

Time lived with obesity linked with mortality

Monash University researchers have found the number of years individuals live with obesity is directly associated with the risk of mortality.

The research shows that the duration of obesity is a strong predictor of mortality, independent of the actual level of Body Mass Index (BMI). As the onset of obesity occurs earlier and the number of years lived with obesity increases, the risk of mortality associated with adult obesity in contemporary populations is expected to increase compared with previous decades. Using data from the Framingham Heart Study, 5209 participants were followed up for 48 years from 1948. The current study however only included participants who were free from pre-existing diseases of diabetes, cardiovascular diseases and cancer.

The research showed that for those who had a medium number of years lived with obesity (between five years and 14.9 years), the risk of mortality more than doubled than for those who had never been obese. The risk of mortality almost tripled for those with the longest duration of obesity (more than 15 years).

Furthermore, the research showed for every additional two years lived with obesity, the risk of mortality increased by between six and seven per cent.

"Before now, we did not know whether being obese for longer was any worse for your health than simply being obese. However, this research shows for the first time that being obese for longer increases your risk of mortality, no matter how heavy you actually are," Monash University researcher, Dr Anna Peeters said.

"This research provides added support for all the current policy trying to prevent obesity in general. It also indicates that we should try extra hard to prevent obesity at younger ages," said Dr Peeters.

The research, published in the International Journal of Epidemiology, was undertaken by Asnawi Abdullah, Rory Wolfe, Johannes Stoelwinder, Christopher Stevenson, Helen Walls and Anna Peeters from Monash University and Maximilian de Courten from the University of Copenhagen.

Study shows Native Americans modified American landscape years prior to arrival of Europeans

Study has important implications to how "sensitive" landscapes are to land-use and farming strategies

A new study by Baylor University geology researchers shows that Native Americans' land use nearly a century ago produced a widespread impact on the eastern North American landscape and floodplain development several hundred years prior to the arrival of major European settlements.

Researchers attribute early colonial land-use practices, such as deforestation, plowing and damming with influencing present-day hydrological systems across eastern North America. Previous studies suggest that Native Americans' land use in eastern North America initially caused the change in hydrological systems, however, little direct evidence has been provided until now. The study appears on-line in the journal *Geology*.

The Baylor study found that pre-European so-called "natural" floodplains have a history of prehistoric indigenous land use, and thus colonial-era Europeans were not the first people to have an impact on the hydrologic systems of eastern North America. The study also found that prehistoric small-scale agricultural societies caused widespread ecological change and increased sedimentation in hydrologic systems during the Medieval Climate Anomaly–Little Ice Age, which occurred about 700 to 1,000 years ago.

"These are two very important findings," said Gary Stinchcomb, a Baylor doctoral candidate who conducted the study. "The findings conclusively demonstrate that Native Americans in eastern North America impacted their environment well before the arrival of Europeans. Through their agricultural practices, Native Americans increased soil erosion and sediment yields to the Delaware River basin."

The Baylor researchers found that prehistoric people decreased forest cover to reorient their settlements and intensify corn production. They also contributed to increased sedimentation in valley bottoms about 700 to 1,000 years ago, much earlier than previously thought. The findings suggest that prehistoric land use was the initial cause of increased sedimentation in the valley bottoms, and sedimentation was later amplified by wetter and stormier conditions.

To conduct the study, the Baylor researchers took samples from several different spots along the Delaware River Valley. Landforms were mapped based on relative elevations to Delaware River base flow and archaeological excavations assessed the presence of human habitation. The Baylor researchers then used a site-specific geoarchaeological approach and a regional synthesis of previous research to test the hypothesis that the indigenous population had a widespread impact on terrestrial sedimentation in eastern North America.

"This study provides some of the most significant evidence yet that Native Americans impacted the land to a much greater degree than previously thought," said Dr. Steve Driese, professor and chair of Baylor's department

of geology, College of Arts and Sciences, who co-authored the study. "It confirms that Native American populations had widespread effects on sedimentation."

http://www.eurekalert.org/pub_releases/2011-03/uoc--psg031611.php

Primordial soup gets spicier

'Lost' samples from famous origin of life researcher could send the search for Earth's first life in a new direction

Stanley Miller gained fame with his 1953 experiment showing the synthesis of organic compounds thought to be important in setting the origin of life in motion. Five years later, he produced samples from a similar experiment, shelved them and, as far as friends and colleagues know, never returned to them in his lifetime.

More 50 years later, Jeffrey Bada, Miller's former student and a current Scripps Institution of Oceanography, UC San Diego professor of marine chemistry, discovered the samples in Miller's laboratory material and made a discovery that represents a potential breakthrough in the search for the processes that created Earth's first life forms.

Former Scripps undergraduate student Eric Parker, Bada and colleagues report on their reanalysis of the samples in the March 21 issue of Proceedings of the National Academy of Sciences. Miller's 1958 experiment in which the gas hydrogen sulfide was added to a mix of gases believed to be present in the atmosphere of early Earth resulted in the synthesis of sulfur amino acids as well as other amino acids. The analysis by Bada's lab using techniques not available to Miller suggests that a diversity of organic compounds existed on early planet Earth to an extent scientists had not previously realized.

"Much to our surprise the yield of amino acids is a lot richer than any experiment (Miller) had ever conducted," said Bada. The new findings support the case that volcanoes - a major source of atmospheric hydrogen sulfide today - accompanied by lightning converted simple gases into a wide array of amino acids, which are were in turn available for assembly into early proteins.

Bada also found that the amino acids produced in Miller's experiment with hydrogen sulfide are similar to those found in meteorites. This supports a widely-held hypothesis that processes such as the ones in the laboratory experiments provide a model of how organic material needed for the origin of life are likely widespread in the universe and thus may provide the extraterrestrial seeds of life elsewhere.

Successful creation of the sulfur-rich amino acids would take place in the labs of several researchers, including Miller himself, but not until the 1970s.

"Unbeknownst to him, he'd already done it in 1958," said Bada.

Miller's initial experiments in the 1950s with colleague Harold Urey used a mixture of gases such as methane, ammonia, water vapor and hydrogen and electrically charged them as lightning would. The experiment, which took place in a closed chamber meant to simulate conditions on early Earth, generated several simple amino acids and other organic compounds in what became known as "primordial soup."

With the gases and electrical energy they produce, many geoscientists believe the volcanoes on a young planet covered much more extensively by water than today's served as oases of raw materials that allowed prebiotic matter to accumulate in sufficient quantities to assemble into more complex material and eventually into primitive life itself. Bada had already begun reanalyzing Miller's preserved samples and drawing conclusions about the role of volcanoes in sparking early life when he came across the previously unknown samples. In a 2008 analysis of samples left from Miller's more famous experiment, Bada's team had been able to detect many more amino acids than his former mentor had thanks to modern techniques unavailable to Miller.

Miller, who became a chemistry professor at UCSD in 1960, conducted the experiments while a faculty member at Columbia University. He had collected and catalogued samples from the hydrogen sulfide mix but never analyzed them. He only casually mentioned their existence late in his life and the importance of the samples was only realized shortly before his death in 2007, Bada said. It turned out, however, that his 1958 mix more closely resembled what geoscientists now consider early Earth conditions than did the gases in his more famous previous experiment.

"This really not only enhances our 2008 study but goes further to show the diversity of compounds that can be produced with a certain gas mixture," Bada said. The Bada lab is gearing up to repeat Miller's classic experiments later this year. With modern equipment including a miniaturized microwave spark apparatus, experiments that took the elder researcher weeks to carry out could be completed in a day, Bada said.

Parker, now a student at Georgia Tech, led the study. Co-authors include H. James Cleaves from the Carnegie Institution of Washington in Washington D.C.; Jason P. Dworkin, Daniel P. Glavin and Michael P. Callahan of NASA Goddard Space Flight Center in Greenbelt, Md.; Andrew D. Aubrey of the Jet Propulsion Laboratory in La Cañada Flintridge, Calif. and Antonio Lazcano of the National Autonomous University of Mexico in Mexico City.

http://www.eurekalert.org/pub_releases/2011-03/jaaj-cit031711.php

Changes in taste function related to obesity and chronic ear inflammation

Children with chronic inflammation of the middle ear can experience changes in their sense of taste, and these changes may be related to childhood obesity, according to a report in the March issue of Archives of Otolaryngology – Head & Neck Surgery, one of the JAMA/Archives journals.

Chronic otitis media with effusion is a persistent inflammation of the middle ear, in which effusion fluid is retained in the middle ear cavity. "Otitis media with effusion (OME) is a disease with a high incidence in childhood and is a common cause of hearing disturbances in children," the authors write as background information in the article. "Although most children have a good prognosis, 10 percent of affected children develop recurrent or persistent OME."

Il Ho Shin, M.D., of Kyung Hee University, Seoul, South Korea, and colleagues conducted a case-control study to evaluate the association between the taste threshold in patients with chronic otitis media with effusion (COME) and the relationship with body mass index. The authors hypothesized that changes in taste function may occur in children with COME and that such changes may be associated with body weight.

The researchers measured the taste thresholds of 42 children with COME who underwent insertion of a small plastic tube into the eardrum to keep the middle ear aerated, and a control group of 42 children without OME. Four standard taste solutions - sugar, salt, citric acid, and quinine hydrochloride - were used in chemical taste tests. The authors found that children with chronic otitis media with effusion had a significantly higher body mass index (BMI) than those in the control group. Test results showed taste thresholds on the anterior (front) part of the tongue were higher in children with COME than in the control group.

Chemical taste tests showed the thresholds of sweet and salty tastes were elevated for children in the COME group. The thresholds of bitter and sour taste were also somewhat higher in the otitis media group, but these differences were not statistically significant. "These findings suggest an association between changes in taste and increased BMI in pediatric patients with COME," the authors conclude.

Arch Otolaryngol Head Neck Surg. 2011;137[3]:242-246. Available pre-embargo to the media at www.jamamedia.org.

http://www.eurekalert.org/pub_releases/2011-03/agu-ath032111.php

Ancient trash heaps gave rise to Everglades tree islands

SANTA FE, N.M. – Garbage mounds left by prehistoric humans might have driven the formation of many of the Florida Everglades' tree islands, distinctive havens of exceptional ecological richness in the sprawling marsh that are today threatened by human development.

Tree islands are patches of relatively high and dry ground that dot the marshes of the Everglades. Typically a meter (3.3 feet) or so high, many of them are elevated enough to allow trees to grow. They provide a nesting site for alligators and a refuge for birds, panthers, and other wildlife.

Scientists have thought for many years that the so-called fixed tree islands (a larger type of tree island frequently found in the Everglades' main channel, Shark River Slough) developed on protrusions from the rocky layer of a mineral called carbonate that sits beneath the marsh. Now, new research indicates that the real trigger for island development might have been middens, or trash piles left behind from human settlements that date to about 5,000 years ago.

These middens, a mixture of bones, food discards, charcoal, and human artifacts (such as clay pots and shell tools), would have provided an elevated area, drier than the surrounding marsh, allowing trees and other vegetation to grow. Bones also leaked phosphorus, a nutrient for plants that is otherwise scarce in the Everglades. "This goes to show that human disturbance in the environment doesn't always have a negative consequence," says Gail Chmura, a paleoecologist at McGill University in Montreal, Canada, and one of the authors of the study.

Chmura will be presenting her research tomorrow, Tuesday 22 March, at the American Geophysical Union's Chapman Conference on Climates, Past Landscapes, and Civilizations. About 95 scientists have converged on Santa Fe this week to discuss the latest research findings from archeology, paleoclimatology, paleoecology, and other fields that reveal how changes in regional and global climate have impacted the development and fates of societies.

In a previous scientific investigation of tree islands, Margo Schwadron, an archeologist with the National Park Service, cut through the elevated bedrock at the base of two islands and discovered that it was actually a so-called "perched carbonate layer," because there was more soil and a midden below. Later, a team including Chmura's graduate student Maria-Theresia Graf performed additional excavations in South Florida and found more of the perched carbonate layers.

Chemical analysis of samples of these curious perched layers revealed that they are made up partially of carbonates that had dissolved from the bedrock below, Chmura says. The layer also contains phosphorus from

dissolved bones, she adds. Her team concluded that trees are key to the formation of this layer: During South Florida's dry season, their roots draw in large quantities of ground water but allow the phosphates and carbonates dissolved in it to seep out and coalesce into the stone-like layer.

The perched carbonate plays a key role in letting tree islands rebound after fires: because it does not burn, it protects the underlying soil, and it maintains the islands' elevation, allowing vegetation to regrow after the fire. Humans are now threatening the existence of tree islands, by cutting down trees (whose roots keep the perched layer in place) and artificially maintaining high water levels year-round in some water control systems, which could cause the layer to dissolve.

Chmura's team now wants to explore exactly when trees started growing on the tree islands.

This research by Chmura et al. is being presented on Tuesday, 22 March, at the American Geophysical Union's Chapman Conference on Climates, Past Landscapes, and Civilizations.

To read the abstract of this presentation, please use this search engine: <http://agu-cc11cp.abstractcentral.com/itin.jsp>

<http://news.sciencemag.org/sciencenow/2011/03/navy-sonar-may-mimic-killer-whal.html>

Navy Sonar May Mimic Killer Whale Sounds

by John C. Cannon on 18 March 2011, 4:42 PM

Sonar drives beaked whales long distances from their favorite deep-water habitats, according to the first study conducted during actual U.S. Navy exercises.

The finding could explain why these whales sometimes end up in dangerously shallow water where they could strand. It also suggests that the level of sonar that the Navy considers safe may be too high.

Blainville's beaked whales belong to a mysterious family of long-snouted whales that prowl kilometer-deep ocean canyons, often far from land. And yet, beaked whales often turn up stranded shortly after the intense sonar exercises the Navy uses to train sailors to detect silent enemy submarines. During one such event in 2000, six beaked whales died on beaches in the Bahamas following Navy testing. Some researchers have hypothesized that sonar noise scares whales into dangerous dive patterns, causing disorienting bends-like symptoms that could throw them off course and into unfamiliar shallow water. But solid evidence for sonar's effects on whale behavior has remained elusive, in part because these whales spend so little time at the surface that charting their behavior is difficult. Previous studies have also played back sonar recordings rather than tracking the effects of actual Navy exercises.

So in the new study, animal behaviorist Peter Tyack of the Woods Hole Oceanographic Institution in Massachusetts and colleagues enlisted the Navy's help. The researchers set up at the Atlantic Undersea Test and Evaluation Center in the Bahamas, where the Navy trains sailors in sonar use. With a set of underwater microphones, they listened for the "click trains" of Blainville's beaked whales - signature sets of clicks that the animals use to home in on squid and other favorite prey in the murky depths of the sea.

Initially, some two dozen whales were foraging on the Navy's test range, according to the clicks. But as the sonar exercises began, the clicks started to disappear, suggesting that the whales cut short their hunting and swam kilometers away from the sound. Once the exercise stopped, the whales returned to the range within a few days, probably because the range is a prime feeding ground.

Tyack and his colleagues also attached satellite tags to several whales, aiming to find out how loud the sonar was when it reached them and to trace their dive patterns. In separate experiments, the team played recordings of sonar simulating that used by Navy ships, general noise similar in frequency to naval sonar, and killer whale calls. Tyack hypothesized that because of the similarity in frequency, whales might mistake sonar for the vocalizations of killer whales, their most dangerous predator. And indeed, the tagged whales responded similarly to both sounds, swimming away from the source and staying deep, only gradually rising for a breath - a tactic whales often use to avoid predators. "For a beaked whale, being deep is safe," Tyack says. "Killer whales and human activities are mostly near the surface."

Still, Tyack says, these whales are accustomed to Navy sonar, so even though they move away from the sound, they probably don't panic. But whales that have never heard the sound might. These naïve whales could bolt, possibly getting trapped in shallow water or diving in dangerous patterns that could give them the bends.

The team, which reports its findings this week in PLoS ONE, also found the whales broke off their foraging dives at sounds of about 140 decibels - a level the Navy considers safe. "This study is a good foundation to start to say that perhaps those levels are high in some cases," says Terrie Williams, a mammalian physiologist at the University of California, Santa Cruz. She points out that most of what we know about whale strandings comes after they occur, providing little information about what led the animals to beach themselves. Williams calls the study a "landmark" in understanding how whales respond to sound: "The question now is, 'When does that response become detrimental to the point of stranding?'"

Vladimir Komarov: The Unsung Space Hero

Analysis by Jennifer Ouellette

There is a new book coming out next month detailing the life and times of Soviet cosmonaut Yuri Gagarin, the first man in space.

He was aboard Vostok 1 when it made its historic spaceflight on April 12, 1961. The book is entitled *Starman: The Truth Behind the Legend of Yuri Gagarin*, and it's generating a bit of buzz not for its purported subject -- Gagarin himself -- but for the account of another doomed spaceflight in 1967 that claimed the life of Gagarin's good friend and fellow cosmonaut, Vladimir Komarov. It's a truly heartbreaking tale.

