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The Largest Solar Water Heater Plant is in … Denmark?

A windswept Danish island shows that solar power needn't be the sole province of sunnier climes.
By John Perlin

The cobblestone streets and historic houses and shops create the impression that nothing on the Danish island of Ærø (aka Aero) has changed for centuries, and its biggest tourist attraction traditionally was its ship-in-a-bottle museum. But a trek just outside its largest towns will bring a 20th-century surprise — giant solar water heating plants.

Interest in the solar alternative began on the island in the 1970s with Denmark's "No to Nuclear" movement. The two oil shocks of that decade when petroleum prices leapt and availability plummeted added to solar's attraction.

"Ordinary people" — a smith, some teachers, a farmer, also a bank manager — established the Aero Energy Office, which became the focal point for information on renewable energy resources. Those clever with their hands built homemade solar hot water collectors. Then came Energy Plan '81 promulgated by the Danish government. The policy designated Aero Island and some other remote spots for renewable since planned natural gas pipelines would bypass them.

View Larger Map

To kick off the renewable program the Danish government began an educational initiative to gain public support. Renewables needed community backing to succeed as each town on the island ran its own energy plant. The islanders learned, for example, that their Swedish neighbors had great success in the 1980s with large fields of solar hot water collectors providing most of the summer heating load, including hot water, for several housing complexes. Like houses in the towns of Aero, the flats in Sweden got their heat from hot water flowing through pipes connected to a shared boiler.

The Swedish experience motivated those living in Marstal, the largest town on the island, to put up what has become the world's largest solar water heating collector farm. It takes up a space of almost 200,000 square feet. The collectors generate the thermal equivalent of 8.2 billion watt hours per year for the Marstal District Heating, helping to supply heat for 1,400 households. The solar unit provides all their heat from June through August, including hot water. Boilers take over the rest of the time.

Throughout the year, solar energy satisfies 30 percent of the town's annual heating needs, and work is under way to raise that to 50 percent. The Marstal District Heating had earlier relied solely on highly polluting heavy oil for fueling its boilers, which made the solar choice an easy one.

Other district heating complexes on the island followed Marstal's example. In 1998 Aereoskoebing District Heating installed 52,743 square feet of solar collectors; in 2001 the Rise District Heating built a 43,000-square-foot solar plant; and most recently, the Soeby District Heating went solar with a farm taking up 24,000 square feet. Totaled, the island boasts 46 square feet of collector area per person, the highest per capita in the world, far exceeding places like Southern California or Arizona that receive at least twice the solar radiation than does Aero Island.

Aero's renewable outlook isn't totally solar — an estimated 50 percent of its electricity comes from three massive windmills, and all renewable sources combined provide 80 percent of the island's energy.

http://www.miller-mccune.com/science-environment/the-largest-solar-water-heater-plant-is-in-denmark-3516/

Climate Change Could Spell Disaster for National Parks

Hotter temperatures, higher seas viewed as "greatest threat ever" to country's scenic treasures.
By Melinda Burns

National parks are slowly being done in by global warming, so much so that experts believe the Joshua trees may not last the century. The National Park Service is now officially tackling global warming's effects on its nearly 84 million acres of scenic land. (U.S. National Park Service)

Glacier National Park in Montana, one of the 10 oldest parks in the United States, is celebrating its centennial this year, but its glaciers won't be around for another 100 years: They will melt away by 2030, if not sooner, because of global warming.
In California, Joshua Tree National Park is preparing to celebrate its 75th anniversary in 2011, but the trees themselves, iconic symbols and "life centers" of the Mojave Desert, are projected to die out this century. Joshua trees need winter freezes to flower and produce seed, and the Mojave is heating up.
Other parks, including Virginia's Historic Jamestowne, where the colonial history of the U.S. began in 1607, could be washed away before the century's end in temperatures approaching those of tropical Panama City, Much of Florida's Everglades could be underwater, too.
In a strategic plan released this month, National Park Service Director Jon Jarvis calls climate change "the greatest threat to the integrity of our national parks that we have ever experienced."
"We are unafraid to discuss the role of slavery in the Civil War or the imprisonment of American citizens of Japanese ethnicity during WWII," he said. "We should not be afraid to talk about climate change. … How will we choose, as the sea rises, which cultural sites we save? How do we decide that the next site for the giant sequoias is hundreds of miles north?"

National Parks Most At Peril
According to a late 2009 report from the Rocky Mountain Climate Organization and the NRDC, these are the 25 U.S. national parks facing the greatest and most immediate threat from climate change.
• Acadia National Park
• Assateague Island National Seashore

• Bandelier National Monument
• Biscayne National Park
• Cape Hatteras National Seashore
• Colonial National Historical Park
• Denali National Park and Preserve
• Dry Tortugas National Park
• Ellis Island National Monument
• Everglades National Park
• Glacier National Park
• Great Smoky Mountains National Park
• Indiana Dunes National Lakeshore
• Joshua Tree National Park
• Lake Mead National Recreation Area
• Mesa Verde National Park
• Mount Rainier National Park
• Padre Island National Seashore
• Rocky Mountain National Park
• Saguaro National Park
• Theodore Roosevelt National Park
• Virgin Islands National Park/Virgin Islands
Coral Reef National Monument
• Yellowstone National Park
• Yosemite National Park
• Zion National Park

For the full report, click here.

The plan marks the first time that the Park Service has publicly committed to a head-on effort throughout its 84 million acres of scenic land, in collaboration with other federal land managers, to deal with the disruptions of climate change. The U.S. Fish and Wildlife Service released a similar plan last year.

"Not facing up to climate change would be catastrophic for the future of the national parks," said David Graber, chief scientist for the Park Service Pacific West Region, encompassing the West Coast and Pacific Islands. "It's the first utterly essential step in a very long trip. We're trying to buy time. We're clearly looking for ways to provide the opportunity for species to exist for decades and centuries longer."

The plan also signals that a sea change may be coming in the way the parks manage their resources, no longer by letting nature take its course, but rather by intervening to save species and ecosystems from oblivion. From now on, a top-level agency climate change coordinating group will address such tough policy questions as whether to help wild animals migrate to cooler areas and distribute plants and trees that can't migrate on their own, what to do when one park's native species becomes another park's invasive species and how to handle ecosystems that have been reshuffled by drought and floods.

It will not be easy. Even among conservationists, Graber said, there are some who believe it is better to hope for the best and not meddle with nature — although, he said, he is not one of them.

"The National Park Service is a very conservative organization," said Graber, who helped oversee the strategic plan as a member of the agency's Climate Change Response Steering Committee. "One of our watchwords for the past half-century is, 'Nature knows best, let nature do what it does.' Moving from that to some kind of eco-engineering is a very difficult philosophical and psychological change. If the Park Service is going to embark on a really serious trajectory, it's going to have to have a conversation with the American people."

Pederson Glacier in Kenai Fjords National Park, as seen in 1909, top, and 2005. (National Park Service)

Ironically, the park plan comes during a summer in which Congress failed to act on legislation that would have put a cap on carbon dioxide, a heat-trapping greenhouse gas that triggers climate change. Greenhouse gas emissions from burning fossil fuels such as coal, oil and natural gas have raised global temperatures by more than 1 degree Fahrenheit since 1900. According to U.S. government estimates, if no action is taken to

curb these gases, global temperatures could rise by as much as 11.5 degrees Fahrenheit by the end of this century, and the sea level could rise by as much as 4 feet. Under that worst-case scenario, Dry Tortugas National Park — seven coral reef and sand islands less than 3 feet high, which serves as key resting stops for migrating birds, 70 miles off the coast of Florida — would likely be the first national park to be lost this century.

