Examines How Career Dreams Die

COLUMBUS, Ohio – A new study shows just what it takes to convince a person that he isn't qualified to achieve the career of his dreams.

Researchers found that it's not enough to tell people they don't have the skills or the grades to make their goal a reality. People will cling to their dreams until they're clearly shown not only why they're not qualified, but also what bad things can happen if they pursue their goals and fail.

"Most people don't give up easily on the dreams. They have to be given a graphic picture of what failure will look like if they don't make it," said Patrick Carroll, co-author of the study and assistant professor of psychology at Ohio State University at Lima.

The findings are especially relevant now as students prepare for an uncertain job market and they, along with their teachers and guidance counselors, try to find the best career choices for them.

"Educators are trying to lead students to the most realistic career options," Carroll said. "You want to encourage students to pursue their dreams, but you don't want to give them false hope about their abilities and talents. It's a fine line.

"This research is important to understanding how students make revisions in their career goals and decide which career possibilities should be abandoned as unrealistic given their current qualifications. They can then zero in on more realistic possible selves that they actually are qualified to achieve," he said.

Carroll conducted the study with Robert Arkin, professor of psychology at Ohio State, and James Sheppard, professor of psychology at the University of Florida. Their results appear in the current issue of the journal Social Cognition.

The research included two similar studies involving separate groups of 64 and 70 upperclass business and psychology students at Ohio State.

The students signed up to meet with a career advisor to learn about a supposedly new master's degree program in business psychology that would train them for "high-paying consulting positions as business psychologists."

However, the program didn't actually exist. The goal was to get the students interested in the program, and see how they reacted when faced with varying levels of threat to their new dreams of becoming a business psychologist.

All the students filled out information sheets which included their current grade point averages.

The students were then separated into four groups. Students in the control group were given an information sheet indicating no GPA requirement for the program.

The other three groups were given sheets indicating the GPA requirement was .10 above whatever they had listed as their own GPA.

In one of these groups, the "career advisor" – who actually worked with the researchers -- simply pointed out that the students' GPA was lower than the requirement.

In another group, the threat was raised slightly: the advisor told the participants that they weren't what they were looking for in the program and that it was unlikely they would be admitted. But the advisor encouraged these participants to apply if they were interested, because they might be reviewed by a lenient admissions committee.

The last group received the strongest threat to their hopes of becoming a business psychologist: they were also told they were not qualified, but might sneak in with a lenient admission committee. But the advisor added that if that happened, the student would probably struggle with the high demands of the program and ultimately end up with no job prospects if he or she somehow managed to graduate.

To add to the threat, the advisor mentioned that he or she knew of cases at other schools where unqualified students couldn't get placed in jobs after graduation and often ended up in low-paying office jobs unrelated to business psychology.

"In this case, the students were given a very vivid picture of what might happen if they failed," Carroll said.

In both studies, the results were similar and striking. The students in the control group and those who were simply told their GPA was too low for the program didn't give up the dream. In tests given after their meetings with the career advisor, these participants actually showed declines in the amount of self-doubt they had about their abilities and showed higher levels of commitment to pursing the degree.

"We have a brilliant ability to spin, deflect or outright dismiss undesired evidence that we can't do something," Carroll said. "We try to find reasons to believe."

However, students given the most vivid threat had higher levels of self-doubt immediately after meeting with the advisor, lower expectations and lower commitment to pursuing a business psychology career.

Carroll said anxiety played the key role for getting these students to drop their interest in becoming business psychologists.

Those who received the strongest threat began with high levels of doubt about their abilities. But they then also experienced much higher anxiety levels as they considered the vivid prospects of failure presented to them.

This led them to lower expectations about getting in to the program, and finally lower anxiety when tested later as they dropped their dream and accepted the fact that they would not become business psychologists.

Carroll said he sees the relevance of this research nearly every day, as students seek his input about career plans or the possibility of graduate school. Sometimes these students have not gotten good enough grades or shown the work ethic they would need to succeed at higher levels, he said.

Still, Carroll said he doesn't often use what he knows to bring these students back to reality.

"I'm very cautious about using what I know with students," he said. "You're dealing with people's dreams and hopes, and with that awareness comes great responsibility.

"The dreams of who you could become are a very important part of how you define yourself, yet they are very vulnerable given that they exist only in our mind's eye as the best possible guesses from current evidence of what we could become in the future," he said. "We need to learn more about how those career dreams are constructed and revised."

In new research, Carroll and his colleagues hope to do just that. The new focus is on what happens when people have to reject certain goals for the future, and whether this process hurts them or helps them find new goals. *This research was supported by a grant from the National Institute of Mental Health.*

Magic ink offers full-colour printing in an instant

* 11:02 25 August 2009 by **Colin Barras**

Borrowing an idea from nature could lead to technology capable of producing full-colour prints in a fraction of a second, according to South Korean engineers.

Many insects and birds owe their bright colours to the interaction of light with finely-patterned surface textures, rather than relying on pigments. The iridescent colours of a peacock's tail are largely a result of the interaction of light with just one biological material – melanin rods.

Engineers have long experimented with replicating these so-called structural colours in synthetic materials, and now Sunghoon Kwon's team at Seoul National University in South Korea has managed it.

Their M-Ink can be used to produce any colour in the visible spectrum and could lead to a new method of cheap and fast full-colour printing, Kwon says.

Just add nanoparticles

M-Ink contains three ingredients: magnetic nanoparticles 100 to 200 nanometres across, a solvation liquid, and a resin. The nanoparticles disperse throughout the resin, giving the ink a brown appearance. But when an external magnetic field is applied, the nanoparticles immediately snap to the magnetic field lines, forming chain-like structures.

The regularly-spaced nanoparticle chains interfere with incoming light, so that the light reflected from the surface is of a particular colour. Adjusting the magnetic field strength shifts the spacing of the field lines and changes the colour, says Kwon. "If you want to control the angle of the magnetic field [to create curves in the image, for instance] you can combine multiple electromagnets," he says.

Finishing off

Meanwhile the solvation liquid creates repulsive forces between the magnetic nanoparticles, ensuring they do not simply clump together in the ink.

Once the desired colour is produced, the nanoparticles can be fixed in place by exposing the ink to UV light, which cures the resin. The researchers' system uses maskless lithography to shine UV light over just the areas of the image that are of the desired colour. By then changing the magnetic fields and the UV light pattern, it's possible to build up a full-colour image.

"We first set the magnet to tune colour to red and then shine UV for 0.1 seconds [to fix the red areas of the image] and then change to blue, for 0.1 seconds again, then green," says Kwon. "You can pattern A4-size [letter-size] full-colour prints within a second."

However, Kwon cautions that the prototype system takes a few seconds to print because it can shift the magnetic field strength only relatively slowly.

Not like a DVD

He says that other potential applications include counterfeit inks: "You can build papers displaying unique features on application of an external magnetic field."

The team is also working on reversible colour fixing, which could have applications in colour-changing gadgets.

Zhong Lin Wang at the Georgia Institute of Technology says the approach is an interesting one, but thinks an existing method involving laser beam patterning of a plastic surface – the method responsible for the iridescent pattern on the surface of a DVD – might be simpler.

Kwon says the two technologies are fundamentally different: "Ours can change the colour of the whole plastic substrate, not just the carving on the surface," he says. The UV fixation method could turn out cheaper than using a laser beam, he adds. *Journal reference: Nature Photonics, DOI: 10.1038/nphoton.2009.141*

Scientists find evidence of iridescence in 40 million-year-old feather fossil

New Haven, Conn.—Known for their wide variety of vibrant plumage, birds have evolved various chemical and physical mechanisms to produce these beautiful colors over millions of years. A team of paleontologists and ornithologists led by Yale University has now discovered evidence of vivid iridescent colors in feather fossils more than 40 million years old.

The finding, published online August 26 in Biology Letters, signifies the first evidence of a preserved color-producing nanostructure in a fossilized feather.

Iridescence is the quality of changing color depending on the angle of observation, such as the rainbow of colors seen in an oil slick. The simplest iridescent feather colors are produced by light scattering off the feather's surface and a smooth surface of melanin pigment granules within the feather protein. Examining feather fossils from the Messel Shale in Germany with an electron microscope, scientists have documented this smooth layer of melanin structures, called melanosomes.

***Scientists discovered that nanostructures found in this 40-million-year-old fossil were responsible for producing iridescent colors in the living feather*. Jakob Vinther/Yale University**

"These feathers produced a black background with a metallic greenish, bluish or coppery color at certain angles - much like the colors we see in starlings and grackles today," said Richard Prum, chair of the Department of Ecology & Evolutionary Biology at Yale and one of the paper's authors.

For more than 25 years, paleontologists have found microscopic tubular structures on fossilized feathers and hair. These were long interpreted as bacteria that had digested the feathers at the time they were fossilized. The team had previously discovered that these structures were in fact not bacteria but melanosomes, which then allowed them to document the original color patterns. Following up on the new finding, they are racing to discover what additional coloration features may be found in fossil feathers.

"The discovery of ultra-structural detail in feather fossils opens up remarkable possibilities for the investigation of other features in soft-bodied fossils, like fur and even internal organs," said Derek Briggs, Yale's Frederick William Beinecke Professor of Geology and Geophysics, and an author of the study.

The discovery could pave the way for determining color features of other ancient birds and even dinosaurs, the team said.

"Of course, the 'Holy Grail' in this program is reconstructing the colors of the feathered dinosaurs," said Yale graduate student and lead author Jakob Vinther. "We are working hard to determine if this will be possible."

Small peptide found to stop lung cancer tumor growth in mice

WINSTON-SALEM, N.C. – In new animal research done by investigators at Wake Forest University School of Medicine, scientists have discovered a treatment effective in mice at blocking the growth and shrinking the size of lung cancer tumors, one of the leading causes of cancer death in the world.

The study, recently published in Molecular Cancer Therapeutics, a journal of the American Association for Cancer Research, is the first to show that treatment with a specific peptide, angiotensin-(1-7), reduces lung tumor growth by inhibiting blood vessel formation.