Robert Krulwich helpfully [*provides the highlights of the account*](#) given by authors Jamie Doran and Piers Bizony, who claim to have based their version of events on details provided by a former KGB officer named Venymin Ivanovich Russayev, and the investigation of a reporter for Pravda named Yaroslav Golovanov. [UPDATE: Krulwich wrote a second post highlighting several questions raised by space historians about the accuracy of *Starman* and the sources the authors relied upon for their book. He is investigating further. Follow Krulwich Wonders for further updates.] If those sources are to be believed, here's what happened:

Once upon a time, there were two Russian cosmonauts, Yuri and Vladimir, who happened to be good friends. One day, USSR leader Leonid Brezhnev decided it would be a nifty idea to show those Americans how space flight is done by staging a mid-space rendezvous between two Soviet spaceships.

Soyuz I would carry one cosmonaut into near-Earth orbit, and then a second spacecraft would be launched with another cosmonaut aboard. Those two men would then switch places and the first cosmonaut would return to Earth in the second spaceship. What could possibly go wrong? In a word, everything.

Suicide Mission

Various technicians inspected Soyuz I prior to launch and found a whopping 203 structural problems; clearly, the mission should be postponed, since any cosmonaut who launched aboard the spacecraft would be unlikely to return alive. And who should be chosen to be that ill-fated cosmonaut, but Vladimir. His friend Yuri would be his alternate.

Not wanting to see his good friend die, Yuri penned a 10-page memo for Brezhnev and gave it to a pal in the KGB to forward. Yuri was a national treasure, a bona fide celebrity by then; surely those in power would listen to his concerns. But the memo never got to Brezhnev. Nobody wanted to be the messenger of bad news, you see. As Krulwich notes, "Everyone who saw that memo... was demoted, fired, or sent to diplomatic Siberia." That included the KGB agent (Russayev) who tried to forward Yuri's memo.

According to Russayev, he asked Vladimir why he simply didn't refuse to fly the mission, and Vladimir answered truthfully: because if he backed out, his alternate would be the one to launch into near-certain death, and that alternate was his good friend Yuri. "He'll die instead of me," he said. "We've got to take care of him." And knowing he was sealing his own fate, Vladimir burst into tears.

Pause a moment and ask yourself: what would you have done? Would you save your own skin and back out of the mission, even though it meant your good friend would likely die in your stead? Could you live with the guilt if you did so? Or would you do what Vladimir did, and sacrifice yourself for your friend?

"Crying With Rage"

Apparently Yuri showed up on that fateful day, April 23, 1967, and demanded to be suited up for the flight instead of his friend, but he was refused. The launch proceeded as planned, with Vladimir on board. And the multiple malfunctions, indeed, proved fatal. As Krulwich writes:

"So there's a cosmonaut up in space, circling the globe, convinced he will never make it back to Earth; he's on the phone with Alexsei Kosygin - then a high official of the Soviet Union - who is crying because he, too, thinks the cosmonaut will die. The space vehicle is shoddily constructed, running dangerously low on fuel; its parachutes -- though no one knows this - won't work, and the cosmonaut... is about to, literally, crash full speed into Earth, his body turning molten on impact. As he heads to his doom, US listening posts in Turkey hear him crying with rage, cursing the people who had put him inside a botched spaceship."

All that was left of Vladimir Komarov was a chipped heel bone and a misshapen molten lump of remains; nonetheless, the state funeral featured an open casket.

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Purportedly, Yuri Gagarin was consumed with guilt over what had happened to his friend, since he hadn't been able to persuade Brezhnev to postpone the mission. There is a rumor that when Yuri finally did come face to face with Brezhnev, he threw a drink in his face. One can only hope this is true.

The worst part of the story is that Vladimir's sacrifice was in vain. One year later, Yuri was on a routine training flight with another flight instructor when their MIG crashed near the town of Kirzhach. Both men died.

There are any number of theories about what went wrong, but conspiracy theorists have bandied about the possibility that the crash wasn't exactly an accident. Perhaps Yuri Gagarin, despite his national hero status, had started to make a few too many waves. We'll probably never know the truth; the Kremlin refused to open a new investigation in April 2007.

Look, space flight is dangerous even today; the various space shuttle tragedies attest to that. It was even more dangerous during the 1960s. The same year Vladimir plummeted to his death, three American astronauts perished when an Apollo capsule caught fire (Gus Grissom, Ed White, and Roger Chaffee). Krulwich rightly points out that in 1969, then-President Nixon had a speech all prepared in the event that the Apollo 11 astronauts were stranded on the moon, slowly suffocating to death as their life support systems failed.

But ask any astronaut why they do it, and they'll likely tell you it's worth the risk -- because there's nothing more amazing than being in space, looking back at the home planet, and marveling, as Yuri Gagarin did on his historic flight, "The Earth is blue... How wonderful. It is amazing."

http://www.eurekalert.org/pub_releases/2011-03/ru-brb032111.php

Biofilm reorganization: Back to the theoretical drawing board

Microcinematic image analysis finds existing theories of bacterial self-organization are lacking

HOUSTON - In a surprising new study, researchers using image-analysis methods similar to those employed in facial-recognition software have made a startling discovery that rules out the two main theories scientists had created to explain how bacteria self-organize into multicellular aggregate mounds. The study by researchers from Rice University and the University of Georgia appears online this week in the Proceedings of the National Academy of Sciences.

The find is important for the study of biofilms -- slimy colonies of bacteria that form on everything from teeth to pacemakers. Federal health officials have estimated that as many as 80 percent of all microbial infections arise from biofilms, and scientists know that the same bacteria can be up to 1,000 times more resistant to antibiotics if they're living inside a biofilm rather than living on their own. To better fight biofilms, scientists have been scrambling to understand the biochemical and biophysical mechanisms that allow bacteria to form aggregates, reorganize and interact.

"The results of our analysis were really surprising," said study co-author Oleg Igoshin, assistant professor in bioengineering at Rice. "Our results didn't support either of the major competing theories people have come up with. Those theories were each predicated on the idea that as the bacterial mounds were forming and reorganizing, the individual bacterium were drawn toward one or another of them by some sort of chemical signal.

"That doesn't appear to be the case at all," Igoshin said. "We didn't find any neighbor-related factors between the groups at all. Instead, there seems to be a signaling mechanism within the group itself that trumps everything else."

The study involved the bacterium *Myxococcus xanthus*, a common soil bacteria that's often studied for its ability to self-organize into various patterns. In the wild, *M. xanthus* are content to collectively hunt other bacteria. But when food is scarce, they stream together into aggregates containing up to 100,000 cells and form spores. The resulting aggregate mounds are large enough to be carried away to better environs by the wind or passing insects.

To study this behavior in the lab, Igoshin and Rice co-authors postdoctoral fellow Chunyan Xie and graduate student Haiyang Zhang created a computer program that could analyze thousands of still frames from microcinematic movies of *M. xanthus*. The movies were created in the laboratory of University of Georgia collaborator and co-author Lawrence Shimkets. The movies showed how *M. xanthus* streamed together to form "aggregates." One hallmark of the *M. xanthus* streaming process is that less than half of the aggregates that initially form will survive through the end of the process. The factors that control this ripening are not understood.

In designing their image-analysis application, Igoshin's team had the computer scrutinize every aggregate -- frame-by-frame -- throughout the streaming process. The computer cataloged 33 properties for each aggregate, including things like area, perimeter size, distance to and size of the nearest neighbor. After all the data were collected, the team ran a statistical analysis to find out if any feature or combination of features could be used to predict which aggregates would eventually win out over their neighbors.

"We found that size mattered most," Igoshin said. "Not size in relation to neighbors, which is something people had previously thought might matter, but size of the aggregate itself. We found that if we answered one question -- is the size of an aggregate beyond a certain threshold -- then we could accurately predict whether the aggregate would survive with 90 percent accuracy."

Igoshin said some of the image analysis methodologies that the team applied to study *M. xanthus* are similar to ones that Chunyan Xie used for facial recognition analyses in her previous work. He said scientists have only recently begun to apply these sorts of image analysis techniques to fundamental biological questions like bacterial self-organization.

"One of the most exciting aspects of this study is the fact that we can apply these methods much more broadly to study self-organization in other bacteria and unicellular organisms," Igoshin said. "In fact, this kind of analysis is sorely needed, because most of the existing methods to study these phenomena are qualitative rather than quantitative. As a discipline, we need quantitative methods if we want to conduct side-by-side comparisons between real-world and computer-generated results."

<http://news.discovery.com/human/radiation-vitamins-nuclear-nasa-110321.html>

Radiation Worrying You? Take a Vitamin

With astronauts facing risks from radiation on long-duration space missions, NASA has recommended a simple solution.

By Irene Klotz | Mon Mar 21, 2011 02:40 PM ET

To mitigate the effects of radiation on astronauts, doctors advise a simple measure: Take a vitamin pill.

Along with the anti-radiation drug potassium iodide, scientists recommend a vitamin pill to plug any nutritional deficiencies in the Recommended Dietary Allowance, a standard established by the U.S. National Academy Sciences in 1941.

"There are ways to greatly modify the radiation response," Ann Kennedy, head of the NASA-backed National Space Biomedical Research Institute's Radiation Effects Team, told Discovery News.

"(Vitamin) deficiencies appear to be extremely important in determining radiation effects and basically determining the incidences of many, many, many chronic diseases, which would include cancer and cataracts," said Kennedy, a radiation oncology professor at the University of Pennsylvania School of Medicine.

"It used to be viewed by the AMA (American Medical Association) that a good diet containing all the usual levels of RDAs of things was enough and you really didn't need a vitamin pill," she added. "Well, they've basically reversed themselves over the past several years and are making the statement that every American should be taking a daily vitamin pill for the prevention of chronic diseases - and that includes cancer."

"I've certainly recommended that for people on the space station, as well as anyone else at NASA that's flying and has a very high occupational radiation exposure and I would certainly recommend that for all those in Japan exposed to higher than normal doses of radiation," she said. "I think it's just as important for them to be getting a vitamin tablet every day as it is to be taking potassium iodide."

If the radiation exposure levels of workers battling Japan's crippled nuclear reactors are correct, the amount rivals what astronauts traveling beyond the protective bubble of Earth's magnetic field would receive, though the types of radiation are different.

"Workers now at the plant - (who) are apparently receiving high doses of radiation and they are not very well protected - could be in a similar range (of exposure) to those that an astronaut will encounter during a solar particle event (solar storm)," said Marcelo Vazquez, who previously oversaw research at the NASA Space Radiation Laboratory at Brookhaven. "The quality of radiation is quite different," Vazquez, now an independent consultant, told Discovery News. "But those workers are apparently close to suffering acute radiation effects."

With the long-term goal of sending humans beyond the space station, which orbits about 220 miles above the planet, NASA has been working on understanding how radiation affects the human body and what can be done to prevent, restrict and reverse its damage. Potential drugs and protocols, including extracts of blueberries and strawberries, are being studied. "Anything that can be learned from the research can be applicable to Earth conditions, like what's actually happening in Japan right now," Vazquez said.

<http://news.discovery.com/animals/giant-bunny-rabbit-island-110321.html>

Biggest-Ever Bunny Didn't Hop, Had No Enemies

No floppy-eared Easter-type bunny, this rabbit had small ears, smallish eyes and enormous heft.

By Jennifer Viegas | Mon Mar 21, 2011 03:00 PM ET

An enormous bunny that lived three to five million years ago was so hefty -- six times the size of most rabbits today - that it didn't hop and had no enemies. The new species, dubbed the Minorcan King of the Rabbits (*Nuralagus rex*), weighed in at over 26.4 pounds and lived on the small island of Minorca.

"*N. rex* was a very robust and peculiar rabbit," project leader Josep Quintana told Discovery News. "Surely he was a very calm and peaceful animal that moved with slow, but powerful, movements."

Quintana, a scientist at the Catalan Institute of Paleontology, and colleagues Meike Kohler and Salvador Moya-Sola describe the giant fossil rabbit in a *Journal of Vertebrate Paleontology* paper. They believe the rabbit lost the ability to hop, because the long, springy spine typical of modern bunnies was replaced by a short, stiff backbone. The researchers think *N. rex* spent most of its days peacefully digging, searching for roots and tubers to eat.

"The ancestors of *N. rex* arrived at Minorca during the Messinian crisis 5.3 million years ago," Quintana said. "During this geological time, the Mediterranean Sea dried up and the Balearic islands connected with the surrounding mainland (of Europe and Africa), so the proto-*Nuralagus rex* arrived walking to Minorca."

When the seawater returned and Minorca returned to its island status, the rabbit found itself with no predators. Over time, it grew to become 10 times the size of its now-extinct mainland cousin. Other inhabitants of the island at the time included a bat, a large dormouse and a giant tortoise.



A newly found species of rabbit, *Nuralagus rex*, weighed in at over 26.4 pounds and lived three to five million years ago on the small island of Minorca. Meike Köhler

With no need for defense, the rabbit lost visual and hearing acuity. Its eye socket reduced in size over time, as did its ears.

The changes, especially the increase in body size, add to the growing evidence for what's known as "the island rule." Simply put, this states that when on islands, big animals often tend to become smaller and small animals frequently tend to grow larger. On the small side of that equation, other islands have been home to tiny elephants and even, in the case of *Homo floresiensis*, tiny humans.

"It is as if nature experimented with form and function, not without a wicked sense of humor," Lucja Fostowicz-Frelik, an American Museum of Natural History paleontologist, told Discovery News.

Fostowicz-Frelik continued that the newly found rabbit "is just another manifestation of the island rule ... We know that their closest relations, rodents, did produce some gigantic forms, not necessarily on islands, which averaged several hundred kilos. Now we see that the lagomorphs (the animal order that includes rabbits, hares and pikas) did not escape the trend."

Brian Kraatz, an assistant professor in the Department of Anatomy at the College of Osteopathic Medicine of the Pacific, agrees. "There is an underlying assumption that rabbits appeared some 40 million years ago and have been perfectly happy to stay just about the same," Kraatz told Discovery News. "This new species is interesting in that it's quite different from what we know of living or fossil rabbits. Aside from its incredibly large size, its hind legs are rather short, not so good for hopping."

He added, "It's unclear whether their feet would have been decent good luck charms."

Bad luck affected the rabbit when a climate cooling likely ruined comfortable living conditions for the species on its island. The researchers suspect this climate change led to the rabbit's extinction.

Through the recent science, however, it lives on, with more studies of its fossils in the works. Quintana also hopes this rabbit "king" will become a popular mascot for the island.

He explained, "I would like to use *N. rex* to lure students and visitors to Minorca!"

http://www.eurekalert.org/pub_releases/2011-03/cwru-ccm032211.php

Cheap catalyst made easy

CWRU researchers aim to bring fuel cells within reach

Catalysts made of carbon nanotubes dipped in a polymer solution equal the energy output and otherwise outperform platinum catalysts in fuel cells, a team of Case Western Reserve University engineers has found.

The researchers are certain that they'll be able to boost the power output and maintain the other advantages by matching the best nanotube layout and type of polymer. But already they've proved the simple technique can knock down one of the major roadblocks to fuel cell use: cost.

Platinum, which represents at least a quarter of the cost of fuel cells, currently sells for about \$65,000 per kilogram. These researchers say their activated carbon nanotubes cost about \$100 per kilogram. Their work is [*published in the online edition of Journal of the American Chemical Society.*](#)

"This is a breakthrough," said Liming Dai, a professor of chemical engineering and the research team leader.

Dai and research associates Shuangyin Wang and Dingshan Yu found that by simply soaking carbon nanotubes in a water solution of the polymer polydiallyldimethylammonium chloride for a couple of hours, the polymer coats the nanotube surface and pulls an electron partially from the carbon, creating a net positive charge. They placed the nanotubes on the cathode of an alkaline fuel cell. There, the charged material acts as a catalyst for the oxygen-reduction reaction that produces electricity while electrochemically combining hydrogen and oxygen. In testing, the fuel cell produced as much power as an identical cell using a platinum catalyst.

But the activated nanotubes last longer and are more stable, the researchers said. Unlike platinum, the carbon-based catalyst: doesn't lose catalytic activity and, therefore, efficiency, over time; isn't fouled by carbon monoxide poisoning; and is free from the crossover effect with methanol. Methanol, a liquid fuel that's easier to store and transport than hydrogen, reduces activity of a platinum catalyst when the fuel crosses over from the anode to the cathode in a fuel cell.

The new process builds on the Dai lab's earlier work using nitrogen-doped carbon nanotubes as a catalyst. In that process, nitrogen, which was chemically bonded to the carbon, pulled electron partially from the carbon to create a charge. Testing showed the doped tubes tripled the energy output of platinum.

Dai said the new process is far simpler and cheaper than using nitrogen-doped carbon nanotubes and he's confident his lab will increase the energy output as well. "We have not optimized the system yet."

http://www.eurekalert.org/pub_releases/2011-03/uom-fio032111.php

First image of protein residue in 50 million year old reptile skin

Published in the journal Royal Society Proceedings B: Biology, the brightly-coloured image shows the presence of amides – the organic compounds, or building blocks of life – in the ancient skin of a reptile, found in the 50 million year-old rocks of the Green River Formation in Utah, USA.