"Climate change is a huge, transforming, all-encompassing threat to the national parks," said Stephen Saunders, founder and president of the Rocky Mountain Climate Organization, a nonprofit group that released a report with the Natural Resources Defense Council last year, naming Dry Tortugas, Jamestown, Glacier and Joshua Tree as four of the nation's 25 most imperiled national parks.

"This is not just about melting polar icecaps," Saunders said. "It's about places close to home that we love. We have never lost entire national parks before."

Saunders, who oversaw the Park Service as deputy assistant secretary of the U.S. Department of the Interior during the Clinton administration, said Jarvis' statement alone would go far to galvanize the agency.

"When the director is that clear that this is the greatest challenge, then doors get opened for people to take action," Saunders said. "In the past, I've been critical of the national parks for not doing enough. Politically, they've been shackled, and the shackles have been taken off. This is a very good job."

Saunders' group and the NRDC have called on Congress to designate brand-new parks and expand existing parks to help save America's best lands from the ravages of climate change. They say the parks should be allowed to redirect a portion of their visitor fees to help cope with climate change.

The parks are already changing as the Earth warms, and not for the better. Only 25 of the 150 glaciers that were present a century ago in Glacier National Park remain today, and they are shrinking. In New Mexico, Bandelier National Monument has lost 90 percent of its piñon forest to heat, drought and beetles. At Jamestown, Hurricane Isabel flooded 90 percent of the park's 1 million cultural artifacts in 2003, and the entire collection had to be moved. At Saguaro National Park in Arizona, hotter, drier conditions favor an invasive grass that is crowding out the native saguaro cactus.

Some parks are already intervening to try to make species more resilient to climate change. Point Reyes National Seashore in California has removed two dams in a large estuary to help bring back endangered trout and salmon. Everglades National Park is removing canals and levees to restore natural freshwater flows and help keep saltwater out. And at Hawaii Volcanoes and Haleakala national parks, biologists are preparing to disperse 12,000 seeds and cuttings of 50 rare species of flowering plants to new locations: They hope to beat the odds of extinction in a shifting rainforest.

"Everything is being viewed as an experiment." Graber said. "This is all unprecedented."

The Park Service plan requires managers to draw up different scenarios for confronting the uncertainties ahead. In a trial run in 2007, scientists came up with a "summer soaker" scenario for Joshua Tree in which warmer temperatures and summer monsoons would likely wipe out the trees and bighorn sheep. Under a "dune" scenario, they said, drought and wildfire would destroy all the park's vegetation.

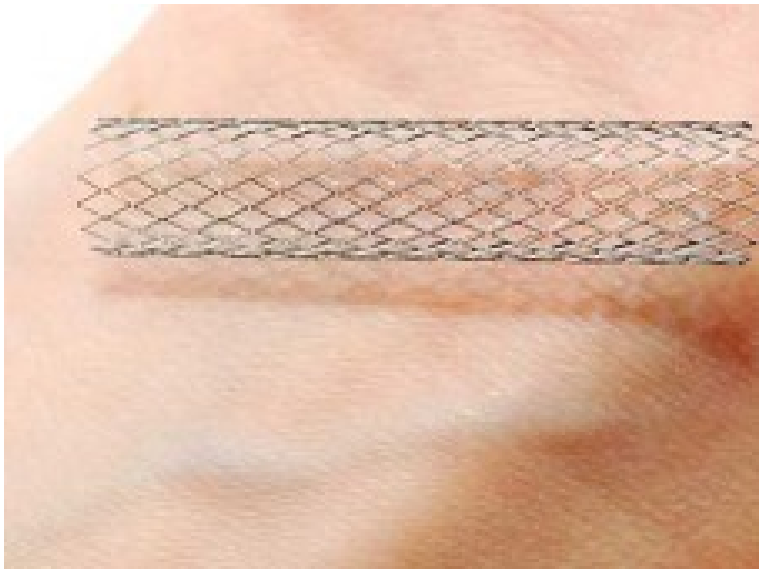
For the Kaloko-Honokohau National Historic Park on Hawaii's Big Island, scientists drew up a "sink or swim" scenario in which the park's fishponds would be flooded, and a "water world" scenario in which everything, including the park's petroglyphs and ancient burials, would be under water. In that case, they said, the park could become an "oceanic and climate change research learning center" to study the effects of sea level rise.

"This crisis is daunting," the new Park Service plan says, "but national parks can provide redemption. For one of the most precious values of the national parks remains their ability to teach us about ourselves and how we relate to the natural world."

http://www.miller-mccune.com/environment/climate-change-could-spell-disaster-for-national-parks-23068/

Stunting Stents

The quicker, easier solution isn't always the wisest choice when it comes to many things in life, including heart disease.
By David Rosenfeld



Are we stenting too much? Medical experts review the procedure, and some believe bypass surgery may be more beneficial for patients with severe heart disease. (Faslooff / istockphoto.com)

The results of a three-year study showing coronary bypass grafts were often better than drug-eluting stents for patients with severe heart disease may not surprise cardiologists and astute patients who have watched the warnings for stents grow in recent years.
Around 1.3 million Americans each year have angioplasty, which props open a clogged artery with a balloon and often involves a stent — what amounts to a tiny mesh-like device that acts like a permanent scaffold. About half of those patients have severe heart disease that researchers now say might be better treated with bypass surgery. A little fewer than 450,000 Americans currently receive bypass grafts, according to the National Center for Health Statistics.
More advanced drug-eluting stents designed in the past decade, which the study compared, are meant to prevent repeat clogging, but they come with their own set of dangers, as Miller-McMune.com highlighted in April.
Researchers now estimate that possibly hundreds of thousands of Americans should be having bypass surgery rather than stenting, resulting in up to 5,000 additional deaths each year and numerous other complications such as heart attack and stroke.
Results of the ongoing Syntax trial (see the PowerPoint presentation here) were reported Sept. 12 at the European Association of Cardio-thoracic Surgery 2010 Annual Meeting in Geneva, Switzerland. Researchers there reported that after a three-year clinical trial of 1,800 patients, those receiving the industry-leading Taxus drug-eluting stent, made by Boston Scientific, were more likely to suffer a heart attack, stroke or even death. For patients with mild heart disease, stenting was found equally effective, though previous research such as the Courage trial and Bari2D have supported medical therapy alone for many of those patients.
The results of the Syntax trial weren't entirely shocking. The two-year outcomes, reported at last year's conference, and the one-year results, published in the *New England Journal of Medicine* in 2009, were all

trending that way. But these latest figures will significantly affect medical practice, experts told the *Los Angeles Times*.

The Syntax trial is associated with the Syntax Score — both funded by Boston Scientific — which helps physicians rate the severity of coronary artery disease.

This growing consensus around which patients benefit most from stents has helped tamp down a decade-long turf war between partisans of interventional cardiology, such as angioplasty and stenting, and those who favor bypass surgery.

For severe heart disease, patients often prefer stents — particularly the drug-eluting kind — because they go home quicker and heal more easily. The procedure, too, is much easier to perform and highly profitable.

Few medical device markets took off as fast as coronary stents. Having experienced huge growth in the 1990s, the stent market peaked at $4 billion in annual sales in 2005. Warnings the devices could cause heart attacks and reports of doctors' over-use led to new guidelines for the most appropriate utilization and a cooling in the industry.