"If you're diagnosed with lung cancer today, you've got a 15 percent chance of surviving five years - and that's just devastating," said co-lead investigator Patricia E. Gallagher, Ph.D., director of the Molecular Biology Core Laboratory in the Hypertension and Vascular Research Center at the School of Medicine. "Those other 85 people - 85 percent - they're not going to see their kids graduate. They're not going to see their children get married." The lung cancer survival rate has changed little in the past 30 years, said Gallagher's co-lead investigator, E. Ann Tallant, Ph.D., a professor in the Hypertension and Vascular Research Center – a fact that motivates them in their research.

Peptides, found in all animals, are compounds formed by linking one or more amino acids together through the sharing of electrons. They are among the building blocks of life. Peptides can perform a wide range of functions in the body, depending on which amino acids are involved. Some can regulate hormones, for example, while others can have an antibiotic function.

Angiotensin-(1-7) is a small peptide that binds to proteins on the surface of cells and prevents cell growth – but only if the cell is actively growing when the binding occurs. That property is what led Tallant and Gallagher to explore the peptide's uses for treating cancer by blocking tumor growth.

Angiotensin-(1-7) works by inhibiting the production of signals sent out by a cancer tumor for food. For tumors to grow, they need nutrients delivered by blood vessels. The signals they send prompt blood vessels to grow and invade the tumor to feed it.

Every day during the six-week study, researchers injected either saline or the angiotensin (1-7) peptide into mice growing human lung cancer tumors. Over the course of the study, the tumors treated with angiotensin-(1-7) shrunk, while the saline-treated tumors grew and, at the end of the study, the tumors treated with angiotensin-(1-7) weighed about 60 percent less than the tumors treated with saline. Analysis also showed that the tumors from mice treated with the peptide had significantly fewer blood vessels compared to the tumors from the saline-treated animals.

The researchers further tested angiotensin (1-7)'s affect on blood vessel formation, or angiogenesis, by treating chick embryos with the peptide – a procedure considered the gold standard for determining anti-angiogenic ability. They found that blood vessels continued to grow in a saline-injected control group, while blood vessel formation decreased by more than 50 percent in the embryos treated with angiotensin-(1-7).

Tallant and Gallagher said the treatment likely has applications beyond lung cancer – they have collected data showing it is effective on breast, colon and brain tumors, as well.

The treatment also presents an attractive possibility for future human cancer therapy from a cost perspective, they said. "Because it's a peptide, it's very small and can be made very easily," Gallagher said. "We sometimes like to say we're the aspirin of cancer therapy."

Co-investigators on the study were graduate students David R. Soto-Pantoja and Jyotsana Menon of the School of Medicine. The study was funded by the Susan G. Komen Breast Cancer Research Foundation, Department of Defense, National Institutes of Health, Unifi, Farley-Hudson Foundation, and Golfers Against Cancer of the Triad.

The first clinical trial of angiotensin-(1-7) has been completed at the School of Medicine and the results are currently being reviewed.

Cheap IVF offers hope to childless millions

* 26 August 2009 **by Josie Glausiusz**

POOR and war-torn, Sudan might be the last place you would expect to find an experiment in cutting-edge fertility treatments. But by the end of October, a clinic at the University of Khartoum plans to offer in vitro fertilisation to couples for less than $300, a fraction of its cost in the west.

The clinic is one of three funded by the Low Cost IVF Foundation (LCIF) of Massagno, Switzerland, the brainchild of IVF pioneer Alan Trounson, who is now president of the California Institute for Regenerative Medicine. The other clinics are in Arusha, Tanzania, and Cape Town, South Africa.

Meanwhile a task force set up by the European Society of Human Reproduction and Embryology (ESHRE) is also set to make IVF affordable for African couples, by vastly simplifying conventional IVF technologies. By the end of the year it plans to begin offering IVF at clinics in Cairo and Alexandria, in Egypt, for around $360.

If successful, such efforts could lower the cost of IVF everywhere. In the US, the price of one round of treatment can be up to $12,000 and is rarely covered by health insurance. In the UK, it costs about £5000 ($8000), which the National Health Service may or may not pay for, depending on where a couple lives.

"Most of what we do in the western world is overkill," says Jonathan Van Blerkom of the University of Colorado at Boulder, a member of the ESHRE team. "If you get these procedures down to a low cost and they are successful, you cannot justify charging $12,000 for an IVF cycle."

It may come as a surprise that the revolution in low-cost IVF is beginning in Africa, given its high birth rate. However, some 10 to 30 per cent of African couples are infertile, often as a result of untreated sexually transmitted diseases, botched abortions and post-delivery pelvic infections. In Sudan, 20 per cent are infertile, double the rate in Europe and the US.

What's more, childless women in many African countries can face public ridicule, accusations of witchcraft, loss of financial support, abandonment and divorce, not to speak of their own shame and depression. "If you are not able to conceive, you are not [considered] normal," says gynaecologist Abdelrahim Obaid Fadl Allah of the University of Khartoum clinic.

So how do the ESHRE group and the LCIF propose to lower the cost of IVF so drastically? "What we did was to say, 'let's take all the complicated high technology out of the process'," says Trounson. "The idea is to provide a service rather than a business."

He and three other doctors who set up the LCIF opted for government-run clinics whose physicians are paid fixed salaries, and donated $30,000 from their own pockets to each of the three clinics to fit them with basic equipment such as second-hand ultrasound machines. The ESHRE group's approach is similar. "We broke the various procedures in IVF down to their essentials," says Van Blerkom.

For example, to stimulate egg production, many clinics in the west prescribe genetically engineered or "recombinant" forms of follicle-stimulating hormone (FSH) because it can cause women to release a dozen or more eggs per cycle. That means some embryos can be frozen in case the first round of IVF doesn't work. Such drugs have the disadvantage of being enormously expensive, sometimes costing thousands of dollars per round of treatment.

Fewer eggs

In contrast, clomiphene is a generic drug which prompts the pituitary gland to pump out more FSH and costs just $11 for one round of treatment. It was used very successfully in the early years of IVF, inducing maturation of up to four viable eggs per cycle. That's far fewer than with injecting FSH directly, but since low-cost IVF facilities are unlikely to have the equipment or liquid nitrogen for freezing extra embryos, fewer eggs are needed anyway.

Using clomiphene, the ESHRE group plans to transfer no more than two embryos to the woman's uterus, while the LCIF initiative plans to transfer only one.

Combined with not freezing extra eggs, this reduces the chance of a successful pregnancy, but as clomiphene has fewer side effects than recombinant FSH, women may be more likely try further rounds of IVF if earlier attempts fail. The ESHRE group estimates this will achieve a pregnancy rate of 15 to 20 per cent, lower than the European rate of 25 per cent and the US figure of 35 per cent.

Another big cost-saving has come in the use of incubators. Western doctors select the best embryos by allowing them to incubate for up to six days; those that fail to divide, or which show cellular defects, are then weeded out and the best transferred. But certain defects - multiple cell nuclei, for example - can be seen as early as the second day, and some embryos which fail in the artificial environment of a culture dish will develop normally in utero, according to Van Blerkom. On this basis, the ESHRE group plans to transfer the embryo on the first or second day after fertilisation.

Incubators themselves can also be made cheaper. Australian company Cryologic sells portable table-top incubators for less than $1000. These lack the fancy electronics and ability to change temperature of standard incubators, but this is unnecessary for IVF. Van Blerkom has used one to successfully incubate embryos and found that the batteries can be recharged with solar panels, also useful in countries where electricity outages are common. Meanwhile, the LCIF is counting on warm water baths to incubate embryos.

One company argues that incubators can be avoided completely, since a natural one - the woman herself - is already walking around. INVO Bioscience of Beverly, Massachusetts, recently launched the INVOcell, a small plastic capsule into which fertilised eggs are placed together with culture media. The capsule, encased in a

protective shell, is then inserted into a woman's vagina for three days, which keeps the embryos at the desired temperature. After removal, doctors select the two best embryos and transfer them to the woman's uterus. The incubator capsule is inserted into a woman's vagina to keep the embryos at the right temperature

Company spokeswoman Katie Karloff claims that using the device - which costs between $85 in Africa and $185 in Europe - can cut the cost of IVF by half. It is also uniquely suited for places that frequently lose electrical power. Karloff reports that the INVOcell has now been used 85 times around the world, with 20 resulting pregnancies. The device has already reduced the price of IVF in clinics in Africa, South America, Pakistan and parts of the Middle East, she says.

There are other expensive materials that can be eliminated too. For example, in the west, developing embryos are usually placed in a Petri dish in a chamber infused with 5 per cent carbon dioxide. The gas is there to balance a chemical reaction occurring when bicarbonate is used as a buffer to maintain the pH of the culture medium. But cylinders of CO2 are expensive, and unnecessary if an embryo is incubated for only one or two days. Bicarbonate-free media can be used to maintain the pH instead.

Cut-price $900 microscopes for confirming cell division can be easily adapted for minimal-cost clinics, says Van Blerkom, as can portable digital ultrasound machines that sell for less than $5000 - far below the typical $400,000 price tag for machines in western IVF clinics.

The clinic in Khartoum is still in the process of installing its equipment, but already it has changed lives by offering simpler fertility procedures. These include intrauterine insemination (IUI), in which a woman is artificially inseminated with her partner's concentrated sperm. Embryologist Maisa Fathi El Fadil says the clinic has so far administered IUI to more than 500 couples, with about 10 to 15 per cent resulting in a successful pregnancy.

One such couple is Nahla Khidir, aged 34, and her husband Osman Khalid, 38. They married in 2006, and when no baby was born their families pestered them with questions and advice. "My wife was crying all day and my friends told me to marry again," Osman says. Tests showed that Nahla's reproductive system was normal, but his sperm had poor motility. After a course of clomiphene to stimulate egg production and one round of IUI, Nahla became pregnant and is due to give birth in September. "We are very happy," Osman says. "I feel as if I died and got up again to life."

Long-range Taser reignites safety debate

* 26 August 2009 **by Paul Marks**

THE manufacturer of the Taser stun gun is sparking new controversy with the commercial launch of a long-range version that can be fired from a 12-bore shotgun.