This image had never been seen by the human eye, until a team led by Dr Roy Wogelius and Dr Phil Manning used state-of-the-art infra-red technology at The University of Manchester to reveal and map the fossilized soft tissue of a beautifully-preserved reptile.

These infra-red maps are backed up by the first ever element-specific maps of organic material in fossil skin generated using X-rays at the Stanford synchrotron in the USA, also by the Manchester researchers.

Chemical details are clear enough that the scientists, from the School of Earth, Atmospheric and Environmental Sciences, are even able to propose how this exceptional preservation occurs.

When the original compounds in the skin begin to break down they can form chemical bonds with trace metals, and under exceptional conditions these trace metals act like a 'bridge' to minerals in the sediments. This protects the skin material from being washed away or decomposing further.

Geochemist Roy Wogelius: "The mapped distributions of organic compounds and trace metals in 50 million year old skin look so much like maps we've made of modern lizard skin as a check on our work, it is sometimes hard to tell which is the fossil and which is fresh. These new infra-red and X-ray methods reveal intricate chemical patterns that have been overlooked by traditional methods for decades."

The new images are compelling, and represent the next step in the academics' research programme to use modern analytical chemistry and 21st century techniques to understand how such remarkable preservation occurs, and ultimately to discover the chemistry of ancient life. These new results imply that trace metal inventories and patterns in ancient reptile skin, even after fossilisation, can indeed be compared to modern reptiles. The infra-red light causes vibrations in the fossilized skin, and a map of where these vibrations occur can be obtained from a fossil by using a trick: a tiny crystal (like an old phonograph record stylus) which moves from point-to-point in a programmable grid across the surface.

At each point where the tiny crystal touches the fossil, an infra-red beam that shines through the crystal reflects off of the crystal base, but a small amount of the beam probes beyond the interface- and if organic compounds are present, they absorb portions of the beam and change the reflected signal. This allows the team to non-destructively map large fossils which do not themselves transmit or reflect the beam – a revolutionary process for paleontologists.

Nick Edwards, first author on the publication, said: "The ability to chemically analyse rare and precious fossils such as these without the need to remove material and destroy them is an important and long overdue addition to field of palaeontology. "Hopefully this will provide future opportunities to unlock the information stored in other similarly preserved specimens."

Dr Manning said: "Here physics, palaeontology and chemistry have collided to yield incredible insight to the building blocks of fossilized soft tissue. "The results of this study have wider implications, such as understanding what happens to buried wastes over long periods of time. The fossil record provides us with a long-running experiment, from which we can learn in order to help resolve current problems."

Newly discovered virus implicated in deadly Chinese outbreaks

Tick-borne disease identified as emerging threat

GALVESTON, Texas - Five years ago, large numbers of farmers in central China began falling victim to an mysterious disease marked by high fever, gastrointestinal disorder and an appalling mortality rate - as high as 30 percent in initial reports. Investigators from the Chinese Center for Disease Control and Prevention hurried to the scene of the outbreak. On the basis of DNA evidence, they quickly concluded that it had been caused by human granulocytic anaplasmosis, a bacteria transmitted by tick bites. Now, though, subsequent studies have shown that original conclusion was incorrect, and that a previously unknown and dangerous virus has been responsible for seasonal outbreaks of the disease in six of China's most populated provinces.

"We expected to find a bacterial infection behaving in an unexpected way - human anaplasmosis has a less than one percent fatality rate in the U.S., and it rarely causes abdominal pain or vomiting or diarrhea," said Dr. Xue-Jie Yu of the University of Texas Medical Branch at Galveston, lead author of a paper on the discovery now appearing in the "online advance" section of the New England Journal of Medicine. "Instead, we found an unknown virus."

Researchers have dubbed the newly discovered pathogen Severe Fever with Thrombocytopenia Syndrome virus, and placed it in the Bunyaviridae family, along with the hantaviruses and Rift Valley Fever virus. Later investigation has placed its mortality rate at 12 percent, still alarmingly high.

Yu, a specialist in tick-borne bacteria like the species responsible for HGA, first suspected that a virus might be responsible for the outbreaks after close examination of patients' clinical data showed big differences from symptoms produced by HGA, and blood sera drawn from patients revealed no HGA or HGA antibodies.

Yu became certain that a virus was at fault after sera taken from patients retained its ability to kill cells, despite being passed through a filter that blocked all bacteria. Still, initial genetic tests failed to generate a match with a known pathogen. "Clearly, we had a virus, but what virus?" Yu said. "I told the people I was working with that they needed to be even more careful, because we were working with an unknown."

That caution seemed appropriate when electron microscope studies of deactivated virus particles revealed what appeared to be a hantavirus - associated in Asia with hemorrhagic fever and in the Americas with a deadly pulmonary syndrome. But when Yu and his colleagues managed to extract the virus' entire genetic code, they found that it didn't match any other known virus.

When researchers from the Chinese Center for Disease Control and Prevention led by study author Dr. Yu Wang analyzed sera taken from 241 symptomatic patients from Henan, Hubei, Shandong, Anhui, Jiangsu and Liaoning provinces, they found 171 contained either the previously unknown virus itself or antibodies against it. In addition, the scientists found the virus in 10 out of 186 ticks collected from farm animals in the area where the patients lived. "This seems to be a tick-borne disease, and the disease comes out when the ticks come out, from late March to late July," Yu said. "Fortunately, even though the full life cycle is not clear, we know that for the virus humans are a dead end - we don't have human-to-human transmission as we did with SARS."

Other authors of the New England Journal of Medicine paper include UTMB Health visiting scientist Dr. Yan Liu, professor Vsevolod Popov, professor Dr. David Walker and research associate Dr. Lihong Zhang; Dr. Qun Li, Wen-Wu Yin, Hang Zhou and Dr. Zi-Jian Feng of the Chinese Center for Disease Control and Prevention; Dr. Mi-Fang Liang, Jian-Dong Li, Dr. Yu-Lan Sun, Quan-Fu Zhang, Chuan Li, Dr. Yan-Ping Zhang, Wei Wu, Qin Wang, Shi-Wen Wang, Jing-Dong Song, Tao Wan, Li-Na Sun, Dr. Tao Hong and Dr. De-Xin Li of the State Key Laboratory for Molecular Virology and Genetic Engineering, National Institute for Viral Disease Control and Prevention; Shou-Yin Zhang, Dr. Rong Hai, Biao Kan, Kang-Lin Wan, Dr. Huai-Qi Jing, Dr. Jin-Xin Lu, Jin-Rong He, Jing-Shang Zhang and Xiu-Ping Fu of the State Key Laboratory for Infectious Disease Control and Prevention, National Institute for Communicable Disease Control and Prevention; Fa-Xian Zhan, Xu-Hua Guan and Dr. Jia-Fa Liu of the Hubei Province CDC; Dr. Xian-Jun Wang and Zhen-Qiang Bi of the Shandong Province CDC; Dr. Guo-Hua Liu of the Henan Province CDC; Dr. Jun Ren of the Anhui Province CDC; Dr. Hua Wang of the Jiangsu Province CDC; Dr. Zhuo Zhao of the Liaoning Province CDC; and Dr. Yu Zhang of the Hubei Province Department of Health. The China Mega-Project for Infectious Diseases, the Western Regional Center of Excellence for Biodefense and Emerging Infectious Diseases and the Chinese Recruitment Program of Global Experts provided support for this research.

http://www.eurekalert.org/pub_releases/2011-03/qu-scp032211.php

Spinal cord processes information just like areas of the brain

Patrick Stroman's work mapping the function and information processing of the spinal cord could improve treatment for spinal cord injuries.

"Basic physiology books describe the spinal cord as a relay system, but it's part of the central nervous system and processes information just like parts of the brain do," explains Dr. Stroman, director of the Queen's MRI Facility and Canada Research Chair in Imaging Physics.

Dr. Stroman's research is directed at precisely mapping the areas above and below a spinal cord injury in order to better determine the precise nature of an injury and the effectiveness of subsequent treatment. When medical research has advanced to a point where clinicians are able to bridge an injury on a spinal cord, Dr. Stroman's spinal mapping technique will be key in accurately pinpointing the injury to be bridged.

The technique involves capturing multiple images of the spinal cord using a conventional MRI system. The image capturing is repeated every few seconds over several minutes. During the imaging temperature sensations on the skin are varied allowing areas of the spinal cord that respond to the temperature changes to be detected in the MRI.

During their research, Dr. Stroman's team was also surprised to discover that levels of attention impact information processing in the spinal cord. By examining the differences in spinal cord functioning in people who were either alert or distracted by a task they were able to see changes in the level of cord activity picked up by the MRI scanner.

"The effect of attention is one of the reasons that when you're playing sports and you get hurt, you often don't become aware of the injury until after the game when your attention and focus changes," says Dr. Stroman. "We already knew that a person's level of attention affects information processing in the brain, but this finding has made us aware that level of attention has to be properly controlled in research that aims to accurately map spinal cord function."

Dr. Stroman's spinal cord mapping research has important implications for those with spinal cord injuries who suffer from chronic pain. The research also applies to any conditions - including multiple sclerosis, fibromyalgia, or congenital conditions - where the function of the spinal cord is affected.

<http://www.nytimes.com/2011/03/22/health/research/22patterns.html>

Patterns: For Heart Risk, No Telltale Body Shape

By RONI CARYN RABIN

A major new analysis challenges the long-held idea that obese people who carry their extra weight mainly around the middle - those with an "apple" shape - are at greater risk for heart disease than "pears," whose fat tends to cluster on their thighs and buttocks.

The new report, published online on March 11 in The Lancet, pooled data from 58 studies about more than 220,000 people, mean age of 58. During the time they were followed, more than 14,000 suffered a heart attack or stroke.

Conventional risk factors like blood pressure, cholesterol, diabetes and smoking were accurate predictors of a heart attack or stroke, but additional information about weight or body shape (ascertained by measuring waist circumference or waist-to-hip ratio) did not improve the ability to predict risk.

"Whatever your shape is doesn't really matter," said Dr. Emanuele Di Angelantonio, a lecturer at the University of Cambridge and a member of the Emerging Risk Factors Collaboration, which carried out the study.

He emphasized that being overweight or obese is one of the main modifiable risk factors for cardiovascular disease, and is often an early sign of future risk. But he said, "Whatever form of obesity or overweight you have is all the same."

<http://www.bbc.co.uk/news/science-environment-12811199>

Quantum computing device hints at powerful future

By Jason Palmer Science and technology reporter, BBC News, Dallas

One of the most complex efforts toward a quantum computer has been shown off at the American Physical Society meeting in Dallas in the US.

It uses the strange "quantum states" of matter to perform calculations in a way that, if scaled up, could vastly outperform conventional computers. The 6cm-by-6cm chip holds nine quantum devices, among them four "quantum bits" that do the calculations. The team said further scaling up to 10 qubits should be possible this year.

Rather than the ones and zeroes of digital computing, quantum computers deal in what are known as superpositions - states of matter that can be thought of as both one and zero at once.

In a sense, quantum computing's one trick is to perform calculations on all superposition states at once. With one quantum bit, or qubit, the difference is not great, but the effect scales rapidly as the number of qubits rises.

The figure often touted as the number of qubits that would bring quantum computing into a competitive regime is about 100, so each jump in the race is a significant one. "It's pretty exciting we're now at a point that we can start talking about what the architecture is we're going to use if we make a quantum processor," Erik Lucero of the University of California, Santa Barbara told the conference.

The team's key innovation was to find a way to completely disconnect - or "decouple" - interactions between the elements of their quantum circuit.

The delicate quantum states the team creates in their qubits - in this case paired superconductors known as Josephson junctions - must be manipulated, moved, and stored without destroying them.

"It's a problem I've been thinking about for three or four years now, how to turn off the interactions," UCSB's John Martinis, who led the research," told BBC News.

"Now we've solved it, and that's great - but there's many other things we have to do."

Qubits and pieces

The solution came in the form of what the team has termed the RezQu architecture. It is basically a blueprint for a quantum computer, and several presentations at the conference focused on how to make use of it.

"For me this is kind of nice, I know how I'm going to put them together," said Professor Martinis.

"I now know how to design it globally and I can go back and try to optimise all the parts."

RezQu seems to have an edge in one crucial arena - scalability - that makes it a good candidate for the far more complex circuits that would constitute a quantum computer proper.

"There are competing architectures, like ion traps - trapping ions with lasers, but the complexity there is that you have to have a huge room full of PhDs just to run your lasers," Mr Lucero told BBC News.

Quantum bit and resonator on a chip (E Lucero) The team has been steadily increasing the complexity of their quantum devices "There's already promise to show how this architecture could scale, and we've created custom electronics based on cellphone technology which has driven the cost down a lot.

"We're right at the bleeding edge of actually having a quantum processor," he said. "It's been years that a whole community has blossomed just looking at the idea of, once we have a quantum computer, what are we going to do with it?"

Britton Plourde, a quantum computing researcher from the University of Syracuse, said that the field has progressed markedly in recent years.

The metric of interest to quantum computing is how long the delicate quantum states can be preserved, and Dr Plourde noted that time had increased a thousand fold since the field's inception.

"The world of superconducting quantum bits didn't even exist 10 years ago, and now they can control [these states] to almost arbitrary precision," he told BBC News.

"We're still a long way from a large-scale quantum computer but it's really in my eyes rapid progress."

<http://www.bbc.co.uk/news/science-environment-12811197>

Religion may become extinct in nine nations, study says

By Jason Palmer Science and technology reporter, BBC News, Dallas

A study using census data from nine countries shows that religion there is set for extinction, say researchers.

The study found a steady rise in those claiming no religious affiliation.

The team's mathematical model attempts to account for the interplay between the number of religious respondents and the social motives behind being one. The result, reported at the American Physical Society meeting in Dallas, US, indicates that religion will all but die out altogether in those countries.

The team took census data stretching back as far as a century from countries in which the census queried religious affiliation: Australia, Austria, Canada, the Czech Republic, Finland, Ireland, the Netherlands, New Zealand and Switzerland.

Their means of analysing the data invokes what is known as nonlinear dynamics - a mathematical approach that has been used to explain a wide range of physical phenomena in which a number of factors play a part.

One of the team, Daniel Abrams of Northwestern University, put forth a similar model in 2003 to put a numerical basis behind the decline of lesser-spoken world languages.

At its heart is the competition between speakers of different languages, and the "utility" of speaking one instead of another.

"The idea is pretty simple," said Richard Wiener of the Research Corporation for Science Advancement, and the University of Arizona. "It posits that social groups that have more members are going to be more attractive to join, and it posits that social groups have a social status or utility. "For example in languages, there can be greater utility or status in speaking Spanish instead of [the dying language] Quechuan in Peru, and similarly there's some kind of status or utility in being a member of a religion or not."

Dr Wiener continued: "In a large number of modern secular democracies, there's been a trend that folk are identifying themselves as non-affiliated with religion; in the Netherlands the number was 40%, and the highest we saw was in the Czech Republic, where the number was 60%."

The team then applied their nonlinear dynamics model, adjusting parameters for the relative social and utilitarian merits of membership of the "non-religious" category.

They found, in a study published online, that those parameters were similar across all the countries studied, suggesting that similar behaviour drives the mathematics in all of them.

And in all the countries, the indications were that religion was headed toward extinction.

However, Dr Wiener told the conference that the team was working to update the model with a "network structure" more representative of the one at work in the world. "Obviously we don't really believe this is the network structure of a modern society, where each person is influenced equally by all the other people in society," he said. However, he told BBC News that he thought it was "a suggestive result".

"It's interesting that a fairly simple model captures the data, and if those simple ideas are correct, it suggests where this might be going. "Obviously much more complicated things are going on with any one individual, but maybe a lot of that averages out."

<http://www.physorg.com/news/2011-03-watson-ability-illness.html>

Watson computer's ability to diagnose illness tested

Watson, IBM's celebrity supercomputer, has already trounced the two best human Jeopardy! players. But does the computer, which uses natural language processing to interpret complex, nuanced questions and provide accurate answers in English, have a bedside manner?

Herbert Chase, professor of clinical medicine in the Department of Biomedical Informatics, has been working with IBM to retrofit the computer to help doctors diagnose and treat patients. "It's been impossible for probably 20 or 30 years for a human to process the information required to practice medicine at the highest, evidence-based, guideline-based level," Chase says.

If the experiment works, Watson could give physicians immediate, accurate answers to unusual, head-scratching questions that come up in their daily practice and do so based not only on the latest published research, but also the blogosphere.

For example, while the general practitioner has a great breadth of knowledge, he or she may lack in-depth information about specific diseases or conditions. Similarly, a specialist may have that depth of knowledge but lack the breadth. "Watson has both, breadth and depth," he says. "It can look up anything, in terms of breadth - bone disease, OBGYN, dermatology. But it also has incredible depth. And it can bring to the primary care physician the depth that he or she would not otherwise have access to."

Over the last year, Chase and two of his students at the College of Physicians and Surgeons have been performing a series of tests on Watson that involve asking the computer questions and sorting through its answers. "Watson has done incredibly well," Chase says. "You say 'fever, weight loss, joint pain, skin rash' and Watson comes up with three or four suggestions [of a diagnosis] which are incredibly accurate." When Watson is off the mark, Chase and his students try to figure out why, and then they report their findings to the programmers at IBM.