In an interview earlier this year, Dr. Steven Bailey, chief cardiologist at the University of Texas Health Science Center at San Antonio, denied that the medical device industry might have influenced doctors to implant too many stents.

"This is not about industry relationships," Bailey said "Folks are out there trying to come up with the best decision plan for our patients. In many cases and many practices, it may be the lone cardiologists, but increasingly there are a number of cardiologists who are part of that care plan. It's not just the surgeon. And there is certainly a critical review of what the literature is telling us."

http://www.miller-mccune.com/health/stunting-stents-22968/

The Fading Art Of The Physical Exam

by Richard Knox
September 20, 2010

Internist Nesli Basgoz examines patient Barry Arcangeli who has a leaky heart valve. Basgoz discovered Arcangeli's heart condition during a routine physical examination.

For centuries, doctors diagnosed illness using their own senses, by poking, prodding, looking, listening. From these observations, a skilled doctor can make amazingly accurate inferences about what ails the patient. Technology has changed that. "We're now often doing expensive tests, where in the past a physical exam would have given you the same information," says Jason Wasfy, a cardiologist-in-training at Massachusetts General Hospital in Boston.
As a result, many doctors are abbreviating the time-honored physical exam — or even skipping it altogether.
Some Patients Never Examined
"It's amazing to me that in this day and age there are some patients who go to their doctor, and the doctor doesn't even examine them," says Roman DeSanctis, a senior cardiologist at Massachusetts General Hospital who is famous for his diagnostic skills.

"I sometimes joke that if you come to our hospital missing a finger, no one will believe you until we get a CAT scan, an MRI and an orthopedic consult. We just don't trust our senses."

- Dr. Abraham Verghese

DeSanctis says he recently listened to one patient's chest and heard the unmistakable sounds of abnormal fluid buildup. It turned out he had lung cancer.
"I said, 'Did Dr. So-and-so mention anything about this when he saw you?' " DeSanctis says. "And he said, 'Well, he took my blood pressure, but he didn't really examine me.' This is not an isolated case."
And it appears that the trend is likely to get worse. "I'm definitely worried that the physical exam is dying a slow death," says Nesli Basgoz, a physician at Massachusetts General Hospital.
She reports that young trainees often ask her why they need to learn the subtle and hard-won skills needed to do a good physical exam.
"They say, 'If it's so important, how come we sit around in a conference room and talk about what's in the chart, instead of spending more time seeing patients?' " Basgoz says.
Basgoz is trying to buck the trend — in her teaching and by setting a good example.

Careful Exam Crucial

To illustrate how important a thorough physical can be, she introduces patient Barry Arcangeli, a 50-year-old man with a leaky aortic valve.

Arcangeli's heart murmur "is loud and it's long," Basgoz says, offering the patient and a visitor the chance to listen for themselves. "Do you hear it?" she says. "It goes 'whooo-whooo.' That 'whooo' sound shouldn't be there at all."

Arcangeli has no heart symptoms, so his leaky valve would probably not have been picked up if Basgoz hadn't noticed it during a routine physical exam. She says at some point he'll probably need a new heart valve, but meanwhile he needs careful monitoring and preventive treatment.

Even when doctors go through the motions of doing a physical, their diagnostic skills aren't what they used to be. One recent study in the *Journal of the American Medical Association* examined stethoscope skills of various kinds among 453 practicing physicians and 88 medical students. Whatever their age or experience, the doctors correctly recognized only 20 percent of heart problems.

At Stanford Medical School, professor Abraham Verghese is leading the charge to restore the physical exam to what he considers its rightful place, and bring doctors' skill up to snuff.

"I sometimes joke that if you come to our hospital missing a finger, no one will believe you until we get a CAT scan, an MRI and an orthopedic consult," Verghese says. "We just don't trust our senses."

Verghese says it's as though the output of machines is the only information that counts.

"You know, we often spend so much time with that entity in the computer — I call it the 'iPatient,' like your iPad and your iPhone. And the real patient in the bed is often left wondering, 'Where is everybody? What are they doing?' I sense that we're spending very little time at the bedside."

Stanford 25

Stanford Medical School in California is trying to make sure its graduates and trainees know how to do 25 bedside tests that it considers essential to good doctoring.

Here's the list:

- Examine the back of the eye
- Examine the pupil of the eye and its response to light
- Examine the thyroid gland
- Examine the neck veins for abnormal size and pulses
- Examine the lung's surface, lung sounds and borders
- Evaluate the heart's motion
- Examine the liver's size and shape
- Evaluate the spleen's size and density
- Evaluate gait (walking movements)
- Test ankle reflexes for nerve abnormalities
- Identify markers of liver disease throughout the body
- Identify signs of stroke caused by blockage of a deep brain artery
- Examine the knee
- Identify abnormal heart sounds
- Evaluate tremors and other involuntary movements
- Recognize markers of disease in the hands and fingernails
- Examine the tongue
- Examine the shoulder for injuries and joint abnormalities
- Assess blood pressure and abnormal pulses
- Assess lymph nodes in the neck
- Detect fluid in the abdomen and abdominal blood flow
- Perform a rectal exam
- Evaluate a mass in the scrotum

- Test balance and ability to perceive the body's position in space
- Use a pocket ultrasound device*

*This item is not yet standard practice in most U.S. medical settings, but Dr. Abraham Verghese of Stanford hopes it will be. He says it's valuable in detecting abnormal fluids, quickly evaluating heart function and assessing organ abnormalities

--Richard Knox

Reversing The Trend

At Stanford, they're trying to reverse the trend. The school's graduates and trainees have to master 25 different bedside exam skills, from palpating a spleen to testing ankle reflexes. (See accompanying sidebar)

Verghese is convinced that doctors who know how to do a competent physical will pick up a lot of serious problems. "My worst nightmare," he says, "is that someone passes through my hands with a diagnosable, treatable condition that I missed because of sloppy technique. And they pop up six months later with somebody else at a point when it's not treatable."

But some critics consider Verghese an incurable romantic.

"I don't believe that trying to resurrect the physical exam of yore is the right use of the increasingly scarce time we have with our trainees," says Bob Wachter, a professor and chief of the Division of Hospital Medicine at the University of California, San Francisco. "And some of the time the physical exam doesn't stand up very well against some of the other tests that we have. It's just not accurate enough."

Wachter says it's more important to spend the time talking to the patient and answering questions than percussing, palpating, peering into eyes and ears, tapping on knees and doing all of the other things in the classic physical.

But Verghese says there's another important reason to do physical diagnosis: Patients miss the laying on of hands.

The Importance Of Touch

"I always listen to language very carefully when people complain about us –- and they complain a lot," the Stanford internist says. "And if you listen to the words people use, it's very often, 'He or she never laid a hand on me, he or she never touched me, he or she was hardly listening and they were busy entering stuff into the computer.' "

Verghese says before doctors dispense with the physical exam they should think about what's really happening during the encounter.

"If you look at the physician exam –- one individual coming to another, telling them things they would not tell their spouse or rabbi or priests, and then, incredibly, disrobing and allowing touch," Verghese says. "I think our skills in examining a patient have to be worthy of that kind of trust."

And the full ritual is necessary, he says, to establish that connection.

http://www.npr.org/templates/story/story.php?storyId=129931999&sc=nl&cc=hh-20100920

Human Connections Start With A Friendly Touch
by Michelle Trudeau
September 20, 2010

Hand-holding causes levels of the stress hormone cortisol to drop, says Matt Hertenstein, an experimental psychologist at DePauw University in Indiana. This couple joined hands while protesting offshore oil drilling in the wake of the Deepwater Horizon spill during a Hands Across the Sand event in Gulfport, Miss.