Government-funded tests on initial versions of the new Extended Range Electronic Projectile (XREP) have revealed possible health risks to people on the receiving end, New Scientist has learned. The manufacturer, Taser International of Scottsdale, Arizona, says the issue has been addressed in redesigned devices, but these have yet to be independently tested.

Unlike the current Taser X26, which fires darts attached to short wires, the XREP is wire-free. Its projectile, the size of a shotgun cartridge, is designed to pierce the target's skin and contains battery-powered circuits that deliver a debilitating shock. It has a range of 20 metres or more, compared with 5 metres for previous Tasers.

A team led by Cynthia Bir, a trauma injury specialist at Wayne State University in Detroit, Michigan, found that some of the 275 XREP cartridges that Taser supplied for testing last year were capable of delivering an electric shock for more than 5 minutes, rather than the 20 seconds of shocking current they are supposed to generate. Previous Taser stun guns shock for only 5 seconds per discharge, though that can be repeated.

Bir's team reported their findings at a conference on non-lethal weapons in Ettlingen, Germany, in May. Steve Wright of Leeds Metropolitan University in the UK, who has studied electric shock weapons, says Bir's report that the device can carry on shocking for 5 minutes is worrying. The effects of prolonged shocking are not known, he says, but the finding raises concerns about the potential damage to a victim's mental health.

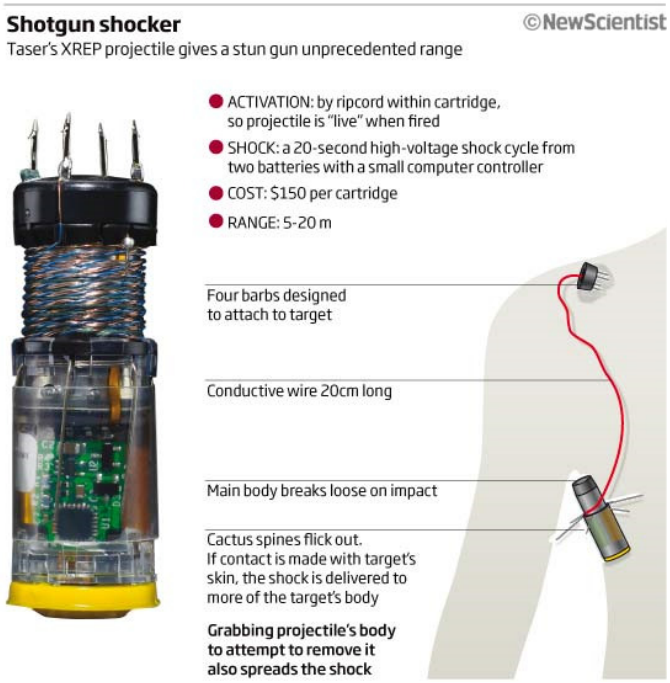
Bir also found problems with the weapon's accuracy. In test firings, it proved difficult to aim, as the aerodynamics of the projectile caused it to fall below the aiming point at a range of 20 metres. "Any lack of accuracy means a greater risk of hitting an unintended part of the body and therefore greater risk of injury," says security researcher Neil Davison, author of a recent book on non-lethal weapons.

Steve Tuttle, a vice-president of Taser International, says the XREP munitions supplied for Bir's tests were early pre-production versions. He says a redesign of the projectile has greatly improved its aerodynamic accuracy, and the fault in the munition's "firmware" - its built-in software - that led to it being capable of providing an extended shock has also been corrected.

The two production versions of the XREP device include features said to improve aiming accuracy. One version, for use with rifled shotguns, has a plastic cap that engages with the rifling and gives the projectile a stabilising spin. The version for smooth-bore shotguns sprouts stabilising fins when it leaves the barrel.

Tuttle says, however, that Taser did ship some pre-production batches to US police departments.

Bir and her team have not had a chance to test the newly modified production rounds that Taser says are more accurate and reliable. Some of them have, however, already been purchased, delivered and used by unnamed "agencies" in the US, Tuttle says. Tests funded by Taser showed the rounds to be safe in terms of their impact effects on cadavers, he says. "There was no internal damage in the vicinity of the XREP impact." There is no requirement under US law for them to undergo independent pre-sales testing.



Bir's tests are being funded by the UK Home Office, the US National Institute of Justice and the Canadian Police Research Centre. All want to know whether the weapon can do what Taser International claims: allow police officers to incapacitate people at greater distance.

For this, the ability to take precise aim is seen as crucial. "In public disorder situations accuracy at range will be particularly important, perhaps to target individuals within a tightly packed group," a review of "less-lethal" technologies by the Home Office states. Such weapons will help contain crowds or prevent them re-forming, the review says.

Shooting cadavers is one thing. But what happens when the weapons are fired at pregnant women, people with health problems or the very young, Wright asks.

"The Home Office will probably say they are merely evaluating a wide range of possible long-range devices and that it doesn't mean they will necessarily deploy them," Wright comments. "But that is what they initially said about the original Taser."

The ongoing dispute between Amnesty International and Taser International flared up last week, with Amnesty repeating its claim that more than 330 people have died in North America after being tased. But lawsuits against Taser alleging wrongful death have been dismissed by US courts, which have found no evidence that the weapons can kill.

Two areas of interest on stun-guns' safety centre on when and how they are used, and the suspected sensitivity of some people to their use. Following the death of a Polish man at Vancouver airport, Canada, in October 2007 after restraint and tasing by police, the government of British Columbia set up the Braidwood commission to investigate Taser use. In July, the commission recommended that officers should not tase someone unless they are "causing, or about to cause, bodily harm" rather than merely defying an officer's order, as now. It also wants paramedic care to be called when any elderly, pregnant or emotionally disturbed people are tased.

That advice echoes that of the US National Institute for Justice, whose medical panel said in May it found "no conclusive medical evidence to indicate a high risk of serious injury or death" from Taser use. But it, too, wants medical care available quickly.

With NIJ funding, Wayne State University is investigating whether some groups may be at particular risk. It aims to establish if people in a highly stressed, compromised physical state - with a rapid heart rate and elevated body temperature, perhaps as a result of drug-taking - are any more vulnerable to cardiac arrhythmias after tasing.

Genetic advance raises IVF hopes

By Pallab Ghosh BBC News, science correspondent

Researchers have found a potential way to correct an inherited disorder affecting thousands of women.

Working on monkeys, they transferred genetic material needed to create a baby from a defective egg to a healthy one, resulting in healthy births.

The US work, featured in the journal Nature, raises hopes of a treatment enabling women with defective eggs to have a child without using donor eggs. However, the child would have a small number of genes from a "third parent".

The treatment would involve so-called "germ line" genetic changes which would be passed down through generations. The genetic fault is contained in structures in the egg called the mitochondria, which are involved in maintaining the egg's internal processes.

If an egg with faulty mitochondria is fertilised the resulting child could have any of hundreds of different diseases including anaemia, dementia, hypertension and a range of neurological disorders.

Previous failures

US researchers have previously tried and failed to correct this defect by adding healthy donated mitochondria into the eggs of patients wishing to have children. But these attempts resulted in birth defects - probably because mitochondria are so delicate that they are damaged when they are transplanted from one egg to another.

The twin monkeys - Mito and Tracker - born using the new technique

As a result, the treatment was banned by the US until it could be demonstrated that it was safe in animal experiments.

A group at the Oregon Health and Science University has now done just that.

They transferred the DNA needed to make a baby out of monkey eggs, leaving behind the potentially diseased genes in the mitochondria. This was transplanted it into eggs emptied of DNA but containing healthy mitochondria. The technique resulted in three healthy births with no sign of any birth defects.

Mixed response

Lead researcher Dr Shoukhrat Mitalipov believes the technology is now ready to be tried out on human patients. He said: "It is estimated that every 30 minutes a child is born with this devastating disease and I believe we could prevent that."

Dr Mitalipov has applied for a research licence to work with human eggs and embryos, and hopes to work with patients soon. He said: "Moving to human trials could be very quick, maybe within two to three years.

"This type of gene therapy is much closer to clinical application than anything else before."

The development has been welcomed by Professor Peter Braude, an IVF specialist at Guys and St Thomas's hospital. He said: "It is a very nice approach that could potentially help thousands of women with mitochondrial disease."

But some groups have expressed concern that this method involves making a genetic change to an egg that can be passed down through generations.

Dr Helen Wallace, of the campaign group GeneWatch, said: "The fact that treatment effects would persist for generations means ethical debate is needed, as well as more safety tests."

But according to Professor Robin Lovell-Badge, of the National Institute for Medical Research in Mill Hill London, people should not worry unduly over the germ-line alterations.

He said: "Mitochondria do not confer any human-specific qualities. "It would be similar to changing the bacteria in our intestines, which I suspect no one would care about. "Altering the nuclear genome is a different matter. As it would be difficult and risky there would have to be very good reasons for doing this."

In the UK, the Human Fertilisation and Embryology Authority has licensed a number of tightly-controlled research projects into mitochondrial diseases. But Parliament would have to change the law to allow the technique to be used on patients.

An Environmentally Friendly Mosquito Repellent?

By Cornelia Dean

A report this week in the journal Nature is taking me back to my childhood summers in New Jersey, where evenings were often marked by the appearance of a slow-moving Jeep towing a battered cart. A machine, about the size of a lawn mower, sat on the cart, spewing a whitish mist — DDT.

The town did the spraying in recognition of the fact that New Jersey was the mosquito core of the universe, a place, it was said, where an only-average sized insect could bring down a deer. Some of us called the mosquito the state bird.

My friends and I would dash along behind the jeep, running in and out of the gassy cloud, breathing in the strong odor of the insecticide as droplets condensed on our clothes and skin. As far as I know, this experience left no ill effects, except a persistent skepticism about claims that exposure to this, that or the other chemical is inevitably a health disaster.

Still, I accept the idea that widespread use of DDT caused environmental problems. The chemical persists in the flesh of animals that come into contact with it, and it concentrates in creatures at the top of the food web, like the fish-hunting ospreys I see often when I am at the coast. Because DDT can thin the shells of their eggs

to the cracking point, widespread use of the chemical almost led ospreys and other raptors to extinction. When I see ospreys now I am reminded of how good it is that little jeep and its cart are long retired.