Unlike Alex Trebek on Jeopardy!, Chase and his students don't want the one best answer, they want several. "We want the top five candidates of the possible illness. We don't care what is No. 1 and No. 2 and No. 3, because although in medicine we certainly pay attention to the likelihood of something, we have to keep in mind the least likely possibilities as well."

Chase believes Watson's greatest potential is in the area of personalized medicine. Since two patients with the same diagnosis won't respond identically to the same treatment, every patient's care needs to be, in effect, custom-designed. With its ability to process vast amount of data, Watson might be able to suggest tailor-made treatment options by factoring in a patient's medical history.

But Watson is unlikely to replace a doctor anytime soon. "The computer is never going to be able to read the signals that the patient is emoting, like 'I don't really want to do that' or 'I'm a little afraid of that,'" Chase says. Watson still has to go through a series of tests to assess how comfortable patients are with seeing their doctor speak to a computer during an exam. It's possible that Watson will play a largely behind-the-scenes role, receiving dictation and answering the doctor's questions about diagnoses and treatment options after the patient has left.

Chase, a kidney specialist, joined the Columbia medical faculty in 1978 as a laboratory scientist. In the 1990s he helped redesign the basic science course for first-year medical students at P&S. In 2000, he left Columbia to become the dean of medical education at Yale, only to return in 2006 with an idea for a study on prescription efficacy that would require more training. He entered Columbia's masters program in biomedical informatics, taking introductory computer science courses with 18-year-old first-year students.

"You remember when you were in college, there was always some old guy sitting in the front row?" he says. "I was that guy!"

He went on to create a machine that could read electronic patient records and identify patients with undiagnosed chronic kidney disease. Now he is a professor in the biomedical informatics department.

Chase thinks a generation of computers based on Watson has the potential to fundamentally change the nature of the doctor-patient relationship, actually bringing patients closer to their caretakers. "I have this vision that Watson will free us to do what we do best," he says, "which is to communicate with the patient."

Provided by Columbia University

<http://www.scientificamerican.com/article.cfm?id=radiation-risks-unknown>

Low-Dose Radiation Risks Unknown

Scientists struggle to calculate long-term effects of low-dose exposures in Fukushima.

By Gwyneth Dickey Zakaib

One thing is certain about the human costs of the radiation leaking from the Fukushima Daiichi nuclear plant in Japan: they will pale in comparison to the catastrophic consequences of the March 11 earthquake and tsunami that triggered the crisis. Nevertheless, experts are tracking radiation levels worldwide to learn more about the accident and to assess the possible impacts on health.

Radioactive vapor and particles released from the plant have spread across the region and followed prevailing winds across the Pacific (see "Plume projections"). "The plume is very large," says Ted Bowyer, a nuclear physicist at the Pacific Northwest National Laboratory in Richland, Wash., one of the first U.S. stations to detect isotopes released from Fukushima. Bowyer adds that the tiny concentrations of radioactive iodine, cesium, tellurium, xenon and lanthanum that have reached the United States are far below normal background levels and not a health risk. The fact that some of the isotopes are short-lived indicates that at least some of the radiation must have originated from breaches in the reactor vessels and not from the plant's overheated caches of spent fuel, he says.

In Fukushima and adjacent prefectures, the Japanese government is reporting radio-active contamination in sea water near the plant and in the food and water supply. Radioactive iodine 131 and cesium 137 have been detected in milk and leafy vegetables such as spinach, as well as in tap water, in some cases above allowable levels for consumption. Such safety limits are based on long-term consumption of these foods, says William McCarthy, deputy director of the radiation protection program within the Environment, Health and Safety Office at the Massachusetts Institute of Technology (MIT) in Cambridge. "The prudent thing is to not eat that food," he says. "That doesn't mean it poses immediate health risks."

Authorities in Japan have banned the shipment of milk from Fukushima prefecture, as well as some produce from Fukushima and three neighboring prefectures. In the short term, the main concern is iodine 131, which can cause cancer in the thyroid gland. With a half life of 8 days, iodine 131 will effectively be gone from the environment in a matter of months once releases have stopped. But cesium 137, another cancer-causing isotope, has a half-life of 30 years and will persist for much longer. Steve Wing, an epidemiologist from the University of North Carolina, Chapel Hill, points out that even the low levels of radiation that remain in the environment could be significant in the long run "because so many more people are exposed, even though the dose per person decreases farther from the plant."

Jacquelyn Yanch, a radiation physicist at MIT, thinks that it is too early to say what the impact will be. "We haven't come up with risk estimates for a situation like this," she says. "We don't know how much is too much."

Experts agree that any long-term effects are most likely to be seen in the workers battling the crisis at the Fukushima nuclear station. The government has increased the allowable dose for workers from 100 millisieverts per year to 250 millisieverts per year--five times the annual allowable dose for US radiation workers--to allow emergency operations to continue. This dose is considered by the US National Institutes of Health as the lower limit for the first symptoms of radiation sickness.

http://www.eurekalert.org/pub_releases/2011-03/jdc-tff031811.php

Trigger found for autoimmune heart attacks

Joslin Diabetes Center research may point toward new ways to diagnose and treat heart disease in people with type 1 diabetes

BOSTON – People with type 1 diabetes, whose insulin-producing cells have been destroyed by the body's own immune system, are particularly vulnerable to a form of inflammatory heart disease (myocarditis) caused by a different autoimmune reaction. Scientists at Joslin Diabetes Center have revealed the exact target of this other onslaught, taking a large step toward potential diagnostic and therapeutic tools for the heart condition.

Researchers in the lab of Myra Lipes, M.D., have shown in both mice and people that myocarditis can be triggered by a protein called alpha-myosin heavy chain, which is found only in heart muscle and in especially low quantities in human heart tissue. While myocarditis often follows viral attacks or other infections, Dr. Lipes

and her colleagues previously demonstrated that mice genetically modified to model type 1 diabetes could generate myocarditis spontaneously.

In their latest work, reported online in the Journal of Clinical Investigation, the scientists analyzed blood from such mice and identified two types of autoimmune response directed specifically against the protein, with the first response directed by a specialized kind of immune system cells called T cells and the second by antibodies.

In both mice and people, T cells are "trained" by specialized cells in the thymus, a small organ in front of the heart, to recognize the body's own cells and refrain from attacking them. The researchers found, however, that in mice these specialized training cells couldn't train on the alpha-myosin heavy chain protein because none of that protein was being produced in those cells.

Next, the scientists showed that the disease didn't develop in similar mice that were genetically engineered to produce the protein in the specialized training cells. "You can totally protect those mice from mortality, which is really extraordinary," says Dr. Lipes, an Investigator in Joslin's Section on Islet Cell & Regenerative Biology and an Assistant Professor at Harvard Medical School. Furthermore, the studies also indicated that alpha-myosin heavy chain was not present in human thymus and that the T cells that sought out the protein could be found in the blood of healthy people. In patients with myocarditis, levels of these cells soared.

The investigation, Dr. Lipes says, suggests that people who are otherwise vulnerable to autoimmune conditions, such as those with type 1 diabetes, may be particularly vulnerable to this risk to their hearts.

Myosin heavy chain proteins are found in two very similar forms in human hearts: alpha-myosin heavy chain, which supports fast muscle contraction and may be particularly prevalent in athlete's hearts, and beta-myosin heavy chain, which is much more common and functions in slower muscle contraction. "We're trying to figure ways to identify the fragment of alpha-myosin heavy chain that is different, because that could aid in developing diagnostic tools and therapies," says Dr. Lipes.

Joslin's HuiJuan Lv is first author on the paper. Other contributors include Evis Havari, Raju V. Gottumukkala, Lizbeth Cornivelli and Ross Smith of Joslin; Khadir Raddassi of Brigham and Women's Hospital; Takashi Matsui and Anthony Rosenzweig of Beth Israel Deaconess Medical Center; Roderick T. Bronson of Harvard Medical School; Anne L. Fletcher, Shannon J. Turley and Kai Wucherpfennig of Dana Farber Cancer Institute; Sheena Pinto and Bruno Kyewski of the German Cancer Research Center. Lead funders were the National Institutes of Health and the Juvenile Diabetes Research Foundation.
http://www.eurekalert.org/pub_releases/2011-03/uoqa-adc031811.php

Arthritis drug could help beat melanoma skin cancer

A breakthrough discovery by the University of East Anglia (UEA) and Children's Hospital Boston promises an effective new treatment for one of the deadliest forms of cancer.

Reporting in the March 24 edition (front cover story) of the journal Nature, the researchers found that leflunomide - a drug commonly used to treat rheumatoid arthritis - also inhibits the growth of malignant melanoma.

Melanoma is a cancer of the pigment cells in our skin. It is the most aggressive form of skin cancer and, unlike most other cancers, incidence of the disease is increasing. More than 10,000 patients in the UK are diagnosed with melanoma each year. If caught early, surgery can be used to safely remove the tumour but the chances of survival for patients whose tumour is already spreading are very low. Around 2000 people a year in the UK die from malignant melanoma because the cancer has returned after being removed surgically.

UEA scientists Dr Grant Wheeler and Dr Matt Tomlinson [conducted a rigorous screen of thousands of compounds](#), looking for those that affect the development of pigment cells in tadpoles. They identified a number of compounds that affected pigment cell development and have now shown with their US collaborators at Children's Hospital Boston that leflunomide significantly restricts tumour growth in mouse models.

And when leflunomide is used in combination with PLX4720, a promising new melanoma therapy currently undergoing clinical trials, the effect was even more powerful - leading to almost complete block of tumour growth. The next stage is for clinical trials to be conducted into the use of leflunomide to fight melanoma. Because leflunomide is already licensed to treat arthritis, this process should be faster than usual and a new treatment for melanoma could be available within around five years.

"This is a really exciting discovery - making use of an existing drug specifically to target melanoma," said Dr Grant Wheeler, of UEA's School of Biological Sciences. "Deaths from melanoma skin cancer are increasing and there is a desperate need for new, more effective treatments. We are very optimistic that this research will lead to novel treatments for melanoma tumours which, working alongside other therapies, will help to stop them progressing."

The novel work, which was partly funded by the Biotechnology and Biological Sciences Research Council (BBSRC), highlights the strength of carrying out large screens of compounds in developmental model systems such as the *Xenopus* tadpole used at UEA and the zebrafish used at Children's Hospital Boston. The hope is that this approach will lead to the discovery of further compounds to treat different diseases in the future.

Lead author Dr Richard White of Children's Hospital Boston and Harvard Medical School, said: "Cancer is a disease not only of genetic mutations, but also one determined by the identity of the cell in which the tumor arises. By studying cancer development in zebrafish and frogs, we gain a unique insight into the very earliest changes that occur in those cells."

'Inhibitors of DHODH suppress neural crest development and melanoma growth via modulation of transcriptional elongation' by R White (Children's Hospital Boston), S Ratanasirintraoort (Children's Hospital Boston), C Lin (MIT), P Rahl (MIT), J Cech (Children's Hospital Boston), C Burke (Children's Hospital Boston), E Langdon (Children's Hospital Boston), M Tomlinson (UEA), J Mosher (University of Michigan), C Kaufman (Children's Hospital Boston), F Chen (Children's Hospital Boston), H Long (Cambridge University), M Kramer (Genzyme Corporation), S Datta (Children's Hospital Boston), D Neuberger (Children's Hospital Boston), S Granter (Children's Hospital Boston), R Young (MIT), S Morrison (University of Michigan), G Wheeler (UEA) and L Zon (Children's Hospital Boston) is published in the March 24 edition of Nature.

http://www.eurekalert.org/pub_releases/2011-03/uoc--usg032311.php

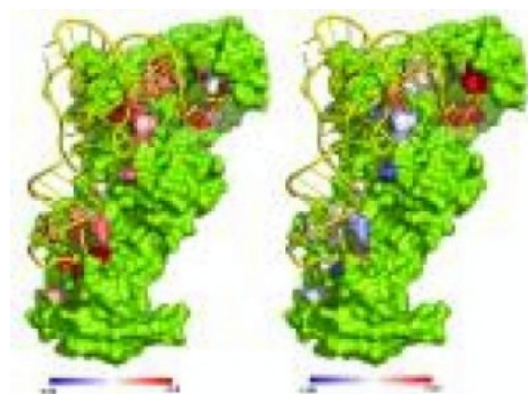
UCSB scientists get glimpse of how the 'code' of life may have emerged

Santa Barbara, Calif. – A portion of the "code" of life has been unraveled by a UC Santa Barbara graduate student from the town of Jojutla, Mexico.

Annia Rodriguez worked with John Perona, professor in UCSB's Department of Chemistry and Biochemistry, to decipher intramolecular communication within a large RNA-protein enzyme responsible for expressing the genetic code for the amino acid glutamine.

To their surprise, the experiments by Rodriguez captured a partial glimpse of how the genetic coding of life may have emerged. The results of the study are published in the journal *Structure*, published by CELL.

Life is based on the ability of all living cells to convert the genetic information in DNA, into the specific sequences of amino acids that make up the proteins that are the cell's workhorses. The key reaction in this decoding process is the attachment of a particular amino acid to one end of a small RNA molecule known as a transfer RNA. The enzyme that catalyzes this amino acid-RNA attachment is the aminoacyl-tRNA synthetase.



Crystal structure of glutaminyl tRNA synthetase (GlnRS, green) in complex with its substrate tRNA^{Gln} (yellow). Left panel: Color-coded residues depict favorable (blue) and unfavorable (red) effects on the free energy of glutamine binding from mutation at this position. Right panel: Effects of mutation on the ability of GlnRS to catalyze amino acid attachment to the tRNA. In this case all effects are unfavorable. Annia Rodriguez/ John Perona / UCSB

Rodriguez performed many laborious experiments in which she removed portions of the aminoacyl-tRNA synthetase that interact with the anticodon stem of the transfer RNA, far from the part of the enzyme that binds the amino acid. Using a biochemical approach known as rapid chemical quench kinetics, Rodriguez discovered that when she made these changes to the enzyme, the binding of the amino acid to the protein was strengthened, even though the amino acid binds far away from the positions where the changes were made.

"It is totally counterintuitive," said Perona. "Imagine if you had a car, and you took out a gear, and the car went faster. Why would you want that gear if it makes your car go slower?"

In all, Rodriguez found that separately removing seven different "gears" from a distant part of the molecule each caused the amino acid to bind more tightly to the aminoacyl-tRNA synthetase. Perona explained that this provides the first systematic analysis demonstrating long-range communication in an enzyme that depends on RNA for its function.

"So what we think is going on is that these enzyme-RNA interactions far from the amino acid binding site evolved together with the needs of the cell to respond to subtle cues from its environment – especially in terms of how much amino acid is available," said Perona. "It makes sense in terms of evolution."

Rodriguez is the first in her family to pursue a Ph.D., which she will complete this year. Now 28 years old, she began her career as a nurse in Cuernavaca, Mexico. Then she went on to obtain a B.S. in biochemical engineering at the Instituto Tecnológico de Zacatepec.

Graduation from her undergraduate program called for work at a research institution and she chose UCSB. Upon graduation, Rodriguez was offered a prestigious five-year scholarship with Mexico's Consejo Nacional de Ciencia y Tecnología (CONACYT) to continue her studies at UCSB.

Although her current research is not focused specifically on human health, Rodriguez said: "My interest in biochemistry started because I wanted to know the mechanisms by which drugs and medications worked inside the human body. I wanted to learn not just the signs and symptoms of disease, but how diseases are developed in a molecular level."

A life without pain is a life without smell

8:00 23 March 2011 by Ferris Jabr

A handful of people around the world have never known the meaning of physical pain – not because they live incredibly sheltered lives, but because their nerves lack a crucial ion channel that helps transmit signals between adjacent nerve cells.

A new study reveals that our sense of smell depends on this same protein gate, establishing a previously unrecognised link between the perception of pain and scent.

Jan Weiss of the University of Saarland School of Medicine in Homburg, Germany, and his colleagues recruited three people who cannot feel pain because they have a rare condition known as congenital analgesia. Weiss wanted to know whether people with this disorder have difficulty with other senses.

The trio of participants – two of whom were siblings – could see and hear well and had never complained about a lousy sense of smell, but the researchers decided to put their noses to the test anyway. When the participants sniffed cotton wool pads soaked in balsamic vinegar, orange, mint, perfume and coffee, they failed to identify any of the odours. In contrast, nine healthy volunteers and the siblings' parents performed just fine, breathing deeply from the pleasant orange and mint scents and turning sharply away from the vinegar.

Weiss and his team already knew that people who cannot experience physical pain usually lack a sodium ion channel called Nav1.7 in the membranes of nerve cells in the dorsal root ganglion and in the ganglia that are part of the autonomic nervous system, and wondered whether this loss could also explain the smelling problems. To find out, they examined tissue samples taken from the nose and olfactory system of normal people during surgery. The examinations revealed Nav1.7 channels in the cell membranes of the neurons that stipple these tissues.

Knockout noses

Weiss bred mice that lacked Nav1.7 in their olfactory neurons and discovered that, although the neurons still produced electrical signals in response to odours, they no longer transferred the signals to other neurons as they typically would.