Social scientists have shown in many studies over the years that supportive touch can have good outcomes in a number of different realms. Consider the following examples: If a teacher touches a student on the back or arm, that student is more likely to participate in class. The more athletes high-five or hug their teammates, the better their game. A touch can make patients like their doctors more. If you touch a bus driver, he's more likely to let you on for free. If a waitress touches the arm or shoulder of a customer, she may get a larger tip. But why does a friendly or supportive touch have such universal and positive effects? What's happening in our brains and bodies that accounts for this magic?

Skin Deep?

To understand this, we'll start on the outside — with the skin. It's our largest organ, covering about 20 square feet, which is about the size of a twin mattress.

If somebody touches you, there's pressure pushing on your skin at the point of contact. And just under the skin are pressure receptors called "Pacinian corpuscles," says Tiffany Field, one of the world's leading touch researchers and the director of the Touch Research Institute at the University of Miami in Florida.

"They receive pressure stimulation," Field says, "and the pressure receptors send a signal to the brain."

The Pacinian corpuscles' signals go directly to an important nerve bundle deep in the brain called the vagus nerve. The vagus sometimes is called "the wanderer" because it has branches that wander throughout the body to several internal organs, including the heart. And it's the vagus nerve that then slows the heart down and decreases blood pressure.

Field describes studies in which subjects were asked to perform something stressful, like public speaking or taking a timed math test. The subjects' partners were also part of the experiment, hugging or holding hands with the subjects when the researchers told them to.

"They found that, in fact, people who were given this stressful task, if they'd been holding hands or being hugged, they would have a lower blood pressure and lower heart rate, suggesting that they were less stressed," Field says.

Impact On Stress

Hand-holding or hugging also results in a decrease of the stress hormone cortisol, says Matt Hertenstein, an experimental psychologist at DePauw University in Indiana.

"Having this friendly touch, just somebody simply touching our arm and holding it, buffers the physiological consequences of this stressful response," Hertenstein says.

In addition to calming us down and reducing our stress response, a friendly touch also increases release of the oxytocin — also called the "cuddle hormone" — which affects trust behaviors.

"Oxytocin is a neuropeptide, which basically promotes feelings of devotion, trust and bonding," Hertenstein says.

Oxytocin levels go up with holding hands, hugging — and especially with therapeutic massage. The cuddle hormone makes us feel close to one another.

"It really lays the biological foundation and structure for connecting to other people," Hertenstein says.

Just Like Chocolate

Besides engendering feelings of closeness, being touched is also pleasant. We usually want more. So what's going on in the brain that accounts for these feelings?

Hertenstein says recent studies from England pinpointed an area in the brain that becomes highly activated in response to friendly touch. It's a region called the orbital frontal cortex located just above your eyes. It's the same area that responds to sweet tastes and pleasing smells.

"A soft touch on the arm makes the orbital frontal cortex light up, just like those other rewarding stimuli," Hertenstein says. "So, touch is a very powerful rewarding stimulus — just like your chocolate that you find in your cupboard at home."

The surging of oxytocin makes you feel more trusting and connected. And the cascade of electrical impulses slows your heart and lowers your blood pressure, making you feel less stressed and more soothed.

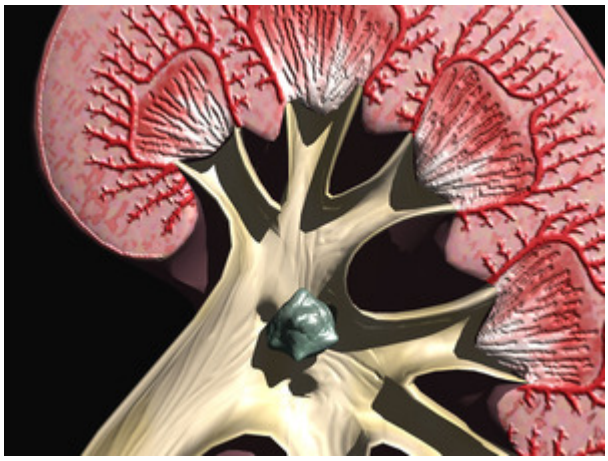
Remarkably, this complex surge of events in the brain and body are all initiated by a simple, supportive touch.

http://www.npr.org/templates/story/story.php?storyId=128795325&sc=nl&cc=hh-20100920

This Too Shall Pass: Avoid Kidney Stones Through Diet

by Allison Aubrey
September 16, 2010

There are surgical interventions to treat kidney stones, but when it comes to prevention, diet may be key. One new study finds that a diet rich in plant-based foods and low-fat dairy may help decrease the risk of developing kidney stones.



3D Clinic/Getty Images
This computer illustration shows a kidney stone in the renal pelvis. Although a major component of kidney stones is calcum, a new study shows that a calcium-rich diet may help inhibit their development.

Many patients who've passed a kidney stone say the pain is excruciating. And David Goldfarb, a nephrologist at New York University, says he feels his patients' pain. Goldfarb had his first stone in his late 20s, and he remembers it as if it were yesterday.
"I was walking down the street when I was suddenly accosted by this tremendous pain. It felt like a large chef's knife had been stuck in my back," Goldfarb says. "And I was doubled over, soaked through my clothes sweating."
A dramatic day in the ER followed. But once the stone passed, Goldfarb says, he — like most people — forgot about it. Very few people take steps to prevent a repeat attack, but he says most kidney stone sufferers will form another stone within 10 years.
"Most people with relatively small stones that passed the stone in the emergency room as I did forget about it — don't follow a diet, don't drink more water," Goldfarb says. "And that's why kidney stones are so recurrent."
After his second attack Goldfarb says he began drinking lots of fluids. To this day, he keeps a water bottle in hand as he sees patients. This strategy has really helped him. And there is lots of evidence that fluid intake is very effective in staving off recurrent kidney stone attacks.

A Counterintuitive Approach

The evidence on diet is just beginning to accumulate. The most recent study published in *Clinical Journal of the American Society of Nephrology* suggests that calcium-rich foods — such as low-fat milk and yogurt — can be protective. This may seems a bit odd — given that kidney stones are partially formed by calcium.
"It is a little bit counterintuitive, maybe, that actually higher intakes of dietary calcium are associated with a reduction in kidney stone risk," says Dr. Eric Taylor, a kidney specialist at Brigham and Women's Hospital in Boston.

The theory is that dietary calcium binds with a waste product in the gut called oxalate. The two substances stick together, crystallize and exit the body long before there's a chance to form kidney stones.
The latest study suggests that it's not just calcium-rich dairy that's beneficial. There's a whole pattern of eating that's linked to reduced risk.