Unless, of course, the bugs are biting. Then, if it were up to me, I would crank up the sprayer and let loose a chemical blast. And for me mosquitoes are just an annoyance. In many parts of the world they are a deadly menace, spreading diseases like malaria.

That's where the Nature paper comes in.

It is a description of work led by Anandasankar Ray, an entomologist at the University of California, Riverside, on fruit flies and their sensitivity to carbon dioxide. The researchers report that they have identified a compound that blocks the ability of the insects to detect it.

The finding is interesting because it is the carbon dioxide we exhale that draws mosquitoes to us. A chemical that blocked that attraction would, in a sense, make us invisible to the insects. That is what seems to have happened when the researchers tested it on a class of mosquitoes — the genus Culex, which spreads West Nile Disease and other ailments.

It is too soon to say whether researchers will ever be able to turn the compounds, 2,3-butanedione and 1-hexanol, into an economical and environmentally benign insect repellent that works on mosquitoes generally.

But if they can, it would be a boon whose benefits might spread far beyond New Jersey, to the regions of the world where malaria is common, and where researchers and health workers argue about whether and how they can use DDT to combat it.

According to the World Health Organization, about 250 million people contract malaria each year, and about 900,000 of them die of it. Almost all of them are children.

Tunnels concentrate air pollution by up to 1000 times

A toxic cocktail of ultrafine particles is lurking inside road tunnels in concentration levels so high they have the potential to harm drivers and passengers, a new study has found. The study, which has been published in Atmospheric Environment, measured ultrafine particle concentration levels outside a vehicle travelling through the M5 East tunnel in Sydney.

Study co-author and director of Queensland University of Technology's International Laboratory for Air Quality and Health, Professor Lidia Morawska, said road tunnels were locations where maximum exposure to dangerous ultrafine particles in addition to other pollutants occurred. "The human health effects of exposure to ultrafine particles produced by fuel combustion are generally regarded as detrimental," Professor Morawska said. "Effects can range from minor respiratory problems in healthy people, to acute myocardial infarction (heart attack) in people with existing heart complaints.

Professor Morawska said the study involved more than 300 trips through the four kilometres of the M5 East tunnel, with journeys lasting up to 26 minutes, depending on traffic congestion.

"What this study aimed to do was identify the concentration levels found in the tunnel. It generated a huge body of data on the concentrations and the results show that, at times, the levels are up to 1000 times higher than in urban ambient conditions," she said.

She said drivers and occupants of new vehicles which had their windows closed were safer than people travelling in older vehicles. "People who are driving older vehicles which are inferior in terms of tightness and also those riding motorcycles or driving convertibles, these people are exposed to incredibly high concentrations," she said. "When compared with similar studies reported previously, the measurements here were among the highest recorded concentrations," she said.

Professor Morawska said tunnels were becoming an increasingly necessary infrastructure component in many cities across the world. "When governments are building tunnels for urban design reasons, they should also consider the impact these tunnels are having on the environment and to people's health," she said.

"The study highlights why governments need to consider how they are going to deal with the air pollution levels inside the tunnel and removal of ultrafine particles in the outside environment."

The study was conducted jointly by Professor Richard de Dear and his doctoral candidate, Mr Luke Knibbs from Macquarie University, in collaboration with Professor Morawska and Dr Kerrie Mengersen from QUT.

'Fatostatin' is a turnoff for fat genes

A small molecule earlier found to have both anti-fat and anti-cancer abilities works as a literal turnoff for fat-making genes, according to a new report in the August 28th issue of the journal Chemistry and Biology, a Cell Press journal.

The chemical blocks a well known master controller of fat synthesis, a transcription factor known as SREBP. That action in mice that are genetically prone to obesity causes the animals to become leaner. It also lowers the amount of fat in their livers, along with their blood sugar and cholesterol levels.

"We are frankly very excited about it," said Salih Wakil of Baylor College of Medicine. "It goes to the origin of [fat synthesis] – all the way back to gene expression."

Unlike cholesterol-lowering statins in use today, which block a single enzyme in the pathway, the chemical, which the researchers call fatostatin, "hits fat from the very beginning," added Motonari Uesugi, who is now at Kyoto University. In doing so, fatostatin influences many of the genes involved in fat production and in various aspects of metabolic syndrome – a collection of risk factors including obesity, high cholesterol and insulin resistance – in one go.

Studies in cell culture showed that fatostatin, previously known only as 125B11, significantly lowers the activity of 63 genes, including 34 directly associated with fatty acid or cholesterol synthesis. Many of those were known to be under the control of SREBP.

More detailed analysis reveals that the drug candidate blocks SREBP by preventing it from becoming active and entering the nucleus, where it would otherwise switch on the fat-making program. It operates by binding another protein (called SCAP), which serves as SREBP's escort into the nucleus.

Obese mice injected with fatostatin show noticeable reductions in their weight despite little difference in their eating habits, the researchers report. After four weeks of treatment, the animals weighed 12 percent less and had 70 percent lower blood sugar levels. Their cholesterol levels (both LDL and HDL) were down too. The concentration of fatty acids in their blood was actually higher, a sign of their greater demand for fat to burn.

While the livers of the obese mice were heavy and pale with fat, treated animals' livers were more than 30 percent lighter and were a healthy-looking red.

Although less obvious, the SREBP-blocking ability might also explain the molecule's earlier reported effects against prostate cancer cells in culture as well. Cells need fatty acids and cholesterol to build their cell membranes and continue growing, they explain.

Fatostatin is not the first molecule to act on SREBP, according to the researchers, but it appears to do so in a somewhat different way than those described previously. Many steps remain, but they are optimistic that fatostatin could prove to be clinically useful in the context of obesity, and perhaps cardiovascular disease and diabetes as well.

"Hopefully down the road, fatostatin or a derivative of fatostatin may be helpful," said Wakil, who has been studying the enzymes involved in fat synthesis ever since he discovered them in the late 1950s. "It could have a broad impact on the key diseases we all suffer from."

Fatostatin or its analogs may also serve a tool for gaining further insights into the regulation of SREBP and fat metabolism, Uesugi said.

The researchers include Shinji Kamisuki, Kyoto University, Uji, Kyoto, Japan; Qian Mao, Baylor College of Medicine, Houston, TX; Lutfi Abu-Elheiga, Baylor College of Medicine, Houston, TX; Ziwei Gu, Baylor College of Medicine, Houston, TX; Akira Kugimiya, Kyoto University, Uji, Kyoto, Japan; Youngjoo Kwon, Baylor College of Medicine, Houston, TX; Tokuyuki Shinohara, Kyoto University, Uji, Kyoto, Japan; Yoshinori Kawazoe, Kyoto University, Uji, Kyoto, Japan; Shin-ichi Sato, Baylor College of Medicine, Houston, TX; Koko Asakura, Baylor College of Medicine, Houston, TX; Hea-Young Park Choo, Kyoto University, Uji, Kyoto, Japan; Juro Sakai, University of Tokyo, Tokyo, Japan; Salih J. Wakil, Baylor College of Medicine, Houston, TX; and Motonari Uesugi, Kyoto University, Uji, Kyoto, Japan, Baylor College of Medicine, Houston, TX.

New Culprit Seen in Ozone Depletion

By CORNELIA DEAN

Government scientists who study the depletion of Earth’s protective ozone layer are pointing to a previously unheralded culprit: nitrous oxide.

Most of the nitrous oxide in the atmosphere emerges naturally, through the action of bacteria in the soil, the researchers say. But the gas is also produced by human activity, through the use of nitrogen-based fertilizers, the application of livestock manure to fields, the burning of biofuels and in other ways.

Though nitrous oxide is not regulated under the Montreal Protocol, the 1987 agreement to limit emissions of ozone-depleting chemicals, the researchers say it is emerging as the leading artificial cause of ozone loss.

The researchers, from the National Oceanic and Atmospheric Administration, report their findings in Friday’s issue of the journal Science.

They note that the health of the ozone layer has been improving since the adoption of the protocol and that nitrous oxide looms large today as an artificial destroyer of the ozone layer, in part because the emissions of other harmful chemicals have been so sharply reduced. But major chemical targets of the Montreal agreement, chlorofluorocarbons, inhibit the ozone-destroying actions of nitrous oxide, the researchers said. So as their levels fall, the harmful influence of nitrous oxide increases.

The Environmental Protection Agency is already contemplating action on nitrous oxide because it is a heat-trapping gas linked to global warming. In April, the agency declared it and five other gases, including carbon dioxide, to be pollutants that endanger public health, making them subject to regulation under the Clean Air Act.

In a statement, the agency said Thursday that work on a reporting system for emissions of nitrous oxide and the five gases was under way. John S. Daniel, one of the authors of the new report, said scientists had for some time known of the ozone-depleting potential of nitrous oxide. But, Mr. Daniel said in a telephone news conference, “there is a sort of gap between the scientific understanding and the policy.”

The researchers did not make any policy recommendations in light of their finding.
“It is not for us to gauge how much risk there is,” said A. R. Ravishankara, who led the work. In any event, he said, at the moment researchers could not say with confidence “how much nitrous oxide comes from where.”
“The uncertainties are significant,” Dr. Ravishankara said.

Dr. Ravishankara estimated that worldwide the ozone layer had been reduced by about 6 percent from what it was before industrialization.

At ground level, ozone is a pollutant, but in the upper atmosphere it blocks ultraviolet radiation that would harm plants and animals on Earth’s surface. When researchers discovered that chemicals like chlorofluorocarbons were depleting this high-level ozone layer, and especially after the discovery of a highly depleted ozone hole over Antarctica, international negotiators produced the Montreal agreement.

Because of the unusual atmospheric chemistry above Antarctica, nitrous oxide does not affect the ozone hole there, Dr. Ravishankara said.

Milk drinking started around 7,500 years ago in central Europe

The ability to digest the milk sugar lactose first evolved in dairy farming communities in central Europe, not in more northern groups as was previously thought, finds a new study led by UCL (University College London) scientists published in the journal PLoS Computational Biology. The genetic change that enabled early Europeans to drink milk without getting sick has been mapped to dairying farmers who lived around 7,500 years ago in a region between the central Balkans and central Europe. Previously, it was thought that natural selection favoured milk drinkers only in more northern regions because of their greater need for vitamin D in their diet. People living in most parts of the world make vitamin D when sunlight hits the skin, but in northern latitudes there isn't enough sunlight to do this for most of the year.