The behaviour of these "knockout" mice also implied that they could not smell. Mice are generally intrigued by the aromas of potential mates and of food, but when the researchers presented the knockout mice with the scents of male and female urine, peanut butter and milk, they showed no interest. The mice were similarly unfazed when researchers exposed them to a chemical that foxes secrete from their anal glands which usually sends rodents scurrying in the opposite direction. When the researchers separated mother knockout mice from their pups, the smell-impaired mums failed to corral their offspring – a behaviour that probably relies on smell.

Co-author Frank Zufall, also of the University of Saarland, says the connection between smell and pain was completely unexpected. "We don't know why these two systems use the same channel," Zufall says, "but it's possible this is a more general sodium ion channel for sensory systems. Earlier evidence has shown it's expressed in taste cells."

Joost Drenth of the Radboud University Nijmegen Medical Centre in the Netherlands says it is a very interesting paper and is likewise curious to find out how else Nav1.7 is involved in our sensory systems. Pain seems to be linked, at least anecdotally, to other senses: a blinding light, a deafening noise and spicy chilli pepper can all be painful.

Zufall adds that the discovery has important implications. Knowing that a particular ion channel is necessary for smell suggests that in the future we may be able to help people who have lost this sense. And because sodium ion channels are often targets for painkillers, it's helpful to know that they could also disrupt the sense of smell as an unintentional side effect. *Journal reference: Nature, DOI: 10.1038/nature09975*

<http://www.newscientist.com/article/mg20928054.000-bestever-quantum-measurement-breaks-heisenberg-limit.html>

Best-ever quantum measurement breaks Heisenberg limit

23 March 2011 by Mark Buchanan

PHYSICISTS have made the most accurate quantum measurement yet, breaking a theoretical limit named for Werner Heisenberg.

The most accurate quantum measurements possible are made using an interferometer, which exploits the wave nature of matter and light. In this method, two identical beams of particles are sent along different paths to a detector, with one interacting with an object of interest along the way. Recombining the beams afterwards creates an interference pattern that reflects how much the interacting beam was disturbed - providing details about the object's properties.

Assuming that the particles interact with the object, but not with one another, the accuracy of such measurements grows in proportion to the number of particles in the beams, N . By allowing such particle interactions, Mario Napolitano of the Institute of Photonic Sciences in Barcelona, Spain, and colleagues have now demonstrated a way to break this so-called Heisenberg limit.

They used a beam of photons to measure the small magnetic field produced by a gas made up of a million ultra-cold rubidium atoms. Normally, the spin of each photon would rotate by a certain amount, thanks to its interactions with the magnetic field of the atoms. But the frequency of the photons was chosen so that the photons also interacted with each other when they were in the gas, so that the presence of one photon altered the way a second behaved. These interactions led to a measurement accuracy that grew in proportion to $N^{3/2}$ - greater than Heisenberg's limit (Nature, DOI: 10.1038/nature09778).

The technique could pave the way for more sensitive searches for gravitational waves - ripples in space triggered by moving objects. The waves should cause the distance between two objects to change, and the study suggests that the laser interferometers used to look for such changes could be made more precise.

<http://www.newscientist.com/article/mg20928054.100-first-viable-sperm-cells-grown-from-scratch.html>

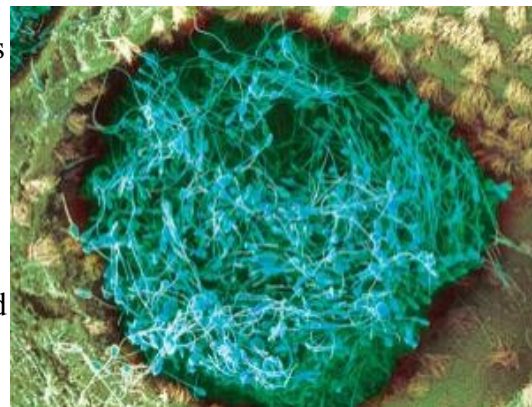
First viable sperm cells grown from scratch

23 March 2011 by Ferris Jabr

FOR the first time viable mouse sperm have been grown outside the testes. If the technique can be repeated with human sperm, it could lead to new ways of treating infertile men.

Takuya Sato at Yokohama City University in Japan and colleagues extracted germ cells from the testes of newborn mice that had not yet begun producing sperm. They placed the cells in agarose gel soaked in nourishing chemicals and hormones such as fetal bovine serum and testosterone. The team had first engineered the mice so that a protein only present in fully grown sperm would fluoresce green. Sure enough, around one month later, the team spotted the glowing protein in nearly half of their samples.

Sato's team then fused the sperm with eggs from female mice and created healthy embryos. When these embryos were implanted into females they produced healthy offspring which were able to mate and give birth to their own pups. The team also confirmed that the testes tissue could be frozen and thawed without damage (Nature, DOI: 10.1038/nature09850).



Here are some I made earlier (Image: Susumu Nishinaga)

"People have been trying to do this for years, but it takes an awful lot of trial and error," says Erwin Goldberg, a cell biologist at Northwestern University in Chicago, who was not involved in the study. The key to the team's success, Goldberg says, was patience: they kept mixing chemicals in the lab until they found exactly the right recipe to keep testes cells alive in a petri dish and satisfy all their nutritional requirements.

Earlier studies using different methods achieved similar, but less promising results. In 2006, Karim Nayernia at the University of Newcastle, UK, transformed stem cells from mouse embryos into sperm cells but most of the offspring died prematurely.

If researchers could convert germ cells from an infertile man into sperm cells, they might be able to pinpoint exactly where something goes wrong in the sperm's development and fix it, says Martin Dym, a reproductive biologist at Georgetown University in Washington DC.

The technique could also help prepubescent boys with cancer, who are not yet producing mature sperm, by growing sperm cells that can be frozen before radiation therapy.

<http://www.nytimes.com/2011/03/22/health/22prepare.html>

Dangers of Leaving No Resident Behind

By GARDINER HARRIS

When the Three Mile Island nuclear generating station along the Susquehanna River seemed on the verge of a full meltdown in March 1979, Gov. Richard L. Thornburgh of Pennsylvania asked a trusted aide to make sure that the evacuation plans for the surrounding counties would work.

The aide came back ashen faced. Dauphin County, on the eastern shore of the river, planned to send its populace west to safety over the Harvey Taylor Bridge.

"All well and good," Mr. Thornburgh said in a recent speech, "except for the fact that Cumberland County on the west shore of the river had adopted an evacuation plan that would funnel all exiting traffic eastbound over - you guessed it - the same Harvey Taylor Bridge."

Nearly 250,000 people would have been sent in opposite directions over the same narrow bridge.

Mr. Thornburgh quickly corrected the plans, but more problems would soon arise - just as they have in many other disasters. As the Japanese are learning, the science behind herding thousands, sometimes millions, of people from danger to safety is uncertain at best. And the lessons learned from one disaster can both hurt and help with the next.

For instance, not enough people left New Orleans and the surrounding areas before Hurricane Katrina struck on August 29, 2005, and more than 1,800 people died. At least part of the cause may have been that Mayor Ray Nagin of New Orleans waited until the day before the storm hit to order a mandatory evacuation.

The lesson of Katrina? Get everybody out, and get them out early.

Three weeks later, a second major storm, Hurricane Rita, came barreling toward the Gulf Coast. Mayor Bill White of Houston, intent on avoiding the mistakes that plagued New Orleans, told everybody in the city to get out, and get out now. "The time for waiting is over," he said.

Oops. Within hours, the interstates around Houston were at a standstill. When mandatory evacuations were later ordered for areas most at risk, those residents could not get out of harm's way because the interstates were already packed with people from low-risk areas. Some spent days in their cars.

The state police set about turning inbound lanes into outbound ones, but that took hours. More people died or suffered health problems from the bungled evacuation than from the storm itself.

The lesson of Rita? Limit evacuations only to those most at risk, and have plans in place well in advance to reverse traffic flow patterns on major arteries.

Every one of the nation's 104 nuclear power plants is required to have detailed evacuation and incident plans in place before operating. The plans are reviewed by federal, state and local authorities. But problems crop up and almost certainly keep being created.

Brian Wolshon, the director of the Gulf Coast Center for Evacuation and Transportation Resiliency, said that he was analyzing one county's emergency plans that seemed to have every detail covered.

"It was a wonderful report, with plans to move senior citizens out of care facilities and even out of hospitals, and they had signed contracts with bus and ambulance providers," said Dr. Wolshon, who is also a professor at Louisiana State University. "But that same low-cost provider had the same contract with the county next door, and they had the capacity to evacuate only one of these counties."

Indeed, emergency authorities have only in recent years begun to realize that evacuations are often regional and even multistate events. Evacuating almost any city in the United States requires significant preparation and resources in surrounding cities. And some events are simply too resource-intensive or too complicated to plan for.

"What if you had a tsunami warning in the Atlantic Ocean and had to evacuate the Eastern Seaboard? You're talking about tens of millions of people. Where are you going to put those people? How are you going to get them there? Good luck with that," Dr. Wolshon said.

Residents in the 10-mile radius surrounding a nuclear power plant are supposed to receive evacuation plans routinely. Those near the Indian Point plant in Buchanan, N.Y., receive such plans annually, according to officials there. The plans are also posted on local government Web sites. And municipal authorities in towns around such plants often have stores of potassium iodide. Potassium iodide can protect people by ensuring that the thyroid gland does not take up radioactive iodine, which can cause cancer.

But Kelly Classic, a physicist at the Mayo Clinic and spokeswoman for the Health Physics Society, warned that people should not take these pills unless instructed to do so. Potassium iodide can cause problems in those with shellfish allergies or kidney, thyroid or heart ailments, she said, and its benefits are fairly short-lived. Federal health officials warned recently that consumers who try to buy the pills on the Internet may get ineffective or dangerous pills.

Radioactive fallout in Japan has so far been almost entirely confined to the 19-mile zone around the Fukushima Daiichi plant that the authorities have designated as posing the highest risk. But weather modeling has suggested that fallout from the disaster could circulate as far as Alaska and Southern California, although officials have said that there is little cause for concern.

"It won't even be at the level of a chest X-ray," Ms. Classic said.

Still, there may be some reasons for worry. A study of Swedish children who were in utero at the time of the Chernobyl accident in 1986 found that they fared worse on standardized academic tests than a control group of subjects. Children in the most affected parts of Sweden - hundreds of miles from the accident site - fared particularly poorly, showing scores about 5 percent lower than the control group. There is no hard evidence, however, of cause and effect.

The developing fetus is particularly sensitive to the effects of radiation.

Evacuation planning at nuclear power plants focuses mostly on residents within 10 miles because they are most at risk for direct exposure in an accident, either through inhalation or contact, said Scott Burnell, a spokesman for the Nuclear Regulatory Commission. But the plans include possible measures in a secondary zone extending 50 miles from the plant to protect against contaminated foods or water, Mr. Burnell said. Farmers and ranchers in this area may be instructed during an accident to put their animals in barns and use stored feed instead of allowing them to graze.

President Obama recently asked the nuclear commission to review the safety of all of the nation's nuclear power plants, but whether that review will include evacuation plans is as yet unknown, Mr. Burnell said.

For Mr. Thornburgh, the lessons of the Three Mile Island accident were to restrain emergency personnel who wanted to act even if such action was not warranted; to resist what he called "emergency macho," or the tendency to stay up all night so as to be able to brag about it later; and to stay calm.

"Not helpful in this effort was the fact that the newly released film 'The China Syndrome' had just opened in the area, including its description of the consequences of a nuclear meltdown as rendering permanently uninhabitable an 'area the size of the state of Pennsylvania,'" he said. "This was not a message calculated to put people's minds at ease."

<http://www.physorg.com/news/2011-03-outcomes-longer-heart-elective-surgeries.html>

Outcomes improved by longer delays between heart attacks and elective surgeries
Before undergoing elective surgery, patients should consider waiting longer after a heart attack than is currently recommended, according to a study scheduled for publication in the May issue of the journal, Annals of Surgery.

The American Heart Association and the American College of Cardiology recommend patients wait at least four to six weeks after a heart attack before undergoing elective surgery. This guidance is based on studies conducted in the 1970s and 1980s.

The new study examined surgical outcomes among more than 550,000 California patients over a five-year period (1999-2004) who underwent five common elective surgeries after a heart attack. Researchers found substantially lower death rates and fewer subsequent heart attacks in those who waited eight or more weeks after a heart attack to undergo hip surgery, gallbladder removal, non-traumatic amputation, colon resection or elective abdominal aortic aneurysm repair.

"Despite medical advancements in the treatment of coronary artery disease today, a recent heart attack remains a very important risk factor for patients undergoing surgery," said Christian de Virgilio, MD, the study's corresponding author and a principal investigator at Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center (LA BioMed). "Our study suggests that patients should wait at least eight weeks after a heart attack before undergoing elective surgery. The results of the study also reignite the question of whether, in this high risk group, physicians should consider coronary artery stenting or bypass prior to elective surgery."

Researchers found the risk of subsequent heart attacks and death generally declined the longer the time between a heart attack and elective surgery. For instance, the risk of death for heart attack in patients undergoing hip surgery declined nearly 40 percent when the surgery took place more than six months after the heart attack.

Among patients who underwent hip surgery within 30 days of a heart attack, the study found 13.1 percent died within a month. Among those whose hip surgery occurred six months to one year after a heart attack, researchers found the death rate within a month was 7.9 percent. The risk of a subsequent heart attack went from 38.4 percent for hip surgery performed within a month of a heart attack to 6.2 percent for hip surgery performed six months to a year after a heart attack.

"Our research examined a much wider range of patients and surgeries than in past studies, and it points out the importance of a recent heart attack in determining the timing for elective surgeries," said Dr. de Virgilio.

Provided by UCLA Medical Center

<http://www.bbc.co.uk/news/health-12846963>

Antibiotics have 'little effect' on cough and phlegm
Taking antibiotics for a bad cough which produces green or yellow phlegm is of little benefit, says Cardiff University research.

A study of over 3,000 adults from across Europe found that patients producing coloured phlegm are more likely to be prescribed antibiotics by their GP.

Yet the antibiotic treatment did not appear to speed up their recovery.

The study appears in the European Respiratory Journal.

An acute cough or a lower respiratory tract infection is a very common reason for people going to see their GP in the UK, says the study.

Coughing up phlegm coloured green or yellow is also one of the most common reasons for GPs prescribing antibiotics, because they believe it is more likely to indicate a bacterial cause.

The team from the School of Medicine at Cardiff University collected data from 13 European countries for their research, asking patients and doctors to record symptoms and treatments for the condition.

The researchers found that patients who produced green or yellow phlegm were prescribed antibiotics "considerably more often" than those with clear or white phlegm.

They also found that, after seven days, the biggest difference between those who were and were not treated with antibiotics was less than one half of a percentage point on a symptom severity scale.

Side effects

Professor Chris Butler, who led the study, said: "Our findings resonate with findings from randomised trials where benefit from antibiotic treatment in those producing discoloured phlegm has been found to be marginal at best or non-existent."

"Our findings add weight to the message that acute cough in otherwise well adults is a self-limiting condition and antibiotic treatment does not speed recovery to any meaningful extent.

"In fact, antibiotic prescribing in this situation simply unnecessarily exposes people to side effects from antibiotics, undermines future self care, and drives up antibiotic resistance," Professor Butler said.

The study also found that GPs from Scandinavia are good at targeting their prescribing of antibiotics while The Netherlands use half as many antibiotics than the UK.

Professor Butler added: "Antibiotics can save people's lives, but we need to keep them away from people who will not benefit from them."

"The more we use them, the less likely they are to work."

<http://www.bbc.co.uk/news/science-environment-12827893>

Quantum physics explanation for smell gains traction

By Jason Palmer Science and technology reporter, BBC News, Dallas

The theory that our sense of smell has its basis in quantum physics events is gaining traction, say researchers.

The idea remains controversial, but scientists reporting at the American Physical Society meeting in Dallas, US, are slowly unpicking how it could work. The key, they say, is tiny packets of energy, or quanta, lost by electrons.

Experiments using tiny wires show that as electrons move on proteins within the nose, odor molecules could absorb these quanta and thereby be detected. If the theory is right, by extending these studies, an "electronic nose" superior to any chemical sensor could be devised.

Lock and key

The means by which a detected molecule is translated into a smell within the brain has already been the subject of Nobel prize-winning research. But how precisely an odorant molecule is detected remains a mystery.

As with the picture of molecular interactions that drives our understanding of enzymes and drugs, the very shape of odorant molecules has been assumed to be the way it is detected in the nose. In this scenario, molecules are seen to be the "key" that fits neatly into a detector molecule in the nose that acts as a lock.

But in 1996, Luca Turin, now of the Massachusetts Institute of Technology in the US, suggested that the "vibrational modes" of an odorant were its signature.

Molecules can be viewed as a collection of atoms on springs, and energy of just the right frequency - a quantum - can cause the spring to vibrate. Since different assemblages of molecules have different characteristic frequencies, Turin proposed, these vibrations could act as a molecular signature.

The idea has been debated in the scientific literature, but presentations at the American Physical Society meeting put the theory on firmer footing.