Beyond Dairy

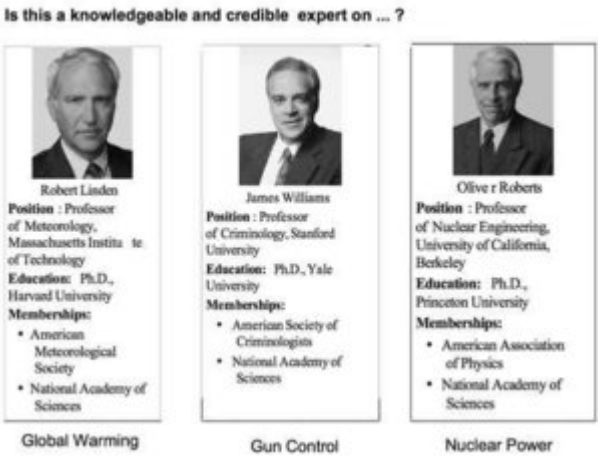
Taylor analyzed the diets of 3,426 people with and without kidney stones. All the individuals had been enrolled in long-term studies that tracked their eating habits over many years. He was particularly interested in people whose diets most resembled the Dietary Approaches to Stop Hypertension, or DASH, diet. The DASH diet, which is similar to a Mediterranean-style diet, was developed decades ago to help people lower blood pressure.
"So, higher intake of fruits, vegetables, nuts and legumes, low-fat dairy and whole grains," Taylor says. "And low intake of sweetened beverages and red and processed meats."
Taylor says the people who adhered most to this pattern of eating were significantly less likely to develop kidney stones.
"We found a decrease in risk in the order of around 40 or 45 percent," says Taylor. "We were very excited by it."
One simple explanation is that a diet rich in fruits in vegetables increases fluid intake, which is known to be beneficial. It's also possible that unidentified compounds in plant foods or dairy products may inhibit the formation of kidney stones.
The new study is no assurance that people prone to kidney stones will be able to prevent them through diet alone. Some people with recurrent stones choose to take prescription diuretics to reduce the risk. What's important, say experts, is that patients have multiple strategies to help prevent recurrent attacks.

http://www.npr.org/templates/story/story.php?storyId=129909820&sc=nl&cc=hh-20100920

Why science can't hold sway

Our biases are overpowering.
By Faye Flam
Inquirer Staff Writer

The Cultural Cognition Project



Whether the experts were regarded as credible depended on a person's preexisting beliefs.
Why do so many Americans disagree with scientific consensus on issues such as global climate change and the safety of burying nuclear waste? Is it our poor education? Science illiteracy? Innumeracy?
None of the above, according to a new study published in Journal of Risk Research. People's positions on these issues and their willingness to believe or discount scientists depends mostly on ideology, or what the study's authors call "cultural cognition."
After surveying 1,500 people, the researchers found that those who were "egalitarian and resentful of economic inequality" were more likely to assume that there was scientific consensus that human activity is contributing to climate change, but not that it's safe to dispose of nuclear waste underground. Those who were more "hierarchical, individualistic and connected to industry and commerce" were more likely to make the opposite assumptions.
According to reports from the National Academy of Sciences, human activity is contributing to climate change and nuclear waste can be buried safely in certain designated sites.
"It's not that one group is paying more attention to what scientific consensus is," said Dan Kahan, a law professor at Yale and author of the study. But there's a pervasive tendency to form perceptions of scientific consensus that reinforce people's values.
The researchers also confronted subjects with fictional authors - Robert Linden, professor of meteorology at MIT; Oliver Roberts, professor of nuclear engineering at U.C. Berkeley; and James Williams, professor of criminology at Stanford. All had Ivy League Ph.D.s and membership in the National Academy of Sciences. Subjects were asked whether they'd recommend a book by any of these authors to a friend.
The result: The experts could be seen as sages or stooges depending on whether they were said to agree with a subject's preexisting belief.
Sure, professor Roberts might have a Ph.D. from Princeton but if he's going to panic about nuclear waste he must be a girly man - or if he thinks it's safe to bury it, someone in the nuclear industry must be paying him.
It's not that people don't like science - it's that they selectively attend to evidence in a way that's gratifying to them, said Kahan. "People will do that with our article," he said. "They'll say that's why those people [who disagree with them] are so dumb."

Contact staff writer Faye Flam at 215-854-4977 or fflam@phillynews.com.
Find this article at:
http://www.philly.com/inquirer/magazine/20100920_Why_science_can_t_hold_sway.html

Watch and learn

How music videos are triggering a literacy boom

By Riddhi Shah | September 19, 2010

(Jaydeep Bhatt) A group of people watched television at a slum in Gulbai Tekra, an area in the city of Ahmedabad in India.

Tiny, sun-soaked Khodi on the western coast of India's Gujarat state is the kind of village where cattle still plough the fields and women fill clay pots with water from the village well. In the past few years, however, the town has been changing: Thatched mud huts are slowly giving way to sturdy, single-story concrete blocks; farmers conduct their business on cellphones. The state buses, which until a decade ago were only filled with men, are now crammed with women. Enrollment in the local school has soared.

These changes can be attributed partly to India's recent economic liberalization, which has raised incomes and brought unprecedented growth across the country. But in Khodi, there's another, more unlikely contributor: the soaring local literacy rate, courtesy of music videos.

Every Sunday in villages across India, groups of people — an assortment of turbaned men, sari-clad women, and gap-toothed children — gather around old television sets to watch their favorite Bollywood film stars sing and dance in song videos culled from movies. These song shows, a popular component of mainstream television programming, are often the only way rural populations can see the stars or access the latest films.

Nine years ago, India's national television network decided to introduce karaoke-style subtitles to these programs — not in a foreign language, but in Hindi, the language the stars were singing in. The first state to broadcast the subtitles was Gujarat. People in Khodi, and in the rest of the state, saw the captions as an opportunity to sing along with the songs. They began paying attention to the moving strip of lyrics at the bottom of the screen. Often, they would copy the words on paper, going back to them after the show was over. And as they did, the reading level in Khodi slowly improved.

According to Hema Jadvani, a researcher who has been studying the effects of the subtitles on Khodi, newspaper reading in the village has gone up by more than 50 percent in the last decade. Her research also

shows that the village's women, who can now read bus schedules themselves, are more mobile, and more children are opting to stay in school.

India's public karaoke-for-literacy experiment is the only one of its kind in the world. Technically known as same-language subtitling, or SLS, it manages to reach 200 million viewers across 10 states every week. In the last nine years, functional literacy in areas with SLS access has more than doubled. And the subtitles have acted as a catalyst to quadruple the rate at which completely illiterate adults become proficient readers.

In the fight against poverty, this is big news. Development organizations the world over have long been grappling with the challenge of increasing literacy, which is linked not only to economic growth, but to better health, greater gender equality, and a more transparent political process. Against this background, the apparent effectiveness of subtitles — along with their low cost, only 1 cent per person per year — has attracted the attention of academics and educators. Viewers in India have shown reading improvement after watching just eight hours of subtitled programming over six months; conventional literacy teaching methods typically require much more time and far greater resources to achieve the same results.

Same-language subtitling extricates literacy from the tangles of school infrastructure and teacher availability. And since television, more than any other medium, has the power to reach out to billions across the developing world, it holds unique promise for hard-to-access groups like rural women, who are discouraged from venturing outside their villages once they hit puberty.

Perhaps most importantly, though, SLS has the ability to make literacy fun. In Khodi, for example, children watching song shows read the lyrics and write them down so that they can sing the songs with their friends later — an enthusiasm they rarely show for school work. Ultimately, by making reading easy and entertaining, SLS can change the way a child feels about school. "I was always tired and lazy. Then I began reading better, and everything just became easier," says Rajesh Sodha, a ninth grade student from Khodi, in a phone interview. "School is more fun now."

The idea of SLS was born in 1996 at Cornell University. Brij Kothari, an Indian PhD student at Cornell, was learning Spanish for a research project. He'd been watching a lot of Spanish cinema but found that the English subtitles made it harder for him to "hear" the original dialogue. Kothari realized that if the films were subtitled in Spanish itself, he'd learn the language more easily. "Then it occurred to me that if all Indian television programming in Hindi was subtitled in Hindi, India would become literate faster," says Kothari, who is now a professor at the Indian Institute of Management in Ahmedabad and founder of PlanetRead, an educational nonprofit.