In the collaborative study, the team used a computer simulation model to explore the spread of lactase persistence, dairy farming, other food gathering practices and genes in Europe. The model integrated genetic and archaeological data using newly developed statistical approaches.

Professor Mark Thomas, UCL Genetics, Evolution and Environment, says: "Most adults worldwide do not produce the enzyme lactase and so are unable to digest the milk sugar lactose. However, most Europeans continue to produce lactase throughout their life, a characteristic known as lactase persistence. In Europe, a single genetic change (13,910*T) is strongly associated with lactase persistence and appears to have given people with it a big survival advantage. Since adult consumption of fresh milk was only possible after the domestication of animals, it is likely that lactase persistence co-evolved with the cultural practice of dairying, although it was not known when it first arose in Europe or what factors drove its rapid spread.
"Our study simulated the spread of lactase persistence and farming in Europe, and found that lactase persistence appears to have begun around 7,500 years ago between the central Balkans and central Europe, probably among people of the Linear b and keramik culture. But contrary to popular belief, we also found that a need for dietary vitamin D was not necessary to explain why lactase persistence is common in northern Europe today."

Many reasons have been put forward for why being able to drink fresh milk should be such an advantage. For example, milk can compensate for the lack of sunlight and synthesis of vitamin D in skin at more northern latitudes, since vitamin D is required for calcium absorption and milk provides a good dietary source of both nutrients. Milk also provides a calorie- and protein-rich food source, comes in a relatively constant supply compared to the boom-and-bust of seasonal crops, and would have been less contaminated than water supplies.

Evidence from other studies suggest dairying was present in south-eastern Europe soon after the arrival of farming, while milk proteins found in ceramic vessels provide evidence for dairying in (present-day) Romania and Hungary some 7,900-7,450 years ago. Traces of fats also point to dairying at the onset of farming in England some 6,100 years ago. But it is most likely that milk was first fermented to make yoghurt, butter and cheese, and not drunk fresh. The Romans used goat and sheep milk to produce cheese, and cattle as a draught animal. However, Germanic and Celtic people practiced cattle dairying and drank fresh milk in significant amounts. The current distribution of lactase persistence would seem to suggest an origin in Northwest Europe – especially Ireland and Scandinavia – since it is found at its highest frequency there today. However, the latest study suggests otherwise. Dairy farmers carrying this gene variant probably originated in central Europe and underwent more widespread and rapid population growth than non-dairying groups.

The spread of fresh milk drinking from the Balkans across Europe also explains why most European lactase-persistent people carry the same version of the gene; it surfed on a wave of population expansion that followed

the rapid co-evolution of milk tolerance and dairy farming. In Africa, there are four known lactase persistence gene variants and probably many more yet to be discovered. Most are likely to be of African origin but the European version is also found there, especially among the Falani people. This diversity is probably the result of an 'imposition' of dairying culture on a pre-existing farming people, rather than the natural spread of dairy farmers.

Tiny ancient shells point to earliest fashion trend

Shell beads newly unearthed from four sites in Morocco confirm early humans were consistently wearing and potentially trading symbolic jewellery as early as 80,000 years ago. These beads add significantly to similar finds dating back as far as 110,000 in Algeria, Morocco, Israel and South Africa, confirming these as the oldest form of personal ornaments. This crucial step towards modern culture is reported this week in the Proceedings of the National Academy of Sciences of the USA (PNAS).

A team of researchers recovered 25 marine shell beads dating back to around 70,000 to 85,000 years ago from sites in Morocco, as part of the European Science Foundation EUROCORES programme 'Origin of Man, Language and Languages'. The shells have man-made holes through the centre and some show signs of pigment and prolonged wear, suggesting they were worn as jewellery.

Across all the locations shells were found from a similar time period from the Nassarius genus. That these shells were used similarly across so many sites suggests this was a cultural phenomenon, a shared tradition passed along through cultures over thousands of years. Several of the locations where shells have been found are so far inland that the shells must have been intentionally brought there.

"Either people went to sea and collected them, or more likely marine shell beads helped create and maintain exchange networks between coastal and inland peoples. This shows well-structured human culture that attributed meaning to these things," said Francesco d'Errico, lead author and director of research at the French National Centre for Scientific Research (CNRS). "Organised networks would also assist trading of other items, as well as genetic and cultural exchange – so these shells help reveal the connections between cognition and culture."

For scientists, beadworks are not simply decoration, they also represents a specific technology that conveys information through a shared coded language. It indicates more advanced thinking and the development of modern cultural traits, giving clues to how such innovative behaviours might link to the spread of humans out of Africa.

"The early invention of the personal ornament is one of the most fascinating cultural experiments in human history," d'Errico continued. "The common element among such ornaments is that they transmit meaning to others. They convey an image of you that is not just your biological self."

Until recently the invention of personal ornaments was thought to coincide with the colonisation of Europe some 40,000 years ago, linking advanced cognitive capacity to early human dispersal. Yet this changed with the 2006 discovery of shell beads in Africa and the Near East dating back 35,000 years earlier, showing that symbolic thinking emerged more gradually through human evolution.

Curiously, shell beads disappear from the archaeological record in Africa and the Near East 70,000 years ago, along with other cultural innovations such as engravings on ochre slabs, and refined bone tools and projectile points. They reappear in different forms up to 30,000 years later, with personal ornaments simultaneously re-emerging in Africa and the Near East, and for the first time in Europe and Asia. This may reflect an entirely new and independent phase of population growth with previously unseen innovations allowing a more efficient exploitation of a wider variety of environments.

The temporary disappearance of cultural innovations could well be linked to population decreases during a long period of harsher climate conditions 60,000 to 73,000 years ago. This would have isolated populations, disrupting social and exchange networks.

This study was part of a broad network of 21 research projects and 44 individual research teams from 12 European countries forming the European Science Foundation EUROCORES programme 'Origin of Man, Language and Languages'(OMLL). This highly interdisciplinary collaborative action brought together scientists from a wide range of disciplines including genetics, linguistics, anthropology, archaeology, neurophysiology or cognitive sciences.

Dr Eva Hoogland, EUROCORES coordinator for the cognitive sciences at the European Science Foundation said: "This study presents a very good example of the groundbreaking results that can be gained from an interdisciplinary environment. Some questions, such as those concerning the interconnections between human cognition and culture, can only be addressed if scientists of varying backgrounds join forces. As witnessed by this study, this opens up new avenues for research when it happens on a structural basis, by leading scientists from across Europe."

This research was also supported with funding from the Natural Environment Research Council, the British Academy and Oxford University in the UK and the Max Planck Society in Germany.

Researchers report gene associated with language, speech and reading disorders

LAWRENCE, KAN. – A new candidate gene for Specific Language Impairment has been identified by a research team directed by Mabel Rice at the University of Kansas, in collaboration with Shelley Smith, University of Nebraska Medical Center, and Javier Gayán of Neocodex, Seville, Spain. The finding, reported in the current issue of the Journal of Neurodevelopmental Disorders, was discovered by examining genes previously identified as candidate genes for reading impairments or speech sound disorders. The results point toward the likelihood of multiple genes contributing to language impairment, some of which also contribute to reading or speech impairment.

A gene on Chromosome 6 – KIAA0319 – was associated with variability in language abilities in a study of children with Specific Language Impairment (SLI) and their family members, as well as with variability in speech and reading abilities. Children with SLI who were selected for the study had no hearing loss, general intellectual deficit or autism.

Language ability involves vocabulary and grammar, whereas speech involves the accuracy of sound production. Both language and speech ability contribute to a child's ability to read. The finding that a candidate gene could influence all three abilities suggests a common pathway that could contribute to overlapping strengths or deficiencies across speech, language and reading.

According to Rice, "We don't understand the biological mechanisms yet but it's important that we have identified the first gene that could be involved across these three different dimensions of development."

Previous research has established that Chromosome 6 is among those that are linked to Speech Sounds Disorder (SSD) and Reading Disability/Dyslexia (RD). Rice said the findings are consistent with numerous reports documenting that language impairments and reading disability often co-exist.

The study involved 322 individuals, including children with SLI, their parents, siblings, and other family members. "We have come to realize that language really sets the platform for reading to emerge and to thrive," Rice added. "Without a solid language system, it's much harder to get reading going."

The study is part of a 20-year research program conducted by Rice, who is the Fred and Virginia Merrill Distinguished Professor of Advanced Studies and director of the Center for Biobehavioral Neurosciences in Communication Disorders at KU's Life Span Institute. Co-investigators on the genetics project were Shelley Smith, professor of pediatrics in the Department of Pediatrics and the Munroe Meyer Institute for Genetics and Rehabilitation at the University of Nebraska Medical Center, and Javier Gayán, Head of the Analysis Group at Neocodex, in Seville, Spain. Neocodex is a research company that specializes in genomics analysis.

The article is available online at http://dx.doi.org/10.1007/s11689-009-9031-x

The Path to New Antibiotics

Researchers Find Vulnerable Enzyme in Pathogens

LA JOLLA, Calif. - Researchers at Burnham Institute for Medical Research (Burnham), University of Texas Southwestern Medical Center and University of Maryland have demonstrated that an enzyme that is essential to many bacteria can be targeted to kill dangerous pathogens. In addition, investigators discovered chemical compounds that can inhibit this enzyme and suppress the growth of pathogenic bacteria. These findings are essential to develop new broad-spectrum antibacterial agents to overcome multidrug resistance. The research was published in the Cell journal Chemistry & Biology on August 27.

Andrei Osterman, Ph.D., an associate professor in Burnham's Bioinformatics and Systems Biology program, and colleagues, targeted the bacterial nicotinate mononucleotide adenylyltransferase (NadD), an essential enzyme for nicotinamide adenine dinucleotide (NAD) biosynthesis. NAD has many crucial functions in nearly all important pathogens and the bacterial NadD differs significantly from the human enzyme.