Most recently, Dr Turin published a paper showing that flies can distinguish between molecules that are chemically similar but in which a heavier version of hydrogen had been substituted.

Like a spring with a heavier weight at one end, the vibration frequency is lowered, and flies appear to notice.

"There's still lots to understand, but the idea that it cannot possibly be right is no longer tenable really," said Andrew Horsfield of Imperial College London. "The theory has to at least be considered respectable at this point," he told BBC News.

Dr Horsfield's research centres on demonstrating how the vibration might be detected.

The idea is that an electron on one part of a protein may move, and arrive at another part lacking a quantum of vibrational energy.

"The electron starts at one end of the room, if you like, and it can only make it to the other end if it gives up energy to the molecule in the middle of the room," he explained.

"Once it's arrived, you say 'Aha! The fact that it's here means that somewhere between where it started and where it is now there's a molecule with the right vibrational frequency'."

Room to move

The difficulty is demonstrating a physical system where this kind of detective work can be accomplished - to show a start and an endpoint to the process.

Dr Horsfield and his collaborators have demonstrated nanowires - wires just billionths of a metre across - that can act as the "room" of the analogy.

They showed how electrons could arrive at one end of these nanowires and give away what molecules they had encountered along the way.

Jennifer Brookes, a University College London researcher based at MIT, carries out computer simulations on the quantum physics at work in the process, in order to put it on a firmer mathematical footing.

"It's a very interesting idea; there's all sorts of interesting biological physics that implement quantum processes that's cropping up," she told BBC News.

"I believe it's time for the idea to develop and for us to get on with testing it."

Her presentation suggested that the vibrational theory of smell, at least as quantum physics is concerned, is a reasonable one.

"Mathematically, the theory is robust, and even if it's not happening in smell, it's interesting to think it might be a discriminatory process in nature in other ways," she said.

http://www.eurekalert.org/pub_releases/2011-03/ki-aie032411.php

Acupuncture is equally effective with simulated needles

Simulated acupuncture - sometimes referred to as placebo - is just as beneficial as real acupuncture for treating nausea in cancer patients undergoing radiotherapy, according to a study from Karolinska Institutet and Linköping University in Sweden.

Patients, who received only standard care including medications for nausea, felt significant more nausea than patients in both the acupuncture groups.

"The beneficial effects seem not to come from the traditional acupuncture method, but probably from the patients' positive expectations and the extra care that the treatment entails," says Anna Enblom, physiotherapist and researcher at the Osher Centre for Integrative Medicine at Karolinska Institutet. "The patients communicated with the physiotherapists administering the acupuncture, received tactile stimulation and were given extra time for rest and relaxation."

The study, which is published in the scientific journal PLoS ONE, included 277 patients at Linköping and Lund university hospitals and Karolinska University Hospital in Solna, all of whom were undergoing radiotherapy of the abdomen or pelvic region for cancer. A selection of 215 patients from this group, were blindly assigned traditional or simulated acupuncture. The former group (109 patients) had needles inserted into their skin to stimulate certain points, and the latter (106 patients) had blunt telescopic placebo needles merely pressed against the skin. The acupuncture patients were then compared with 62 patients who had only received the standard care regime with medications for nausea and no acupuncture.

The results show that the patients who had received genuine or simulated acupuncture felt much less nauseous than those who had received standard care only. Of the patients who had had some form of acupuncture, only 37 felt nausea and seven per cent vomited, compared with 63 per cent and 15 per cent of the standard care group. However, no differences were observed between the two acupuncture groups, despite the fact that the placebo needle was applied to the skin for a total of only two minutes during the entire five-week treatment period.

The patients' expectations seemed to be important for the effect: 81 per cent of those who expected to feel ill did so, in contrast to only 50 per cent of those who did not.

"It's important to remember that the effects of the treatment are valuable to the patients, even if they can be said to have been caused by unspecific factors, such as the manner in which the patients were taken care of and their positive expectations," says Dr Enblom. "So our next step is to study which part of the acupuncture procedure actually are of importance, to make possible the use of those components to further increase quality of care."

The published study also formed a part of Dr Enblom's previously published doctoral thesis from Linköping University.

Publication: 'Getting the Grip on Nonspecific Treatment Effects: Emesis in Patients Randomized to Acupuncture or Sham Compared to Patients Receiving Standard Care', Anna Enblom, Mats Lekander, Mats Hammar, Anna Johnsson, Erik Onelöv, Martin Ingvar, Gunnar Steineck & Sussanne Börjeson, PLoS ONE, online 23 March 2011.

Great Depression did not significantly improve life expectancy in the US

LSHTM study of statewide bank crises finds no major impact of the depression on mortality

A study published today provides a new perspective on the Great Depression of the 1930s. A widely held view is that there were remarkable improvements in life expectancy of over five years. Using data from urban populations, researchers found that it was actually associated with an increase in suicides but reduction in motor-vehicle accidents, a pattern consistent with the impacts of the current recession in Europe and the U.S. The study, led by the London School of Hygiene & Tropical Medicine, is published in today's issue of the *Journal of Epidemiology & Community Health*.

Senior author of the study, Dr David Stuckler, of the London School of Hygiene & Tropical Medicine and Harvard School of Public Health, said: "Our study provides evidence that even major depressions do not imply mortality crises. Whether health improves or worsens during hard times depends mainly on how governments choose to respond."

Professor Martin McKee, of the London School of Hygiene & Tropical Medicine, said: "This study reminds us of the importance of learning the lessons of the Great Depression for the situation we face now, both in terms of the implications for the economy and for health."

Previous studies had mainly relied on countrywide data to study trends in health during the Great Depression. For the first time, the authors looked at mortality data on 30 causes of death covering 114 US cities and 36 US states between 1929 and 1937. Banking crises were an iconic feature of the depression, and also one of the very few measures available to capture the variation in the impact of the Great Depression among states. Importantly, at that time, banks were not allowed to operate across state borders, whereas workers and production could do. Banks may 'suspend' temporarily, but no one knew at the time how permanent this would be, creating a loss of a sense of control. The authors investigated the relationships of bank suspensions and personal income with the rises and falls in mortality.

Overall, the authors found that a higher rate of bank suspensions was significantly associated with higher suicide but lower death rates from motor-vehicle accidents; no significant effects were observed for 30 other causes of death. Consistent with smaller-scale studies of this period, the authors found no evidence of a delayed, longer-term effect of the Great Depression on population health. Using alternative measures, such as economic output and personal income, the authors found similar patterns.

The authors concluded: "We found that mortalities in US urban populations significantly fell during the Great Depression. We were able to confirm our hypothesis that, within this overall change, there were some components, such as reductions in infectious disease mortality and increases in deaths from chronic diseases that were independent of bank suspensions. Thus, these changes cannot clearly be linked to the Great Depression."

The authors note that it is likely that the New Deal, the birth of the U.S. social security system and large fiscal stimulus, combined with Prohibition of alcohol, helped to prevent a major mortality crisis. They show that, after Prohibition was lifted in 1933, in an effort to stimulate the economy, alcohol-related mortality increased significantly. Other regions that introduced major cuts to social welfare had differing patterns of mortality during crises, the authors note, pointing to the mortality crises in eastern European during their economic depressions of the 1990s. They conclude, "Future work is needed to understand the potentially protective effects of the New Deal and Prohibition."

:: Stuckler D, Meissner C, Fishback P, et al. Banking crises and mortality during the Great Depression: evidence from US urban populations, 1929-1937 *J Epidemiol Community Health* (2011). doi:10.1136/jech.2010.121376

http://www.eurekalert.org/pub_releases/2011-03/l-mis032411.php

MRSA infection shown to be seasonal

New study from Rhode Island Hospital shows second half of year more common for MRSA infection

PROVIDENCE, R.I. – A new study from Rhode Island Hospital has found a significant increase in the occurrence of methicillin-resistant *Staphylococcus aureus* (MRSA) infections in the summer and autumn months. The increase was more pronounced in the pediatric population than in adults. The study is now published online in advance of print in *PloS ONE*.

Lead author Leonard Mermel, D.O., Sc.M., medical director of the department of epidemiology and infection control at Rhode Island Hospital, and his colleagues conducted a retrospective 10-year study by examining MRSA isolates submitted to the hospital's microbiology laboratory.

Their findings indicate that for pediatric patients there were approximately 1.85 times as many community-associated (CA) MRSA infections and 2.94 as many hospital-associated (HA) MRSA infections in the third and

fourth quarters of the year than in the first two quarters. For adults, there were 1.14 times as many CA-MRSA infections in the second two quarters as in the first two quarters, but no seasonal variation was observed in adult HA-MRSA infections.

The researchers also reviewed published articles over the last 70 years that had any mention of seasonality and Staph aureus infections. They summarized the literature search in two comprehensive tables that reveal an increased incidence of such infections during summer and autumn in many temperate regions of the world and during the warmest months of the year in tropical regions.

The researchers believe that it is the sequence of the third and fourth quarters that is important in demonstrating the peak in MRSA infections rather than just the warmest quarter of the year. Mermel says, "We reviewed meteorological data for Rhode Island during the decade of our study period and found that the second quarter was warmer, on average, than the fourth quarter. We believe that an increased incidence of infection in autumn, the fourth quarter, may reflect a lag between Staphylococcal colonization and subsequent infection."

The researchers note that hydration of the skin is important for microbial growth, and maximum hydration is achieved when high temperatures combine with high relative humidity, which also promotes increased sweat production. Mermel says, "The presence of both factors, heat and humidity, may be critically important in providing the environmental conditions that facilitate heavy growth of *S. aureus* on the skin."

Mermel, who is also a professor of medicine at The Warren Alpert Medical School of Brown University, says, "We've demonstrated that Staph infections, particularly skin infections in children, follow a seasonal pattern. Until now, this basic observation of one of the most common human infections has been generally unnoticed, minimized or doubted in the medical literature." He concludes, "It is hoped that this study will promote further investigation into the seasonality of *S. aureus* infections to better understand the biologic basis for this observation."

http://www.eurekalert.org/pub_releases/2011-03/uol-rrr032311.php

Researchers reveal remarkable fossil

525-million-year-old discovery of 'feathered helmet from beyond the clouds'

Researchers from China, Leicester and Oxford have discovered a remarkable fossil which sheds new light on an important group of primitive sea creatures.

The 525-million-year-old fossil belongs to a group of tentacle-bearing creatures which lived inside hard tubes. Previously only the tubes have been seen in detail but this new specimen clearly shows the soft parts of the body including tentacles for feeding.

Details of the discovery have been announced today in the journal *Current Biology*. The study was funded by the Royal Society and the National Natural Foundation of China.

The creature belongs to a group called pterobranch hemichordates which are related to starfish and sea urchins but also show some characteristics that offer clues to the evolution of the earliest vertebrates. About 30 species of pterobranch are known to exist today although 380-490 million years ago a group of these animals called graptolites were common across the prehistoric oceans.

Pterobranches are creatures which secrete a substance that builds up into a hard tube around their soft body. Tentacles extend from the top of the tube to catch plankton. Although less than 4cm in length, the new fossil is beautifully preserved and minute details can be seen including 36 tiny tentacles along one feathery arm.

Professor David Siveter from the University of Leicester's Department of Geology commented, "Amazingly, it has exceptionally preserved soft tissues - including arms and tentacles used for feeding - giving unrivalled insight into the ancient biology of the group."

This is the detail of 525 million-year-old hemichordate. Professor Derek Siveter, Oxford University

Colleagues from Yunnan University and the Universities of Leicester and Oxford collaborated in identifying and describing the remarkable find which was discovered in Yunnan Province, China. It has been named *Galeaplumosus abilus* which means 'feathered helmet from beyond the clouds', referring to both the creature's shape and its location - 'Yunnan' literally translates as 'south of the clouds'.

The team from Yunnan (Professor Hou and Dr Ma), Leicester (Professors David Siveter and Richard Aldridge; Drs Mark Williams and Jan Zalasiewicz) and Oxford (Professor Derek Siveter) are engaged in long term study of these important fossils. Hou, Xian-guang, Aldridge, R.J., Siveter, David J., Siveter, Derek J., Williams, M., Zalasiewicz, J.A. & Ma Xiao-ya. 2011. A pterobranch hemichordate zooid from the lower Cambrian. Current Biology.



Study: Teachers unaware of growing gender gaps in classrooms

CHAMPAIGN, Ill. – A gap in reading and math scores still exists in lower grades, with boys continuing to outpace girls in math, and girls ahead of boys in reading, two University of Illinois education professors say.

Using national longitudinal data to perform their analysis, Joseph P. Robinson and Sarah Lubienski investigated male and female achievement in math and reading, looking for when gender gaps first appeared and where in the distribution the gaps were most prevalent.

Except for kindergarteners in the 99th percentile, boys and girls generally start out on equal footing in math competency. In elementary school, girls throughout the distribution lose ground to boys in math achievement before eventually regaining some ground in middle school, according to research published by the professors in the American Educational Research Journal.

"If you just look at the average gap, there is no gap in math between boys and girls when they start kindergarten," Robinson said. "But when you start to break it down throughout the distribution, taking a look at the low- and high-achieving girls and boys, that's where we see that there's a gap favoring boys at the upper-most extreme of the distribution. The 99th percentile of boys is outscoring the 99th percentile of girls."

Over time, as students progress through elementary school, the gap "begins to widen, favoring boys in the lower part of the distribution," Robinson said. "By third grade, you can see it throughout the whole range of kids."

Robinson and Lubienski also compared teachers' assessments of boys and girls. They discovered that teachers seem to overestimate girls' mathematics achievement relative to boys, rating girls higher than boys in both subjects, even when cognitive assessments suggest that boys have a math advantage.

"Our results suggest that there is still a gender gap, not only with achievement, but with teachers' perceptions," Lubienski said.

Based in part on other research, the professors suspect that teachers might be mistaking girls' compliance in the classroom for comprehension, a topic that the researchers are exploring in a forthcoming study.

"We thought that teachers might rate boys higher in math, but we found that even when boys are outscoring girls, the teachers think the girls are outscoring the boys," Lubienski said. "This might be because girls tend to be perceived as 'good girls' in the classroom, and then teachers assume that they understand the material because they complete their work and don't cause trouble."

The researchers say that there's also a gap in reading that favors girls. Although the gap favoring girls generally narrows over time, it also eventually widens among low-achieving girls and boys, who struggle to keep up with their classmates.

"Clearly, the boys start out behind the girls in reading achievement," Lubienski said. "In general, the mid-achieving boys eventually catch up, but the lowest-achieving boys don't. In other words, if you're a boy and you're really struggling to read, you most likely won't catch up with your peers. It's those boys at the bottom that teachers should be most concerned about when it comes to reading."

The issue of gender gaps in math and reading in U. S. schools has been an ongoing one in education circles, with some researchers arguing that a gender gap doesn't exist in math anymore, something that was concluded from looking at test results from several states. "There have been debates about whether there really is a gender gap in math," Lubienski said.

"But our research looked at national data, and they show that there is indeed still a gender gap in math. It's small, but it's there, and it grows between kindergarten and fifth grade."

As a country, the U.S. seems to have more of a gender gap in early elementary education than in most countries, the researchers say. One hypothesis to explain the gap could be that the U.S. has first and second grade female teachers who are "math-anxious."

"I've seen a surprising number of teachers who want to teach in the lower grades because they're scared of math," Lubienski said. "Other research has shown a link between math-anxious teachers and girls' math performance, so that could also account for the early gender disparities that we found."

Instead of having one teacher for all of the subjects, Robinson and Lubienski believe that having math specialists teaching in the elementary grades, and not just generalists who teach every subject, could help to close the achievement gap.

"If you have a teacher who actually likes math, rather than one who just wants to get it over with, then I think it would be helpful, especially considering that we have these early gaps and other countries don't," Lubienski said. "There's some debate about whether kids need to stay with one teacher because it nurtures them. But from a math education standpoint, having dedicated math specialists is certainly worth exploring."

For education policymakers, the professors say their research suggests that teachers need to intervene earlier when students struggle.

"We should target effective interventions for the content domains where we see gaps, and we must ensure that these interventions are in place by the grades in which we start to see gaps emerge, which our research suggests is earlier than previously thought," Robinson said.

"We can't just ignore the gender gap and think that it's done," Lubienski said. "There's been some concern about boys being short-changed in school, and our research supports that claim for boys who have difficulty with reading."

"But teachers might also underestimate the attention that young girls need in math," Lubienski said. "So we need to pay attention not only to the low-achieving boys who are struggling with reading, but also to the girls – both the high-achievers as well as the low-achievers – as they learn math in the early grades."

<http://www.physorg.com/news/2011-03-mayo-clinic-parkinson-drugs-impulse.html>

Mayo Clinic researchers tie Parkinson's drugs to impulse control problems

Mayo Clinic researchers found that dopamine agonists used in treating Parkinson's disease result in impulse control disorders in as many as 22 percent of patients.

Mayo Clinic first reported on this topic in 2005. The follow-up study was published online in the February 2011 issue of *Parkinsonism and Related Disorders*.