Five years later, Kothari managed to persuade the Indian state channel to subtitle its first batch of song shows, and since then he has campaigned tirelessly to popularize subtitling as a literacy tool.

But even as far back as the early 1990s, there was some research support for the idea that television subtitles can improve reading skills. Finland, for example, a country that has repeatedly placed first on education rankings created by the Organization for Economic Cooperation and Development, has attributed much of its educational success to captions. For several decades now, Finland has chosen to subtitle its foreign language television programs (in Finnish) instead of dubbing over them. As a result, Finnish high school students read better than students from European countries that dub their TV programs. They are also more proficient at English.

A Belgian psychologist named Gery d'Ydewalle looked at the effects of subtitling in a 1991 study. He found that reading of subtitles on a screen is almost involuntary. In other words, viewers find it nearly impossible to ignore subtitles, regardless of whether they can hear the sounds or understand the language. We've all experienced this — the inescapable pull of closed captioning when we're watching a film, or find ourselves near a TV in a loud bar or an airport.

Following d'Ydewalle's findings, academics began researching the link between foreign-language subtitles and the ability to learn that language. What they found matched Finland's experience with English shows — children and adults who watched television subtitled in a foreign language were likely to be able to pick up that language easily. As for same-language subtitles, research by Kothari and others has shown that viewers with low-level reading skills show considerable literacy and vocabulary improvement after watching subtitled television.

Importantly, researchers found that the best results come from subtitling music. “Songs build phonemic awareness — the ability to break a word into syllables — more than dialogue,” says Clara Schmidt, an American educator who has independently evaluated the effect of Kothari’s system in India. Songs repeat lyrics, which gives viewers more time to make the sound-letter association. Viewers also often want to memorize the lyrics to a song, which motivates them to make an effort to read the subtitles — a factor that’s missing with ordinary dialogue.

As helpful as subtitling appears to be, it isn’t a cure-all for literacy problems. One important shortcoming is that it can’t teach people to read from scratch: Viewers who can’t recognize letters aren’t likely to benefit from seeing subtitles scroll by. The method works best with what educators call early-literates: children and adults who have basic familiarity with the alphabet, but can’t read fluently enough to make productive use of their skill. Primary schools or basic reading classes are still needed to teach students that the letter “a” makes an “ah” sound.

As its results suggest, however, SLS may hold promise in other arenas where readers are struggling to move beyond basic skills. Greg McCall, a special education teacher in Hawaii, created his own same-language subtitles to help his students, including learning-disabled students. McCall says he stumbled upon SLS while looking for ways to engage ninth-graders with difficult texts like “Les Miserables.” Instead of asking them to read the book, he showed them the musical and found that students were instantly more involved. Soon, he began adding subtitles and saw a marked improvement in reading ability. With traditional literacy software, says McCall, reading among his students improved by the equivalent of 0.7 classroom years in a year of teaching. Using SLS he saw a jump of two classroom years.

McCall has been campaigning for his research to be discussed at a national level and suggests that it has applications across a wide spectrum of people: from children who are just beginning to learn how to read to teen dropouts to adults who never learned how to read fluidly. “America is not being honest about its literacy problem,” he says. Three out of five Americans in jail can’t read. Fifty million adult Americans can’t read beyond a fifth-grade level, leaving them at a semi-literate level that is often ignored in mainstream literacy campaigns.

The solution, say educators like Schmidt and McCall, is to make closed-captioning compulsory for all children’s programming. “The government should also subtitle all MTV programs,” recommends Schmidt.

But academics do warn against a potential pitfall: If subtitles become part of mainstream education, students may start to see them as “learning” rather than entertainment. For SLS to work, they argue, it must be seen primarily as fun, and it must stay out of schools. “My fear is that once it enters the classroom, it will become boring and turn people off,” says Stephen Krashen, an education researcher and professor emeritus at the University of Southern California.

The problem of semi-literacy, of course, is a worldwide one — in India, for example, out of the 650 million officially literate people, only 300 million can read fluently. The low cost of SLS makes it easily replicable even in the poorest parts of the world. Gradually, says Kothari, governments and private organizations have begun to show interest in the idea. South Africa and Rwanda are considering implementing SLS on their state television channels. In Pakistan, a private television channel is talking about using same-language subtitles in Urdu on film song programs watched in Afghanistan and Pakistan.

In the international educational landscape, where every small victory means spending hours negotiating with inefficient bureaucracies and a constant battle for funds, SLS is a rare bright spot. Using nothing more than a television set and a few songs, the method brings real literacy improvement and reading practice to people right in their living rooms. The simple system can inherently change the way we look at reading; it promises to exchange the tedium of the classroom for the entertainment of an hour of MTV.

In the words of Khodi’s local school principal, Bachchubhai Lakhabhai: “SLS manages to achieve in a few hours what we haven’t been able to do for years.”

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http://www.boston.com/bostonglobe/ideas/articles/2010/09/19/watch_and_learn/#

Lost libraries
The strange afterlife of authors' book collections

By Craig Fehrman | September 19, 2010
A few weeks ago, Annecy Liddell was flipping through a used copy of Don DeLillo's "White Noise" when she saw that the previous owner had written his name inside the cover: David Markson. Liddell bought the novel anyway and, when she got home, looked the name up on Wikipedia.

Markson, she discovered, was an important novelist himself--an experimental writer with a cult following in the literary world. David Foster Wallace considered Markson's "Wittgenstein's Mistress"--a novel that had been rejected by 54 publishers--"pretty much the high point of experimental fiction in this country." When it turned out that Markson had written notes throughout Liddell's copy of "White Noise," she posted a Facebook update about her find. "i wanted to call him up and tell him his notes are funny, but then i realized he DIED A MONTH AGO. bummer."

The news of Liddell's discovery quickly spread through Facebook and Twitter's literary districts, and Markson's fans realized that his personal library, about 2,500 books in all, had been sold off and was now

anonymously scattered throughout The Strand, the vast Manhattan bookstore where Liddell had bought her book. And that's when something remarkable happened: Markson's fans began trying to reassemble his books. They used the Internet to coordinate trips to The Strand, to compile a list of their purchases, to swap scanned images of his notes, and to share tips. (The easiest way to spot a Markson book, they found, was to look for the high-quality hardcovers.) Markson's fans told stories about watching strangers buy his books without understanding their origin, even after Strand clerks pointed out Markson's signature. They also started asking questions, each one a variation on this: How could the books of one of this generation's most interesting novelists end up on a bookstore's dollar clearance carts?

What Markson's fans had stumbled on was the strange and disorienting world of authors' personal libraries. Most people might imagine that authors' libraries matter--that scholars and readers should care what books authors read, what they thought about them, what they scribbled in the margins. But far more libraries get dispersed than saved. In fact, David Markson can now take his place in a long and distinguished line of writers whose personal libraries were quickly, casually broken down. Herman Melville's books? One bookstore bought an assortment for $120, then scrapped the theological titles for paper. Stephen Crane's? His widow died a brothel madam, and her estate (and his books) were auctioned off on the steps of a Florida courthouse. Ernest Hemingway's? To this day, all 9,000 titles remain trapped in his Cuban villa.

The issues at stake when libraries vanish are bigger than any one author and his books. An author's library offers unique access to a mind at work, and their treatment provides a look at what exactly the literary world decides to value in an author's life. John Wronoski, a longtime book dealer in Cambridge, has seen the libraries of many prestigious authors pass through his store without securing a permanent home. ”Most readers would see these names and think, 'My god, shouldn't they be in a library?'” Wronoski says. ”But most readers have no idea how this system works.”