"It's clear that because of bacterial resistance, we need new, wide-spectrum antibiotics," said Dr. Osterman. "This enzyme is indispensable in many pathogens, so finding ways to inhibit it could give us new options against infection."

According to the National Institutes of Health, drug resistance is making many diseases increasingly difficult—and sometimes impossible—to treat. They point to tuberculosis and methicillin-resistant Staphylococcus aureus (MRSA) as two pathogens that pose a serious threat to human health.

Using a structure-based approach, the team searched for low-molecular-weight compounds that would selectively inhibit bacterial NadD, but not the human equivalent, by screening, in silico, more than a million compounds. Experimental testing of the best predicted compounds against Escherichia coli and Bacillus anthracis (anthrax) led them to a handful of versatile inhibitory chemotypes, which they explored in detail.

Using protein crystallography, a 3D structure of the enzyme in complex with one of the inhibitors was solved providing guidelines for further drug improvement.

"This is proof-of-concept that NadD is a good target to create antibacterial agents," said Dr Osterman. "This knowledge will be useful for both biodefense and public health. The next step is to find better inhibitors. We do not have a silver bullet yet, but we are certainly hitting a golden target."

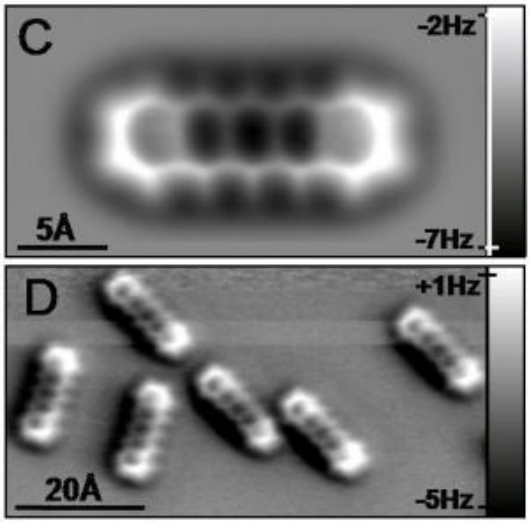
This research was supported by a grant from the National Institute of Allergy and Infectious Diseases.

Microscopes zoom in on molecules at last

* 10:22 28 August 2009 **by MacGregor Campbell**

Thanks to specialised microscopes, we have long been able to see the beauty of single atoms. But strange though it might seem, imaging larger molecules at the same level of detail has not been possible – atoms are robust enough to withstand existing tools, but the structures of molecules are not. Now researchers at IBM have come up with a way to do it.

The earliest pictures of individual atoms were captured in the 1970s by blasting a target – typically a chunk of metal – with a beam of electrons, a technique known as transmission electron microscopy (TEM).



Pentacene as you've never seen it before (Image: IBM and Science)

Later refinements of this technique, such as the TEAM project at the Lawrence Berkeley National Laboratory in California achieved resolutions of less than the radius of a single hydrogen atom. But while this method works for atoms in a lattice or thin layer, the electron bombardment destroys the arrangement of atoms in molecules

Other techniques use a tiny stylus-like scanning probe to explore the atom-scale world. One method uses such a probe to measure the charge density associated with individual atoms – a technique called scanning tunnelling microscopy (STM).

Another, called atomic force microscopy (AFM), measures the attractive force between atoms in the probe and the target. The image is created by bumping the probe over the atoms of the molecule – much in the way we might feel our way around in a dark bedroom.

Both methods build up a picture of a target's surface and should be suitable for imaging individual molecules. But they have not been able to approach the detail of TEM.

Sticky problem

Leo Gross and his colleagues at IBM in Zurich, Switzerland, modified the AFM technique to make the most detailed image yet of pentacene, an organic molecule consisting of five benzene rings (see picture).

The molecule is very fragile, but the researchers were able to capture the details of the hexagonal carbon rings and deduce the positions of the surrounding hydrogen atoms.

One key breakthrough was finding a way to stop the microscope's tip from sticking to the fragile pentacene molecule because of attraction due to electrostatic and van der Waals forces – van der Waals is a weak force that operates only at an intermolecular level.

The team achieved this by fixing a single carbon monoxide molecule to the end of the probe so that only one atom of relatively inactive oxygen came into contact with the pentacene.

Although van der Waals force attracted the tip to its target, a quantum-mechanical effect called the Pauli exclusion principle pushed back. This happens because electrons in the same quantum state cannot approach each other too closely. As the electrons around the pentacene and carbon monoxide molecules are in the same state, a small repulsive force operates between them.

Repulsive pictures

The researchers measured the repulsive force the probe encountered at each point, and from this they could construct a "force map" of the molecule. The level of detail available depends on the size of the probe: the smaller the tip, the better the picture.

The image is "astonishing", says Oscar Custance of Japan's National Institute for Materials Science in Tsukuba. In 2007, his team used AFM to distinguish individual atoms on a silicon surface, but he acknowledges that the IBM team has surpassed this achievement. "This is the highest resolution I have ever seen," he says.

The IBM researchers believe their technique may open the door to super-powerful computers whose components are built with precisely positioned atoms and molecules. The work may also provide insights into the actions of catalysts in reactions, allowing researchers to understand what is happening at the atomic level, says Gross. *Journal reference: Science, DOI: 10.1126/science.1176210*

Psoriasis cuts sensitivity to disgust

* 13:35 28 August 2009 **by Gaia Vince**

It's hard to ignore a face filled with disgust, but people with an unsightly skin disorder seem to have a muted response to such facial expressions. This reduced sensitivity may serve to protect them from hurtful reactions.

Christopher Griffiths, a dermatologist at Manchester University, UK, and colleagues showed people with psoriasis – a non-infectious skin condition that produces reddening and lesions – a series of images of faces while scanning their brains.

Images of disgusted faces elicited less activation in the insular cortex, which processes feelings and observations of disgust, compared with a control group. Images of fearful faces produced normal levels of activation in the amygdala, which responds to fear, in both groups.

Volunteers with psoriasis were also less likely to identify disgust in faces that showed only subtle signs of the emotion, compared with controls.

People often react with disgust to psoriasis, even thought it is not infectious, says Griffiths. He reckons the brain adaptations in people with the disease "emerged to protect people that do not conform to facial norms".

The psychological burden of the disorder is always far worse than the physical pain, says Linda Papadopoulos, a psychodermatologist based in London who specialises in the social effects of skin disorders.

"This study is fascinating. It's the first I know of that shows neurological changes in psoriasis sufferers, but the results don't surprise me," she says. "People with obvious skin disorders often show behavioural changes."

Journal reference: Journal of Investigative Dermatology, DOI: 10.1038/jid.2009.152

Finnish scientists discover nerve growth factor with therapeutic potential in Parkinson's disease

Scientists in the Academy of Finland's Neuroscience Research Programme have reported promising new results with potential implications for the treatment of Parkinson's disease. They have been studying the impacts of nerve growth factors in the treatment of PD, and their latest results show that a certain growth factor can be used to halt the progress of damage brought on by a nerve poison and possibly even restore the function of damaged cells.

The studies on nerve growth factors used an experimental PD model in rats. Administration of the growth factor reduced motor disturbances in rats.

The severe motor disturbances that are seen in PD are caused by the slow degeneration of dopamine nerves in the brain. There are treatments that alleviate the symptoms of the disease, such as hand tremor, but they do not prevent or halt the degeneration of nerve cells. The nerve growth factors studied to date have slowed nerve cell degeneration to some extent, but they have had only limited therapeutic effect. Several known nerve growth factors, such as GDNF, also attach to extracellular tissue, possibly deterring their movement to nerve cells that require treatment.

Working under the supervision of Academy Professor Mart Saarma, scientists at the University of Helsinki Institute of Biotechnology have now been investigating two new nerve growth factors. MANF (mesencephalic astrocyte-derived neurotrophic factor) is released from glial cells in the midbrain and is a member of the same growth factor family as CDNF, another growth factor that Saarma's team have investigated. A University of Helsinki team led by Professor Raimo K. Tuominen discovered that in the experimental PD model, MANF and CDNF injections into the brain prevented dopamine nerve destruction caused by nerve poison and to some extent even restored the function of damaged cells in rats.

The latest results suggest that MANF spreads more readily in brain tissue than other known growth factors. This may be a highly significant finding in respect to the development of growth factor therapy for PD.

The results are published in the 29 July issue of the Journal of Neuroscience.

Researchers Find High-Dose Therapy for Liver Disease Not Effective

High-dose ursodeoxycholic acid detrimental for treatment of primary sclerosing cholangitis

ROCHESTER, Minn. — A national team of researchers led by scientists at Mayo Clinic has found that a common treatment for primary sclerosing cholangitis, a chronic liver disease, is not helpful for patients, according to a study published this month in the journal Hepatology.

Primary sclerosing cholangitis (PSC) is a disease of the bile ducts. In this case, the term "cholangitis" refers to inflammation of the bile ducts, while "sclerosing" describes the hardening and scarring of the bile ducts that result from chronic inflammation.

"Primary sclerosing cholangitis is a serious liver disease lacking an effective medical therapy," says Keith Lindor, M.D., Mayo Clinic gastroenterologist and the study's lead researcher. "Some studies have shown that

the use of ursodeoxycholic acid, a naturally occurring bile acid, may be a potential solution for patients. Our research, however, showed long-term use of this treatment in high dosages is not suitable for patients."

In this six-year, multicenter trial, 150 patients were enrolled in the study to determine the effectiveness of ursodeoxycholic acid (UDCA) in treatment of PSC. Seventy-six patients were treated with higher doses (28 to 30 mg/kg/day) of UDCA and 74 patients were given a placebo. Serious adverse events were more common in the UDCA group than the placebo group, which prompted researchers to halt the study. UDCA has been thought to be a possible treatment solution for PSC patients, but this trial indicates that the drug, used at this higher dose, is not helpful.

"All of us were surprised that the higher doses of UDCA did not help; in fact, the risk of developing even more liver problems increased with the higher dosages," says Dr. Lindor. "While this was thought to be the best potential treatment for PSC, our study found that not to be the case."

Dr. Lindor says that patients who are currently on higher doses of UDCA should consult with their doctors. He also points out that these study findings highlight the need for more research to look into better treatment options for PSC.