Dopamine agonists, a class of drugs that include pramipexole (Mirapex) and ropinirole (Requip), are commonly used to treat Parkinson's disease. The drugs stimulate the brain's limbic circuits, which are thought to be pathways for emotional, reward and hedonistic behaviors. The medications have been linked to such impulse control disorders as pathological gambling and hypersexuality and to compulsive behaviors such as binge eating, spending, computer use or "hobbying."

Researchers reviewed Parkinson's disease patients' records over a recent two-year period, says Anhar Hassan, M.B., B.Ch., a neurology fellow at Mayo Clinic and lead investigator on the study.

"During this time, movement disorder physicians at Mayo Clinic were keenly aware that impulse control disorders could occur with these dopamine agonist drugs. If they encountered a patient who was taking this drug, they asked them or an accompanying family member whether or not they had noticed any new type of behavior. What we found was that in as many as 22 percent of patients during that two-year period had a new onset impulse control disorder," she says.

The study found that the higher the dose, the greater the likelihood of an impulse control behavior. "One in four patients who were on a medium therapeutic dose of the medication had an impulse control disorder," Dr. Hassan says. "For patients who were taking a higher range of the medication, about one in three developed an impulse control disorder."

Patients taking dopamine agonists should be aware of potential behavioral changes so they can be caught early, before they or their families are harmed, Dr. Hassan says. Once a new behavior is identified, reducing or stopping the medication usually resolves the problem over a few days to a month, she says.

Provided by Mayo Clinic

<http://www.physorg.com/news/2011-03-acupuncture-pain-placebo.html>

Acupuncture for pain no better than placebo and not without harm

Although acupuncture is commonly used for pain control, doubts about its effectiveness and safety remain.

Investigators from the Universities of Exeter & Plymouth (Exeter, UK) and the Korea Institute of Oriental Medicine (Daejeon, South Korea) critically evaluated systematic reviews of acupuncture as a treatment of pain in order to explore this question. Reporting in the April 2011 issue of *PAIN*, they conclude that numerous systematic reviews have generated little truly convincing evidence that acupuncture is effective in reducing pain, and serious adverse effects continue to be reported.

"Many systematic reviews of acupuncture for pain management are available, yet they only support few indications, and contradictions abound," commented lead investigator Professor Edzard Ernst, MD, PhD, Laing Chair in Complementary Medicine, Peninsula Medical School, Universities of Exeter & Plymouth, UK.

"Acupuncture remains associated with serious adverse effects. One might argue that, in view of the popularity of acupuncture, the number of serious adverse effects is minute. We would counter, however, that even one avoidable adverse event is one too many. The key to making progress would be to train all acupuncturists to a high level of competency."

Researchers carefully identified and critically examined systematic reviews of acupuncture studies for pain relief and case reviews reporting adverse effects. Reviews were defined as systematic if they included an explicit Methods section describing the search strategy and inclusion/exclusion criteria. Systematic reviews had

to focus on the effectiveness of any type of acupuncture for pain. Of the 266 articles found, 56 were categorized as acceptable systematic reviews.

The authors observe that recent results from high-quality randomized controlled trials have shown that various forms of acupuncture, including so-called "sham acupuncture," during which no needles actually penetrate the skin, are equally effective for chronic low back pain, and more effective than standard care. In these and other studies, the effects were attributed to such factors as therapist conviction, patient enthusiasm or the acupuncturist's communication style.

If even sham acupuncture is as good as or better than standard care, then what is the harm? The answer lies in the adverse effect case studies. These studies were grouped into three categories: Infection (38 cases), trauma (42 cases) and other adverse effects (13 cases). Many of these adverse side effects are not intrinsic to acupuncture, but rather result from malpractice of acupuncturists. The most frequently reported complications included pneumothorax, (penetration of the thorax) and bacterial and viral infections. Five patients died after their treatment.

In an accompanying commentary, Harriet Hall, MD, states her position forcefully: "Importantly, when a treatment is truly effective, studies tend to produce more convincing results as time passes and the weight of evidence accumulates. When a treatment is extensively studied for decades and the evidence continues to be inconsistent, it becomes more and more likely that the treatment is not truly effective.

This appears to be the case for acupuncture. In fact, taken as a whole, the published (and scientifically rigorous) evidence leads to the conclusion that acupuncture is no more effective than placebo."

More information: The article is "Acupuncture: Does it alleviate pain and are there serious risks? A review of reviews" by E. Ernst, Myeong Soo Lee and Tae-Young Choi (DOI: 10.1016/j.pain.2010.11.004). The accompanying commentary is "Acupuncture's claims punctured: Not proven effective for pain, not harmless" by Harriet Hall, MD (DOI: 10.1016/j.pain.2011.01.039). Both appear in PAIN, Volume 152, Issue 4 (April 2011) Provided by Elsevier <http://www.newscientist.com/article/mg20928044.900-mosquito-needle-helps-take-sting-out-of-injections.html>

Mosquito needle helps take sting out of injections

*** 24 March 2011 by Paul Marks**

LOOK away now if you are afraid of needles. A motorised, harpoon-like needle sounds painful, but in fact hurts far less than a regular injection because it resembles a mosquito's mouth parts.

Seiji Aoyagi and colleagues at Kansai University in Osaka, Japan, have developed a needle that mimics a mosquito's proboscis, which is serrated and barely touches the skin so you don't feel the initial bite. A smooth hypodermic, on the other hand, leaves a lot of metal in contact with the skin, stimulating the nerves and causing pain.

Aoyagi hopes his design could help diabetic people who have to take blood samples. Etched from silicon, the needle imitates three of the creature's seven mobile mouthparts: the two serrated maxillae and the tubular labrum (see diagram).

Unlike Aoyagi's previous attempts to mimic a mosquito's bite, each of these parts is driven by tiny motors based on lead zirconium titanate (PZT) - a piezoelectric crystal that expands very slightly when you apply an alternating voltage (Sensors and Actuators, DOI: 10.1016/j.sna.2010.02.010). The vibrations of the crystal can be used as a simple motor to control how the needle enters the skin.

The sections of the needle break the skin in the same sequence as they do with a mosquito, vibrating at about 15 hertz to ease it into the skin - as observed in mosquitoes under high-speed video microscopes.

Aoyagi has tested his needle on himself and three volunteers, who agree that the pain is much reduced but lasts longer than with a conventional syringe. He thinks that by mimicking more of the creature's mouthparts, including an addition to steady the needle's entry, he'll be able to reduce that dull pain.

Microfluidics engineer Suman Chakraborty of the Indian Institute of Technology in Kharagpur, who has also worked on similar designs in the past, is impressed by Aoyagi's progress. "It's a substantial move towards improving the technology," he says.

Taking a three-pronged approach
A needle that works like a mosquito's mouthparts could cut injection pain



World's wind and waves have been rising for decades

*** 18:00 24 March 2011 by Wendy Zukerman**

Wind speeds and wave heights over the world's oceans have been rising for the past quarter-century.

It's unclear if this is a short-term trend, or a symptom of longer-term climatic change. Either way, more frequent hurricanes and cyclones could be on the horizon.

Ian Young at the Australian National University in Canberra and colleagues analysed satellite data from 1985 to 2008 to calculate wave heights and wind speeds over the world's oceans. They found that winds had strengthened – speeding up over most of the world's oceans by 0.25 to 0.5 per cent, on average, each year. Overall, wind speeds were 5 to 10 per cent faster than they had been 20 years earlier.

The trend was most pronounced for the strongest winds. For instance, the very fastest 1 per cent of winds were getting stronger by 0.75 per cent per year, says Young. Average wave height was also on the rise, but less so; and the highest waves showed the strongest trend. The results were compared against conventional measurements taken from deep-water buoys and numerical modelling. "There is variability, but the same general features are observed," Young says.

From space to sea

Previous attempts to investigate these phenomena used observations from ships and buoys, but these could generally provide only a regional picture. Using altimeter data from satellites allowed the team to detect decadal trends on a global scale for the first time.

Satellite altimeters use radar to measure the height of points on the Earth's surface, and can measure wave height very precisely. Measuring the amount of backscattering from the radar signals, meanwhile, can help calculate wind speed. The global view afforded by the satellites reveals stronger trends in some areas than in others. For example, both wave height and wind speed have been increasing more rapidly in the oceans of the southern hemisphere than in the north.

Wave driver

Young can only speculate on what is causing the increases. "If we have oceans that are warming, that energy could feed storms, which increase wind speeds and wave heights," he says. But with a data series that covers just two decades, it's too early to tell whether there's a long-term trend at work. "We don't know the driving force."

Considering there are so many regional forces influencing waves and wind, "it's surprising that there is such a uniform trend", says Mark Hemer, a wave researcher at the Centre for Australian Weather and Climate Research in Hobart, Tasmania. Variability in winds and waves associated with weather systems such as El Niño and La Niña, the North Atlantic Oscillation and the Southern Annular Mode could all help to explain it, he says.

In either case, if winds continue to strengthen and waves to rise – even if only for a few years – it suggests more intense storms, hurricanes and cyclones are on the horizon, says Young.

However, Tom Baldock, a coastal engineer at the University of Queensland in St Lucia, Australia, says that although there is no reason to doubt the analysis, it doesn't mean more coastal natural disasters will necessarily ensue. "Tornados, hurricanes and cyclones occur through complicated regional weather conditions, and are not just related to wind speed and wave height," he says. For example, there are higher wind speeds at high latitudes, but most cyclones hit around the equator.

The new study may be more relevant to the burgeoning offshore gas, wind, wave and tidal power industries, Baldock thinks. "Larger waves are a hazard for any offshore construction."

Journal reference: Science, DOI: 10.1126/science.1197219

Giffords' husband hopes she'll be at April launch

(AP) -- *The astronaut husband of wounded Rep. Gabrielle Giffords said Thursday there's a "pretty good chance" she will attend his space shuttle launch next month.*

"We still don't know for sure. I'm just awaiting final approval from her doctors," shuttle commander Mark Kelly told reporters at a news conference at NASA's Johnson Space Center. Kelly said his wife, who is recovering from a gunshot wound to the head, is doing "remarkably well. She's improving every day - and in the realm of brain injuries that is very significant and pretty rare," he said. "She's starting to walk, talk more - more every day."

Giffords is also beginning to deal with the shooting at a Tucson, Ariz., shopping center in January, he said. "Despite that, she remains in a very good mood," he said.

Kelly spoke at the traditional preflight news conference for shuttle crews. Wearing a turquoise "Gabby" wristband, he spoke first, reading from a statement before the crew took questions. He said he wanted reporters to focus on the shuttle mission, not his wife's recovery. He is the commander of NASA's next-to-last shuttle flight. Shuttle Endeavour is due to blast off for the final time April 19. The fleet is retiring after shuttle Atlantis makes one last trip to the International Space Station this summer.

Kelly quit training after his wife was shot while meeting with constituents. But a month later he decided to fly the two-week mission. At the time, he said he wanted his wife to attend the launch.

"She's been looking forward to this for a long time," he said Thursday.

Within two weeks of the shooting, Giffords was transferred to TIRR Memorial Hermann hospital in Houston. Kelly said he sees her every morning before work and at the end of the day.

<http://www.scientificamerican.com/article.cfm?id=arctic-sea-ice-ties-for-smallest>

Arctic sea ice ties for smallest area this winter

Even at its biggest, Arctic sea ice extent this winter was among the smallest ever seen, apparently tying with 2006 for the least amount of ice covering the region around the North Pole, U.S.

WASHINGTON (Reuters) - Even at its biggest, Arctic sea ice extent this winter was among the smallest ever seen, apparently tying with 2006 for the least amount of ice covering the region around the North Pole, U.S. researchers reported. Sea ice on the Arctic Ocean usually starts growing in September and hits its maximum area in February or March; this year, the maximum appeared to occur on March 7, when ice stretched over 5.65 million square miles (14.64 million square km), according to the National Snow and Ice Data Center.

That area of ice-covered water is 471,000 square miles (1.2 million square km) below the average maximum ice extent observed by satellites from 1979 to 2000, the center said in a statement.

As of Tuesday, the extent of the ice had shrunk for five straight days, but there is a chance it could expand again, the center said. "Sea ice extent in February and March tends to be quite variable, because ice near the edge is thin and often quite dispersed," the statement read. This thin ice is sensitive to weather, which can make it move or melt quickly, and it often stays around the maximum for days or weeks, as it has done this year.

Arctic sea ice extent -- the area the ice covers in summer and winter -- is one measure scientists use to track changes in global climate. The center plans to release a detailed analysis of winter sea ice conditions during the second week of April. *(Editing by Sandra Maler)*

<http://www.scientificamerican.com/podcast/episode.cfm?id=bones-can-reveal-deceaseds-weight-11-03-24>

Bones Can Reveal Deceased's Weight

The shape of bones can give a general idea about the weight a person carried in life. Cynthia Graber reports.

We see it all the time on shows like Bones and CSI. Skeletal remains can yield all sorts of clues - gender, age, past physical traumas. But not the person's weight. Now, scientists say that skeletons may be able to reveal whether the person had some extra padding.

The scientists evaluated the femurs (or thigh bones) of 121 deceased men for whom they had both weight and height. The group was split into two weight categories based on BMI, body mass index. The researchers found that the femurs of the individuals in the heavier group had significantly wider shafts. The study was published in the Journal of Forensic Sciences. [Gina Agostini and Ann Ross, The Effect of Weight on the Femur: A Cross-Sectional Analysis]

The scientists say that previous studies showed that obese individuals actually walk differently than those of average weight. So their bones are dealing with an increase in weight load and a difference in the biomechanics of movement. This brings on a physiological change to withstand the stress. Skeletons will never be able to give us an exact read on someone's girth, but they may be able to give investigators more evidence...to weigh.

- Cynthia Graber

<http://www.physorg.com/news/2011-03-braingate-neural-interface-day-milestone.html>

BrainGate neural interface system reaches 1,000-day performance milestone

Demonstrating an important milestone for the longevity and utility of implanted brain-computer interfaces, a woman with tetraplegia using the investigational BrainGate system continued to control a computer cursor accurately through neural activity alone more than 1,000 days after receiving the BrainGate implant, according to a team of physicians, scientists, and engineers developing and testing the technology at Brown University, the Providence VA Medical Center, and Massachusetts General Hospital (MGH).

Results from five consecutive days of device use surrounding her 1,000th day in the device trial appeared online March 24 in the Journal of Neural Engineering.

"This proof of concept - that after 1,000 days a woman who has no functional use of her limbs and is unable to speak can reliably control a cursor on a computer screen using only the intended movement of her hand - is an important step for the field," said Dr. Leigh Hochberg, a Brown engineering associate professor, VA rehabilitation researcher, visiting associate professor of neurology at Harvard Medical School, and director of the BrainGate pilot clinical trial at MGH.

The woman, identified in the paper as S3, performed two "point-and-click" tasks each day by thinking about moving the cursor with her hand. In both tasks she averaged greater than 90 percent accuracy. Some on-screen targets were as small as the effective area of a Microsoft Word menu icon.

"Our objective with the neural interface is to reach the level of performance of a person without a disability using a mouse," said report lead author John Simeral, a VA researcher and assistant professor of engineering at Brown. "These results highlight the potential for an intracortical neural interface system to provide a person that has locked-in syndrome with reliable, continuous point-and-click control of a standard computer application."

In each of S3's two tasks, performed in 2008, she controlled the cursor movement and click selections continuously for 10 minutes. The first task was to move the cursor to targets arranged in a circle and in the center of the screen, clicking to select each one in turn. The second required her to follow and click on a target as it sequentially popped up with varying size at random points on the screen.

From fundamental neuroscience to clinical utility

Under development since 2002, the investigational BrainGate system is a combination of hardware and software that directly senses electrical signals produced by neurons in the brain that control movement. By decoding those signals and translating them into digital instructions, the system is being evaluated for its ability to give people with paralysis control of external devices such as computers, robotic assistive devices, or wheelchairs. The BrainGate team is also engaged in research toward control of advanced prosthetic limbs and toward direct intracortical control of functional electrical stimulation devices for people with spinal cord injury, in collaboration with researchers at the Cleveland FES Center.

The system is currently in pilot clinical trials, directed by Hochberg at MGH.

BrainGate uses a tiny (4x4 mm, about the size of a baby aspirin) silicon electrode array to read neural signals directly within brain tissue. Although external sensors placed on the brain or skull surface can also read neural activity, they are believed to be far less precise. In addition, many prototype brain implants have eventually failed because of moisture or other perils of the internal environment.

"Neuroengineers have often wondered whether useful signals could be recorded from inside the brain for an extended period of time," Hochberg said. "This is the first demonstration that this microelectrode array technology can provide useful neuroprosthetic signals allowing a person with tetraplegia to control an external device for an extended period of time."

Moving forward

Device performance was not the same at 2.7 years as it was earlier on, Hochberg added. At 33 months fewer electrodes were recording useful neural signals than after only six months. But John Donoghue - VA senior research career scientist, Henry Merritt Wriston Professor of Neuroscience, director of the Brown Institute for Brain Science, and original developer of the BrainGate system - said no evidence has emerged of any fundamental incompatibility between the sensor and the brain. Instead, it appears that decreased signal quality over time can largely be attributed to engineering, mechanical or procedural issues. Since S3's sensor was built and implanted in 2005, the sensor's manufacturer has reported continual quality improvements. The data from this study will be used to further understand and modify the procedures or device to further increase durability.