The literary world is full of treasures and talismans, not all of them especially literary--a lock of Byron's hair has been sold at auction; Harvard has archived John Updike's golf score cards.

For private collectors and university libraries, though, the most important targets are manuscripts and letters and research materials--what's collectively known as an author's papers--and rare, individually valuable books. In the first category, especially, things can get expensive. The University of Texas's Harry Ransom Center recently bought Bob Woodward and Carl Bernstein's papers for $5 million and Norman Mailer's for $2.5 million. Compared to the papers, the author's own library takes a back seat. ”An author's books are important,” says Tom Staley, the Ransom Center's director, ”but they're no substitute for the manuscripts and the correspondence. The books are gravy.”

Updike would seem to have agreed. After his death in 2009, Harvard's Houghton Library bought Updike's archive, more than 125 shelves of material that he assembled himself. Updike chose to include 1,500 books, but that number is inflated by his own work--at least one copy of every edition of every book in every language it was issued. ”He was not so comprehensive in the books that he read,” says Leslie Morris, Harvard's curator for the Updike archive. In fact, Updike was known to donate old books to church book sales and to hand them out to friends' wives. Late in life, he made a deal with Mark Stolle, who owns a bookstore in Manchester-by-the-Sea. ”He would call me once his garage was filled,” Stolle remembers, ”and I would go over and buy them.”

While he didn't seem to value them, Updike's books begin to show how and why an author's library does matter. In his copy of Tom Wolfe's ”A Man in Full,” which was one of Stolle's garage finds, Updike wrote comments like ”adjectival monotony” and ”semi cliché in every sentence.” A comparison with Updike's eventual New Yorker review suggests that authors will write things in their books that they won't say in public.

An author's library, like anyone else's, reveals something about its owner. Mark Twain loved to present himself as self-taught and under-read, but his carefully annotated books tell a different story. Books can offer hints about an author's social and personal life. After David Foster Wallace's death in 2008, the Ransom Center bought his papers and 200 of his books, including two David Markson novels that Wallace not only annotated, but also had Markson sign when they met in New York in 1990. Most of all, though, authors' libraries serve as a kind of intellectual biography. Melville's most heavily annotated book was an edition of John Milton's poems, and it proves he reread "Paradise Lost" while struggling with "Moby-Dick."

And yet these libraries rarely survive intact. The reasons for this can range from money problems to squabbling heirs to poorly executed auctions. Twain's library makes for an especially cringe-worthy case study because, unlike a lot of now-classic authors, he saw no ebb in his reputation--and, thus, no excuse in the handling of his books. In 1908, Twain donated 500 books to the library he helped establish in Redding, Conn. After Twain's death in 1910, his daughter, Clara, gave the library another 1,700 books. The Redding library began circulating Twain's books, many of which contained his notes, and souvenir hunters began cutting out every page that had Twain's handwriting. This was bad enough, but in the 1950s the library decided to thin its inventory, unloading the unwanted books on a book dealer who soon realized he now possessed more than 60 titles annotated by Mark Twain. Today, academic libraries across the country own Twain books in which "REDDING LIBRARY" has been stamped in purple ink.

But the 1950s also marked the start of a shift in the way many scholars and librarians appraised an author's books. They began trying to reassemble the most famous authors' libraries--or, in worst-case scenarios like Twain's, to compile detailed lists of every book a writer had owned. The effort and ingenuity behind these lists can be astounding, as scholars will sift through diaries, receipts, even old library call slips. A good example is Alan Gribben's "Mark Twain's Library: A Reconstruction," which runs to two volumes and took nine years to complete.
This raises an obvious question: Why not make the list of an author's books before dispersing them? The answer, usually, is time. Book dealers, Wronoski says, can't assemble scholarly lists while also moving enough inventory to stay in business. When Wallace's widow and his literary agent, Bonnie Nadell, sorted through his library, they sent only the books he had annotated to the Ransom Center. The others, more than 30 boxes' worth, they donated to charity. There was no chance to make a list, Nadell says, because another professor needed to move into Wallace's office. "We were just speed skimming for markings of any kind." Still, the gap between the labor required on the front end and the back end can make such choices seem baffling and even--a curious charge to make when discussing archives--short-sighted. Libraries, for their part, must also allocate limited resources, and they do so based on a calculus of demand, precedent, and prestige.

This means the big winners are historical authors (in the 1980s, Melville's copy of Milton sold at an auction for $100,000) and those who fit into a library's targeted specialties. "We tend to focus on Harvard-educated authors," Morris says. "The Houghton Library is pretty much full and has been for the last 10 years."
In David Markson's case, the easiest explanation for why his books ended up at The Strand is that he wanted them to. Markson, who lived near the bookstore, would stop by three or four times a week. The Strand, in turn, hosted his book signings and maintained a table of his books, and Markson's daughter, Johanna, says he frequently told her in his final years to take his books to The Strand. "He said they'd take good care of us," she says.

And so, after Johanna and her brother saved some books that were important to them--"I want my children to see what kind of reader their grandfather was," Johanna says--a truck from The Strand picked up the rest, 63 boxes in all. Fred Bass, The Strand's owner, says he had to break Markson's library apart because of the size of his operation. "We do it with most personal libraries," Bass says. "We don't have room to set up special collections."

Markson had sold books to The Strand before. In fact, over the years, he sold off his most valuable books and even small batches of his literary correspondence simply to make ends meet. Markson recalled in one interview that, when he asked Jack Kerouac to sign a book for him, Kerouac was so drunk he stabbed the pen through the front page. Bass said he personally looked through Markson's books hoping to find items like this. "But David had picked it pretty clean."

Selling his literary past became a way for Markson to sustain his literary future. In "Wittgenstein's Mistress" and the four novels that followed, Markson abandoned characters and plots in favor of meticulously ordered allusions and historical anecdotes--a style he called "seminonfictional semifiction." That style, along with the skill with which he prosecuted it, explains both the size and the passion of Markson's audience.

Markson's late style also explains the special relevance of his library, and it's a wonderful twist that these elements all came together in the campaign to crowdsource it. Through a Facebook group and an informal collection of blog posts, Markson's fans have put together a representative sample of his books. The results won't satisfy the scholarly completist, but they reveal the range of Markson's reading--not just fiction and poetry, but classical literature, philosophy, literary criticism, and art history. They also illuminate aspects of Markson's life (one fan got the textbooks Markson used while a graduate student) and his art (another got his copy of "Foxe's Book of Martyrs," where Markson had underlined passages that resurface in his later novels). Most of all, they capture Markson's mind as it plays across the page. In his copy of "Agape Agape," the final novel from postmodern wizard William Gaddis, Markson wrote: "Monotonous. Tedious. Repetitious. One note, all the way through. Theme inordinately stale + old hat. Alas, Willie."

Markson's letters to and from Gaddis were one of the things he sold off--they're now in the Gaddis collection at Washington University--but Johanna Markson says he left some papers behind. "He always told us, 'When I die, that's when I'll be famous,'" she says, and she's saving eight large bins full of Markson's edited manuscripts, the note cards he used to write his late novels, and his remaining correspondence. A library like Ohio State's, which specializes in contemporary fiction, seems like a good match. In fact, Geoffrey Smith, head of Ohio State's Rare Books and Manuscripts Library, says he would have liked to look at Markson's library, in addition to his papers. "We would have been interested, to say the least," Smith says.
But if Markson's library--and a potential scholarly foothold--has been lost, other things have been gained. A dead man's wishes have been honored. A few fans have been blessed. And an author has found a new reader. "I'm glad I got that book," Annecy Liddell says. "I really wouldn't know who Markson is if I hadn't found that. I haven't finished 'White Noise' yet but I'm almost done with 'Wittgenstein's Mistress'--it's weird and great and way more fun to read."