PSC is a progressive disease that leads to liver damage and, eventually, liver failure. Liver transplant is the only known cure for PSC, but transplant is typically reserved for people with severe liver damage.

PSC most often affects people in their 30s to 50s. The average age at diagnosis is 40. However, the condition can arise in childhood. About 60 to 75 percent of people diagnosed with the disease are men. Approximately 70 percent of people with PSC have an associated disease such as inflammatory bowel disease, osteoporosis, gallbladder disease and bile duct cancer or cholangiocarcinoma. However, only 1 to 5 percent of people with inflammatory bowel disease have PSC.

Mayo Clinic's Division of Gastroenterology and Hepatology has been ranked #1 in the U.S. News & World Report Honor Roll of Top Hospitals since the rankings began 20 years ago.

Other members of the Mayo Clinic research team include M. Edwyn Harrison, M.D., Denise Harnois, D.O., Roberta Jorgensen, Jan Petz, Jill Keach, Julie Braaten, M.D., Ellen Miceli, Jeff Schmoll, Tanya Hoskin, Prabin Thapa and Felicity Enders, Ph.D. Other researchers include Kris Kowdley, M.D., and Jody Mooney, M.D., Virginia Mason Medical Center; Velimir Luketic, M.D., and Carol Sargeant, M.D., Virginia Commonwealth University School of Medicine; Timothy McCashland, M.D., and Tamara Bernard, M.D., University of Nebraska; and Alex Befeler, M.D., and Debra King, M.D., Saint Louis University.

Teetotallers more likely to be depressed

Abstaining from alcohol consumption is associated with an increased risk of depression according to a new study published in Addiction journal.

It has long been recognised that excessive alcohol consumption can lead to poor physical and mental health. However, there has been mounting evidence that low levels of alcohol consumption may also be associated with poor mental health possibly due to abstainers having other health problems or being reformed heavy drinkers.

The study utilised data from the Nord-Trøndelag Health Study (HUNT Study) based in Norway. This provided information on the drinking habits and mental health of over 38,000 individuals. Using this data the authors were able to show that those individuals who reported drinking no alcohol over a two week period were more likely than moderate drinkers to report symptoms of depression. Those individuals who additionally labelled themselves as “abstainers” were at the highest risk of depression. Other factors, such as age, physical health problems and number of close friends could explain some, but not all of this increased risk. The authors also had access to reported levels of alcohol consumption 11 years prior to the main survey. This showed that fourteen percent of current abstainers had previously been heavy drinkers, but this did not explain all of the increased risk of depression amongst abstainers.

The authors conclude that in societies where some use of alcohol is the norm, abstinence may be associated with being socially marginalised or particular personality traits that may also be associated with mental illness.

It should also be noted that alcohol use is associated with many physical health problems, with excessive alcohol consumption being estimated to contribute to over 33,000 death in the UK each year and many more injuries. The current guidance is for men to drink no more than three to four units each day, and women to drink no more than two to three units.

Skogen J. C., Harvey S. B., Henderson M., Stordal E., Mykletun A. Anxiety and depression among abstainers and low-level alcohol consumers. Addiction 2009; 104: 1519-1529

UF scientists construct 'off switch' for Parkinson therapy

Common drug shuts down gene therapy in rats, addressing safety concerns for humans

GAINESVILLE — A common antibiotic can function as an "off switch" for a gene therapy being developed for Parkinson's disease, according to University of Florida researchers writing online in advance of September's Molecular Therapy.

The discovery in rats answers an important question — how can new, therapeutic genes that have been irrevocably delivered to the human brain to treat Parkinson's be controlled if the genes unexpectedly start causing problems?

Meanwhile, in a review of Parkinson treatments, the researchers say that prior experimental attempts using growth factors — naturally occurring substances that cause cells to grow and divide — to rescue dying brain cells may have failed because they occurred too late in the course of the disease.

Together, the findings suggest that gene therapy to enable the brain to retain its ability to produce dopamine, a neurotransmitter that falls in critically short supply in Parkinson's patients, could be safely attempted during earlier stages of the disease with an added likelihood of success.

Parkinson's disease affects more than 1 million Americans, causing patients to gradually develop movement problems, including tremors, stiffness and slowness. It is caused by degeneration and death of nerve connections that produce dopamine, a substance necessary for communication between cells that coordinate movement.

"We have worked every day for 10 years to design a construct to the gene delivery vector that enhances the safety profile of gene transfer for Parkinson's disease," said Ronald Mandel, a professor of neuroscience at UF's McKnight Brain Institute and the Powell Gene Therapy Center. "With that added measure of safety, we believe we can intervene with gene transfer in patients at earlier stages of the disease. We strongly believe that trials to save dopamine-producing connections in patients with Parkinson's disease have failed because the therapy went into patients who were in the late stages of the disease and who had too few remaining dopamine-producing connections."

Often patients are given prescriptions for levodopa, or L-dopa, which is converted into dopamine by enzymes in the brain. But the treatment loses its effectiveness over time and does nothing to slow the disease's progression.

Meanwhile, trials in the United States to treat Parkinson's involving direct infusion of growth factors or the transplantation of genes that produce growth factors have had limited success, with some side effects.

Mandel's research group has concentrated on using an adeno-associated virus to engineer brain cells in animal models with genes that can protect dopamine-producing cells, which then do the vital work of producing GDNF, short for glial cell line-derived neurotrophic factor. The naturally occurring protein is important for the survival of dopamine-producing neurons during brain development, and a survival factor when given to adults.

In this case, scientists engineered the virus with two genes that must act in concert to produce the protein. But this precise interaction can be inhibited with dietary doxycycline, an antibiotic that is often prescribed in low doses to treat bacterial growth related to acne.

Depending on the amount of the antibiotic, protein production can be reduced or stopped, which would for the first time give medical investigators the ability to regulate gene therapy after the treatment was delivered.

"With this technique, you could adjust the therapy in the patient," said Fredric P. Manfredsson, a postdoctoral associate in UF's department of neuroscience. "That would be extremely helpful because no one is really certain yet what dosage is required for a protective effect in humans. The process is also much more sensitive than we had imagined it would be. GDNF production can be shut down completely with a dose of doxycycline that is much smaller than what is commonly prescribed."

Mandel said that adding the safety construct to the gene vector and proving its effectiveness were arduous tasks in which Manfredsson played an essential role.

A variety of methods were used to gauge GDNF production, but one was uncommon and involved the novel observation of the rats' weight. In prior research, the scientists had found delivering the protein to certain regions of the brain would hinder weight gain in younger rats and can cause weight loss in older rats. In the recent experiments, scientists found they could control the rate of weight gain in the rats with dietary doxycycline, which essentially verified they were controlling the GDNF therapy.

"The ability to control gene regulation is important for the future development of gene therapy, and optimizing its safe application to humans," said Dr. Mark Tuszynski, a professor of neurosciences and director of the Center for Neural Repair at the University of California, San Diego, who did not participate in the research. "The work of Dr. Mandel and colleagues brings us an important step closer to this goal."

The work was supported by the National Institute of Neurological Disorders and Stroke.

Heart 'patches' grown in fatty apron

A FATTY apron of tissue called the omentum, which sits over the stomach and intestines, may be the perfect spot to grow patches of cells for heart repair.

Heart attacks can cause permanent damage to heart tissue. In theory, tissue grown in the lab can repair the damage, but this doesn't always integrate well into the body.

To solve this problem, Smadar Cohen, a tissue engineer at Ben-Gurion University of the Negev in Beersheba, Israel, and colleagues seeded rat cardiac cells onto scaffolds which they transplanted into the omentums of eight rats. After a week of growth, they transplanted the patches of heart tissue into the damaged hearts of another set of rats. The patches integrated well with existing heart cells and beat in time, unlike patches grown in the lab (Proceedings of the National Academy of Sciences, DOI: 10.1073/pnas.0812242106).

The team attributes the success to the omentum-grown cells developing a denser, more mature set of blood vessels. The same trick might one day also work in people, although some might object to having two transplants.

Photosynthetic viruses keep world's oxygen levels up

* 30 August 2009 **by Nora Schultz**

NEXT time you take in a lungful of oxygen, consider this: it was made possible in part by ocean viruses.

The viruses, which infect single-celled algae called cyanobacteria, are hyperefficient photosynthesisers thanks to a unique set of genes.

Previous work had shown that cyanophage viruses have some photosynthesis genes, apparently used to keep the host cyanobacteria on life support during the infection, which otherwise knocks out the cells' basic functions.

Now Oded Béjà from the Technion-Israel Institute of Technology in Haifa says that the cyanophages' photosynthetic proficiency doesn't stop there. While screening DNA sequences in water samples collected during Craig Venter's Global Ocean Sampling Expedition, his team discovered seven more photosynthesis genes coding for a complex of proteins collectively named photosystem I. They believe the viral complex has a unique shape that makes cyanophage photosynthesis hyperefficient.

The viral complex has a unique shape that makes photosynthesis hyperefficient

In normal photosynthesis, photosystem I grabs electrons from proteins higher up in the photosynthesis chain reaction. The team believe the viral photosystem I genes allow the cyanophages to not only take electrons from the proteins involved in photosynthesis but also from other algal proteins.

"We suspect that when these phages enter the cell, they start to replace [the cell's] photosystem," says Béjà. "By grabbing electrons from all sources available at the time, they get more energy out of photosynthesis."

Eric Wommack of the University of Delaware in Newark says the discovery suggests these viruses may play a role in global oxygen production. "Their hosts produce half the world's oxygen and roughly 10 per cent of these cells are infected by cyanophages," he says. "So it is possible that as much as 5 per cent of the world's oxygen production results from cyanophage infected cells."

Researchers identify protein involved in causing gum disease, osteoporosis, arthritis

Investigators at Hospital for Special Surgery, collaborating with researchers from other institutions, have contributed to the discovery that a gene called interferon regulator factor-8 (IRF-8) is involved in the development of diseases such as periodontitis (gum disease), rheumatoid arthritis and osteoporosis. The study, which will be published online August 30, ahead of print, in the journal Nature Medicine, could lead to new treatments in the future.