"None of us will be fully satisfied with an intracortical recording device until it provides decades of useful signals," Hochberg said. "Nevertheless, I'm hopeful that the progress made in neural interface systems will someday be able to provide improved communication, mobility, and independence for people with locked-in syndrome or other forms of paralysis and eventually better control over prosthetic, robotic, or functional electrical stimulation systems [stimulating electrodes that have already returned limb function to people with cervical spinal cord injury], even while engineers continue to develop ever-better implantable sensors."

In addition to demonstrating the very encouraging longevity of the BrainGate sensor, the paper also presents an advance in how the performance of a brain-computer interface can be measured, Simeral said. "As the field continues to evolve, we'll eventually be able to compare and contrast technologies effectively."

As for S3, who had a brainstem stroke in the mid-1990s and is now in her late 50s, she continues to participate in trials with the BrainGate system, which continues to record useful signals, Hochberg said. However, data beyond the 1000th day in 2008 has thus far only been presented at scientific meetings, and Hochberg can only comment on data that has already completed the scientific peer review process and appeared in publication. *More information:* <http://www.braingate2.org/>

Fukushima men stood in radioactive water without boots

Wendy Zukerman, Asia-Pacific reporter

Three workers exposed to up to 180 millisieverts of radiation at the Fukushima Daiichi nuclear plant have been transferred to a specialist radiation research centre in Chiba city.

Kyodo reports that two of the three men had been standing in water that contained radioactive materials 10,000 times the normal level, without wearing rubber boots:

Electrical engineering firm Kandenko Co., which employs the men, said its workers were not required to wear rubber boots as its safety manuals did not assume a scenario where its employees carry out work standing in water at a nuclear power plant.

This is the first reported case of radiation injuries among Japan's emergency nuclear workers.

Not including the recent events, 24 workers at Fukushima have been injured since the earthquake and tsunami hit Japan's north-east coast on 11 March. According to the Tokyo Electrical Power Company (TEPCO), most injuries have been caused by unexpected explosions at the plants.

TEPCO released a statement on Friday confirming that three workers in the first and underground floor of the turbine building had been exposed to a radiation dose of more than 170 millisieverts.

"Being exposed to 100 millisieverts of radiation at once could raise the chances of getting cancer," says Shunichi Yamashita, president of the Japan Thyroid Association and a researcher at Nagasaki University. Although the workers were "decontaminated", TEPCO "judged that there is possibility of beta ray burn injury". Beta radiation consists of low-energy particles that can burn the skin and increase the risk of skin cancer.

The men were initially taken to Fukushima Medical University Hospital, and then to the National Institute of Radiological Sciences in Chiba prefecture today. Details are murky as to when water first flooded the site. The Japanese government's Nuclear and Industrial Safety Agency told the newspaper Yomiuri Shimbun the area had been flooded from seawater in recent spraying operations.

But according to the Australian Broadcasting Corporation, "TEPCO said almost no water was present during an on-site inspection the previous day. Because of this, the workers were believed to have continued their work even after their dosimeter alarm went off, assuming a problem with the machine," a TEPCO official told ABC.

Meanwhile, Japan's Nuclear and Industrial Safety Agency said that a high-level radiation leak detected at the no. 3 reactor yesterday suggests possible damage to the reactor's vessel, pipes or valves. Kyodo reports that the government has "encouraged residents within a 30-kilometre radius of the power station to voluntarily leave".

<http://www.physorg.com/news/2011-03-algae-bacteria-hogged-oxygen-ancient.html>

Algae and bacteria hogged oxygen after ancient mass extinction, researchers say (PhysOrg.com) -- After the biggest mass extinction in Earth's history -- 250 million years ago -- ocean algae and bacteria rebounded so fast that they consumed virtually all the oxygen in the sea, slowing the recovery of the rest of animals for several million years.

A mass extinction is hard enough for Earth's biosphere to handle, but when you chase it with prolonged oxygen deprivation, the biota ends up with a hangover that can last millions of years. Such was the situation with the greatest mass extinction in Earth's history 250 million years ago, when 90 percent of all marine animal species were wiped out, along with a huge proportion of plant, animal and insect species on land.

A massive amount of volcanism in Siberia is widely credited with driving the disaster, but even after the immense outpourings of lava and toxic gases tapered off, oxygen levels in the oceans, which had been depleted, remained low for about 5 million years, slowing life's recovery there to an unusual degree.

The reason for the lingering low oxygen levels has puzzled scientists, but now Stanford researchers have figured out what probably happened. By analyzing the chemical composition of some then-underwater limestone beds deposited over the course of the recovery in what is now southern China, they have determined that while it took several million years for most ecosystems in the ocean to recover, tiny single-celled algae and bacteria bounced back much more quickly.

In fact, according to biogeochemist Katja Meyer, the tiny organisms rebounded to such an extent that the bigger life forms couldn't catch a break – much less their breath – because the little ones were enjoying a sustained population explosion. As the vast hordes of tiny dead organisms rotted, dissolved oxygen in the seawater was consumed by aerobic microbes involved in the decay process, leaving scant oxygen for larger organisms in what became an oxygen-depleted, or anoxic, environment.

The driver of the ongoing population boom appears to have been the massive amounts of carbon dioxide pumped into the atmosphere during the volcanism, Meyer said, which caused the world to warm.

"More warmth means an invigorated hydrological cycle, so you get more rain and this rain is also more acidic because there is more carbon dioxide dissolved in the rain," Meyer said.

The increased amounts of more acidic rain increased weathering of the land surface, which sent more nutrients into the ocean, which fueled explosions of life such as algae blooms.

"It is kind of counterintuitive that high productivity on the part of algae and bacteria would likely be generating these toxic geochemical conditions that prevent most of animal life from recovering from mass extinction," Meyer said.

But the process, she said, is basically the same as when excess runoff from fertilizers goes into a body of water, whether it's a pond on a golf course or the infamous dead zone in the Gulf of Mexico created by farm runoff carried down the Mississippi River. "You get this giant bloom of algae and then it starts to smell bad as that algae decays, pulling oxygen out of the water and causing fish die-offs," Meyer said.

In spite of the almost inestimably high numbers of algae and bacteria living and dying during this time, there is little direct evidence of them in the fossil record because such tiny, soft-bodied creatures just don't preserve well. So Meyer and her colleagues had to work with indirect evidence of the microorganisms to determine their abundance during the years after the mass extinction. The population proxy they used was the carbon present in the limestone.

Carbon – like all elements – comes in different varieties, called isotopes, distinguished by the number of neutrons each has in its nucleus. The researchers worked with two carbon isotopes, carbon 12, which has six neutrons, and carbon 13, which has seven. Both isotopes are present in ocean water, but living things on Earth have always shown a preference for incorporating the lighter isotope, carbon 12, into their structures. Thus, where life is abundant, the ratio of carbon 13 to carbon 12 in seawater is higher than it is where there is no life.

Limestone records the composition of the seawater in which it was deposited, including the relative amounts of light and heavy carbon isotopes, so by analyzing the isotope ratio in the rocks, Meyer could infer the abundance of life in the water where the limestone formed.

Comparable modern environments, such as the Bahama Banks in the Caribbean Sea, where carbonate platforms similar to the limestones are forming, are typically teeming with life at the range of depths in which Meyer's limestones formed. In these environments, the ratio of carbon 13 to carbon 12 is generally constant from shallow to deep water.

But microorganisms are typically most abundant in shallow waters, so if marine life in the era after the mass extinction had been confined to algae and bacteria, then the shallower depths should show a markedly greater ratio of carbon 13 to carbon 12 than would be found at depth.

Meyer's analysis showed there was a difference of about 4 parts per thousand in carbon isotope ratios from the shallow waters to depths, roughly twice what it is today. "We only see this gradient in the interval after the mass extinction prior to the recovery of animal life," said Meyer.

Meyer is the lead author of a research paper about the study published last month in *Earth and Planetary Science Letters*. The extinction 250 million years ago is known as the Permian-Triassic mass extinction, as it coincides with the end of the Permian period and the beginning of the Triassic period on the geologic time scale.

"It appears there was a huge amount of biological productivity in the shallow waters that was making the bottom waters uninhabitable for animals," said Jonathan Payne, assistant professor of geological and environmental sciences, who is a coauthor of the paper and in whose lab Meyer has been working.

"It looks like the whole recovery was slowed by having too much food available, rather than too little," Payne said. "Most of us think that if the biota isn't doing well, maybe we should feed it more. This is clearly an example where feeding it less would have been much better."

More information: Research paper in Earth and Planetary Science Letters: DOI:10.1016/j.epsl.2010.12.033

Provided by Stanford University

<http://www.nature.com/news/2011/110324/full/news.2011.186.html>

New lead on deadly pancreatic cancer

Mouse model reveals mechanism of potential therapy for lethal tumours.

Alison Abbott

There are currently no effective weapons against pancreatic ductal adenocarcinoma, for which death usually follows diagnosis by just months. But scientists have stumbled across an unexpected way to break through the cancer's formidable defences in clinical trials involving humans and, unusually, mice. Their results are published today in *Science*.

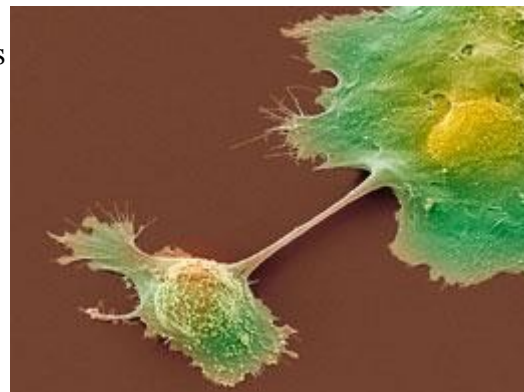
Robert Vonderheide, an immunologist at the University of Pennsylvania's Abramson Cancer Center in Philadelphia, and his team activated immune cells that chewed holes in the protective shell, or stroma, that the pancreatic cancer builds around itself, and attacked the tumour cells.

Surprisingly, the immune cells involved were not the usual suspects - sophisticated anti-tumour T cells - but more primitive cells called macrophages.

"This opens up a fresh set of possibilities for seeking new treatments," says Terry Van Dyke, head of the Mouse Cancer Genetics Program at the National Cancer Institute in Frederick, Maryland, who was not involved in the study. "It's a clear indication that activating macrophages will be efficacious."

Breaking the barrier

It is the unusually tough stroma surrounding pancreatic ductal adenocarcinomas that is responsible for the disease's poor prognosis. Not only is it almost entirely impenetrable to drugs, but it also becomes enmeshed with white blood cells that prevent the immune system from launching its own attack on the cancer.



A clinical trial run in both mice and humans has examined a new way to attack pancreatic cancer. Steve Gschmeissner / Science Photo Library

Others have designed molecular strategies to attack the stroma in the hope of facilitating drug access, and these are currently being tested in the clinic. But the stromal assault by Vonderheide's team occurred inadvertently.

The authors' original intention was to try to counteract the stroma's immunosuppressive actions by activating the protein CD40. This protein activates many types of immune cell, although it is best known for its ability to activate anti-tumour T cells. And it was on these that the scientists focused their attention, expecting the activated T cells to slip through the stroma and target the cancer.

They carried out a clinical trial on 21 patients with inoperable pancreatic cancer who were being treated with gemcitabine, the standard chemotherapy drug for the disease. They gave the patients additional injections of an experimental CD40-activating antibody.

On average, the 21 patients survived several weeks longer than would have been expected without the antibody treatment, and four patients exhibited temporary regression of their tumours. The authors examined biopsies from two of the shrunken tumours under the microscope and found them stuffed with macrophages but devoid of T cells. "Even before the patient trial had finished, we realised that the therapy was looking successful, but perhaps not for the reasons we had imagined," says Vonderheide.

Antibody action

To establish the underlying mechanism, the scientists turned to mice that had been genetically engineered to develop a cancer similar to human pancreatic ductal adenocarcinoma. They were able to repeat the human trial in the animals, with a full set of controls, and subject them to more detailed and invasive examinations.

They treated one set of animals with gemcitabine and a mouse version of the CD40-activating antibody, and other sets with gemcitabine alone, antibody alone or no drugs. Tumours regressed in 30% of mice treated with the antibody — whether or not they had also received gemcitabine. "It was also a surprise to find that gemcitabine itself was not contributing much to the therapeutic effect," says Vonderheide. The authors then took a close look at how the immune systems of the mice, and their tumours, had responded to CD40 activation.

"The antibody did actually cause T cells to be activated, but for some reason they remained in lymph nodes and didn't migrate to the tumours," says Vonderheide. Instead, they found activated macrophages swarming into tumours, he says — and also hanging around the stroma, which started to curl inwards and break down.

"This discovery could never have been made without using a mouse model of the cancer to dissect out the mechanism in detail," says Van Dyke, who recently moved to the National Cancer Institute to start a big translational medicine programme that will similarly match patient and mouse clinical trials in several cancers. Many such efforts are springing up around the world, including a large programme at Harvard in Cambridge, Massachusetts, launched with US stimulus money.

"Despite a lot of effort, only one new drug, erlotinib, has been approved by the Food and Drug Administration in the last decade for metastatic pancreatic cancer, and that only prolongs life by two weeks," says Vonderheide. "Maybe our discovery will lead to new ideas about how to manipulate the immune system for best therapeutic effect." *References Beatty, G. L. et al. Science 331, 1612-1616 (2011).*

<http://news.discovery.com/human/politicians-randomly-selected-elections-2012-110325.html>

Randomly Selected Leaders May Make Politics More Efficient

By Marianne English | Fri Mar 25, 2011 06:40 PM ET

Injecting randomly selected politicians into legislatures could create a more efficient political process, according to a group of scientists.

In a research project, a team led by Alessandro Pluchino from the University of Catania in Italy and colleagues discovered that when they added independent politicians to the mix in their simulations, more laws passed and average societal welfare increased. But why favor randomly assigning positions rather than being elected? Looking closer, the researchers' model views legislators as possessing both personal and public interests. In the simulation, legislators hypothetically possess two rights: to propose a piece of legislation and voting in favor of or against a given proposal.

Crafting legislation isn't necessarily restricted by party, whereas voting rights usually are constrained by party goals, the authors say.

They used the model in different simulations, where each party had varying degrees of power. Injecting independents into the mix increased the legislature's performance in all simulations, the authors write.

Ultimately, the findings do not support getting rid of democratic elections altogether, but rather suggest adding random members to legislatures based on political imbalances between parties.

The authors say their system focuses on current structures of parliaments, but can be expanded to other types of legislatures as well.

The research also draws inspiration from Carlo M. Cipolla, a historian who created a diagram that generalizes people into four areas: Intelligent, Helpless/Naïve, Bandit-like and Stupid. Keep in mind the model doesn't categorize legislators in these areas as people, but rather in their approaches for public good as a legislator.

The work received an award from the Ig Nobel, which acknowledges unique projects that seem comical at first, but are though-provoking as well.

Would America be better off with randomly selected officials? What do you think?

<http://www.newscientist.com/article/dn20290-look-into-my-eyes-to-predict-my-amputation-risk.html>

Look into my eyes to predict my amputation risk

10:00 26 March 2011 by Wendy Zukerman

A glimpse in an eye might soon be enough to diagnose the nerve damage associated with diabetes.

Up to 50 per cent of people with diabetes experience nerve damage, which in extreme cases leads to the loss of limb sensation, prompting the need for amputation. Nerve fibre damage is typically assessed through invasive tests, including nerve and tissue biopsies.

Now Nathan Efron at the Queensland University of Technology in Brisbane, Australia, and colleagues have developed a non-invasive alternative. Diabetes affects peripheral nerves, but Efron suspected that it might also leave a signature in the cornea – the most densely innervated tissue in the body. He has now shown this is true using a corneal confocal microscope: on average, the corneas of diabetic people with nerve damage have a lower density of nerve fibres, and nerves are shorter than in healthy controls.



Seeing the damage done (Image: Suren Mannvelyan/Alamy)

Nerve starvation

Peripheral nerves lose their function in people with diabetes because excess glucose in the blood reduces blood flow to arms and legs. "You are starving the nerve fibres of nutritious oxygen," says Efron.

Initially, it was thought that diabetes affected only these peripheral nerves. So to find that cranial nerves – such as those supplying the eye – were degenerating as well was a surprise, Efron says.

Efron's team has now developed a clinical test based on the findings. Team member Rayaz Malik at the University of Manchester, UK, developed software that compares images of the central cornea with those taken from diabetics with varying degrees of nerve damage. According to Efron, the test is now being used by several hospitals. "It's a very interesting idea," says Hugh Taylor at the University of Melbourne, Australia. With the use of powerful microscopes, "the eye can be used as a fantastic window into the health of the body".

But he says that before the test is widely adopted, its results need to be compared against established measures, such as biopsies, to ensure they are as accurate. The team presented the work at the Asia Pacific Academy of Ophthalmology Congress in Sydney, Australia, this week.