"The study doesn't have immediate therapeutic applications, but it does open a new avenue of research that could help identify novel therapeutic approaches or interventions to treat diseases such as periodontitis, rheumatoid arthritis or osteoporosis," said Baohong Zhao, Ph.D., lead author of the study and a research fellow in the Arthritis and Tissue Degeneration Program at Hospital for Special Surgery located in New York City.

Dr. Zhao initiated the study while working in the laboratory led by Drs. Masamichi Takami and Ryutaro Kamijo at Showa University, Tokyo, where much of the work was performed. Dr. Zhao completed the study and extended the work to human cells during the past year at Hospital for Special Surgery working with Dr. Lionel Ivashkiv.

Specifically, the researchers discovered that downregulation of IRF-8 (meaning that the gene produces less IRF-8 protein) increases the production of cells called osteoclasts that are responsible for breaking down bone. An osteoblast is a type of cell that is responsible for forming bone and an osteoclast is a type of cell that breaks down bony tissue (bone resorption). In humans and animals, bone formation and bone resorption are closely coupled processes involved in the normal remodeling of bone. Enhanced development of osteoclasts, however, can create canals and cavities that are hallmarks of diseases such as periodontitis, osteoporosis and rheumatoid arthritis.

Previous researchers have spent time identifying genes that are upregulated during enhanced development of osteoclasts, such as NFATc1, but few studies have identified genes that are downregulated in the process. To fill this knowledge gap, scientists at Hospital for Special Surgery, collaborating with researchers at other institutions, used microarray technology to conduct a genome-wide screen to identify genes that are downregulated during the formation of osteoclasts. They found that expression of IRF-8 was reduced by 75 percent in the initial phases of osteoclast development.

The researchers then genetically engineered mice to be deficient in IRF-8 and gave the animals x-rays and CT (computed tomography) scans to analyze IRF-8's influence on bone. They found that the mice had decreased bone mass and severe osteoporosis. Experiments demonstrated that this was due not to a decreased number of osteoblasts, but because of an increased number of osteoclasts. The researchers concluded that IRF-8 suppresses the production of osteoclasts.

Tests in human cells confirmed these findings. This included a study that showed that silencing IRF-8 messenger RNA in human osteoclast precursors with small interfering RNAs resulted in enhanced osteoclast production. In other words, decreased IRF-8 means more osteoclasts are produced.

This led the investigators to examine the effect of IRF-8 on the activity of a protein called NFATc1 that was previously reported to interact with IRF-8. They found that IRF-8 inhibited the function and expression of NFATc1. This makes sense given that upregulation of NFATc1 is involved in triggering osteoclast precursor cells to turn into osteoclasts.

"This is the first paper to identify that IRF-8 is a novel key inhibitory factor in osteoclastogenesis [production of osteoclasts]," said Dr. Zhao. "We hope that the understanding of this gene can contribute to understanding the regulatory network of osteoclastogenesis and lead to new therapeutic approaches in the future."

Other authors involved in the study are Masamichi Takami, Ph.D., Atsushi Yamada, Ph.D., Xiaogu Wang, Ph.D., and Ryutaro Kamijo, Ph.D., from Showa University in Tokyo, Japan; Takako Koga, Ph.D., and Hiroshi Takayanagi, M.D., Ph.D., from Tokyo Medical and Dental University and the International Research Center for Molecular Science in Tooth and Bone Disease, both in Japan; Xiaoyu Hu, M.D., Ph.D., and Lionel Ivashkiv, M.D., from Hospital for Special Surgery; Tomohiko Tamura, M.D., Ph.D., and Keiko Ozato, Ph.D., from the National Institutes of Health; and Yongwon Choi, Ph.D., from the University of Pennsylvania School of Medicine.

The work was supported by in part by the High-Tech Research Center Project for Private Universities from the Ministry of Education, Culture, Sports, Science and Technology in Japan; by Grants-in-Aid for Scientific Research from the Japan Society for the Promotion of Science; and by grants from the U.S. National Institutes of Health.

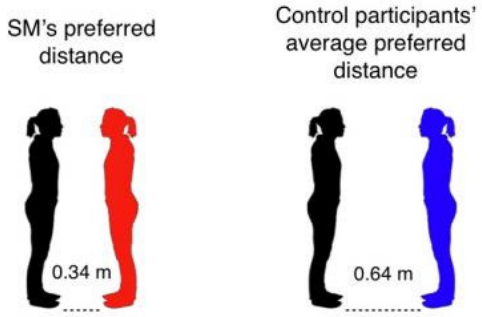
Caltech neuroscientists find brain region responsible for our sense of personal space

Finding could offer insight into autism and other disorders

Pasadena, Calif.—In a finding that sheds new light on the neural mechanisms involved in social behavior, neuroscientists at the California Institute of Technology (Caltech) have pinpointed the brain structure responsible for our sense of personal space.

The discovery, described in the August 30 issue of the journal Nature Neuroscience, could offer insight into autism and other disorders where social distance is an issue.

The structure, the amygdala—a pair of almond-shaped regions located in the medial temporal lobes—was previously known to process strong negative emotions, such as anger and fear, and is considered the seat of emotion in the brain. However, it had never been linked rigorously to real-life human social interaction.



Patient SM, a woman with complete bilateral amygdala lesions (red), preferred to stand close to the experimenter (black). On average, control participants (blue) preferred to stand nearly twice as far away from the same experimenter. Images drawn to scale. **Nature Neuroscience/Dan Kennedy (Caltech)**

The scientists, led by Ralph Adolphs, Bren Professor of Psychology and Neuroscience and professor of biology and postdoctoral scholar Daniel P. Kennedy, were able to make this link with the help of a unique patient, a 42-year-old woman known as SM, who has extensive damage to the amygdala on both sides of her brain.

"SM is unique, because she is one of only a handful of individuals in the world with such a clear bilateral lesion of the amygdala, which gives us an opportunity to study the role of the amygdala in humans," says Kennedy, the lead author of the new report.

SM has difficulty recognizing fear in the faces of others, and in judging the trustworthiness of someone, two consequences of amygdala lesions that Adolphs and colleagues published in prior studies.

During his years of studying her, Adolphs also noticed that the very outgoing SM is almost too friendly, to the point of "violating" what others might perceive as their own personal space. "She is extremely friendly, and

she wants to approach people more than normal. It's something that immediately becomes apparent as you interact with her," says Kennedy.

Previous studies of humans never had revealed an association between the amygdala and personal space. From their knowledge of the literature, however, the researchers knew that monkeys with amygdala lesions preferred to stay in closer proximity to other monkeys and humans than did healthy monkeys.

Intrigued by SM's unusual social behavior, Adolphs, Kennedy, and their colleagues devised a simple experiment to quantify and compare her sense of personal space with that of healthy volunteers.

The experiment used what is known as the stop-distance technique. Briefly, the subject (SM or one of 20 other volunteers, representing a cross-section of ages, ethnicities, educations, and genders) stands a predetermined distance from an experimenter, then walks toward the experimenter and stops at the point where they feel most comfortable. The chin-to-chin distance between the subject and the experimenter is determined with a digital laser measurer.

Among the 20 other subjects, the average preferred distance was .64 meters—roughly two feet. SM's preferred distance was just .34 meters, or about one foot. Unlike other subjects, who reported feelings of discomfort when the experimenter went closer than their preferred distance, there was no point at which SM became uncomfortable; even nose-to-nose, she was at ease. Furthermore, her preferred distance didn't change based on who the experimenter was and how well she knew them.

"Respecting someone's space is a critical aspect of human social interaction, and something we do automatically and effortlessly," Kennedy says. "These findings suggest that the amygdala, because it is necessary for the strong feelings of discomfort that help to repel people from one another, plays a central role in this process. They also help to expand our understanding of the role of the amygdala in real-world social interactions."

Adolphs and colleagues then used a functional magnetic resonance imaging (fMRI) scanner to examine the activation of the amygdala in a separate group of healthy subjects who were told when an experimenter was either in close proximity or far away from them. When in the fMRI scanner, subjects could not see, feel, or hear the experimenter; nevertheless, their amygdalae lit up when they believed the experimenter to be close by. No activity was detected when subjects thought the experimenter was on the other side of the room.

"It was just the idea of another person being there, or not, that triggered the amygdala," Kennedy says. The study shows, he says, that "the amygdala is involved in regulating social distance, independent of the specific sensory cues that are typically present when someone is standing close, like sounds, sights, and smells."

The researchers believe that interpersonal distance is not something we consciously think about, although, unlike SM, we become acutely aware when our space is violated. Kennedy recounts his own experience with having his personal space violated during a wedding: "I felt really uncomfortable, and almost fell over a chair while backing up to get some space."

Across cultures, accepted interpersonal distances can vary dramatically, with individuals who live in cultures where space is at a premium (say, China or Japan) seemingly tolerant of much closer distances than individuals in, say, the United States. (Meanwhile, our preferred personal distance can vary depending on our situation, making us far more willing to accept less space in a crowded subway car than we would be at the office.)

One explanation for this variation, Kennedy says, is that cultural preferences and experiences affect the brain over time and how it responds in particular situations. "If you're in a culture where standing close to someone is the norm, you'd learn that was acceptable and your personal space would vary accordingly," he says. "Even then, if you violate the accepted cultural distance, it will make people uncomfortable, and the amygdala will drive that feeling."

The findings may have relevance to studies of autism, a complex neurodevelopmental disorder that affects an individual's ability to interact socially and communicate with others. "We are really interested in looking at personal space in people with autism, especially given findings of amygdala dysfunction in autism. We know that some people with autism do have problems with personal space and have to be taught what it is and why it's important," Kennedy says.

He also adds a word of caution: "It's clear that amygdala dysfunction cannot account for all the social impairments in autism, but likely contributes to some of them and is definitely something that needs to be studied further."

Other coauthors of the paper, "Personal Space Regulation by the Human Amygdala," are postdoctoral scholar Jan Gläscher and J. Michael Tyszka, the associate director of the Caltech Brain Imaging Center and director of Magnetic Resonance Physics. The work was funded by the National Institute of Mental Health, the Simons Foundation, the Della Martin Foundation, and a global Center of Excellence grant from Japan.