By Craig Fehrman is working on a book about presidents and their books. ■

http://www.boston.com/bostonglobe/ideas/articles/2010/09/19/lost_libraries/

Simple steps to happier politics

Surprising insights from the social sciences
By Kevin Lewis | September 19, 2010
It's easy to be discouraged by our polarized political environment. A new study suggests there may be an easy way out. Right before the 2008 presidential election, prospective voters were asked to complete an online survey. Some of the participants were assigned a brief self-affirmation exercise, where they had to choose the personal trait (from a list of 10) that was most important to them and write a sentence or two explaining that choice. Other participants encountered the same list but had to choose the trait that was least important and explain why someone else might find it important. All participants then viewed video clips from the last presidential debate. Those who were "affirmed," who wrote about what was most important to them, moderated their partisan views of Obama, with Republicans becoming less harshly critical and Democrats less gushing in their enthusiasm. Even more surprising, though, was that this pattern held up after the election: When the researchers e-mailed Republicans 10 days after the election, the affirmed Republicans had a significantly more favorable outlook on Obama's presidency. So maybe Senator Al Franken had the right idea with his famous Saturday Night Live skit "Daily Affirmation with Stuart Smalley."
Binning, K. et al., "Seeing the Other Side: Reducing Political Partisanship via Self-Affirmation in the 2008 Presidential Election," Analyses of Social Issues and Public Policy (forthcoming).
Green = weak?
Marketers may assume that "green" products are more appealing to consumers, especially to environmentally conscious consumers. But according to a recent study, green branding sends a signal that can undermine other essential features of a product. Specifically, green products tend to be associated with gentleness, not strength. For example, people were more interested in eco-friendly baby shampoo than eco-friendly car shampoo, tires, or laundry detergent. The researchers also found a similar effect in an experiment with hand sanitizer during flu season. They put two bottles of sanitizer — one was green-colored and labeled "eco-friendly," while the other was just clear and labeled "regular" — on a table. If they knew they were being watched, most people used the green version, but if no one seemed to be watching, most people used the regular version.
Luchs, M. et al., "The Sustainability Liability: Potential Negative Effects of Ethicality on Product Preference," Journal of Marketing (September 2010).
The problem with talking about it
A common refrain in conflicts is to "talk it out." While this may be effective in certain situations, some forms of talk may make the problem worse. A psychologist at Princeton University conducted an experiment in war torn eastern Congo with a radio-broadcast soap opera designed to reduce ethnic hostility. In some broadcast areas, the soap opera was followed by a 15-minute talk show. After a year of the broadcast, researchers interviewed a large sample of Congolese in the listening area. Although the talk show had the intended effect of increasing discussion among listeners, it also had the unintended effect of increasing intolerance. Apparently, the talk show provoked more contentious discussion and made people even more aware of ethnic grievances.
Paluck, E., "Is It Better Not to Talk? Group Polarization, Extended Contact, and Perspective Taking in Eastern Democratic Republic of Congo," Personality and Social Psychology Bulletin (September 2010).
Who prays, stays
In a previous column, I wrote about a study showing that prayer can reduce alcohol consumption. The researchers behind that study have now come out with a study showing that prayer can curtail another vice: infidelity. Among a sample of several hundred college students, those who reported praying more for their partner were less likely to report cheating six weeks later. Of course, this pattern could simply mean that the kind of people who pray don't tend to be the kind of people who cheat. So the researchers randomly assigned students to pray (in this case, for their partner) for four weeks. Compared to those who were assigned to undirected prayer or to think positive thoughts about their partner, praying for one's partner reduced reported cheating behavior. The researchers videotaped a bunch of couples actually discussing the future of their relationship. Independent assessments of these discussions found greater commitment by those who had prayed for their partner.

Fincham, F. et al., "Faith and Unfaithfulness: Can Praying for Your Partner Reduce Infidelity?" Journal of Personality and Social Psychology (forthcoming).

Write unclearly

It almost goes without saying that one should write clearly. But that depends. According to a new study, if your goal is education, you may not want to write too clearly. In one experiment, people read a short story by Mark Twain that was printed in a font that was either easy or difficult to read; the story was also presented as either a "Historical Analysis Study" or a "Short Story Study." When read as a short story for enjoyment, the story was rated better in the easy-to-read font, but, as a historical analysis, the story was rated better in the hard-to-read font. In another experiment, while reading the same Twain story, some people were asked to furrow their brow, an action that has been shown to induce the perception of complexity. Among those who furrowed their brow, the story was rated better when read as a historical analysis, but worse when read for enjoyment.

Galak, J. & Nelson, L., "The Virtues of Opaque Prose: How Lay Beliefs about Fluency Influence Perceptions of Quality," Journal of Experimental Social Psychology (forthcoming).

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http://www.boston.com/bostonglobe/ideas/articles/2010/09/19/simple_steps_to_happier_politics/

Physician-Provocateur With TV Dreams

By PAM BELLUCK

Craig Dilger for The New York Times
MANY HATS Dr. Doug Farrago, creator of Placebo Journal and star of a nascent reality TV project, checks a young patient, Chas Ellis, in Auburn, Me.

AUBURN, Me. — It probably zipped right by most viewers of "House, M.D.": two brief flashes of doctors on the show reading or carrying a small magazine. But for Dr. Douglas Farrago, it meant something.

For 10 years, Dr. Farrago, a family doctor here, has been the majordomo of said publication: an irreverent, intentionally sophomoric, sometimes scatological medical magazine called Placebo Journal. And though he is not a "House" fan, the product placement was just one example of Dr. Farrago's enterprising streak.

Doctoring is "an algorithmic job," said Dr. Farrago, 45. "You can't just make up things in medicine: 'Let's just try Jell-O.' So I want to do something creative."

There was the time at a medical conference he posted an advertisement for "Oxycotton Candy," parodying the frequently abused drug Oxycontin. Conference organizers "got so mad," he recalled, that "security said, 'You have to take it down.' "

And there were the bumper sticker slogans in Placebo Journal: "My other car was lost in a malpractice suit" and "Maybe Hippocrates was wrong?" Not to mention the magazine's selection of sexually transmitted disease greeting cards: "Maybe we will date some more, get married and have babies, but until then I think you should know that I have a roaring case of scabies."

"I pride myself on a lot of the lowbrow stuff," Dr. Farrago said.

Ten thousand subscribers, he says, pay $28 a year for Placebo Journal, which is published every two months and skewers the health care system's half-baked mistakes, pokes fun at doctors, patients, insurers and drug companies, or just goes for the gross-out.

"My audiences are physicians," Dr. Farrago said. "They see all this stuff. They don't want to do differential diagnosis and read through complex cases. They just want to take this on the toilet bowl and laugh."

But if Dr. Farrago and two television producers succeed with their latest project, people could be seeing a different side of him. The producers are pitching a reality show in which Dr. Farrago would parachute into communities around the country and help overstretched family doctors care for patients for several days: sort of a medical "Supernanny."

"The goal is to take viewers into both of Doug's lives: the hard-working family practice physician who does everything he can to help his patients get well and stay that way, and the self-described 'King of Medicine' who uses his satirical skills to take on a health care system," according to Bruce Halford, a co-producer with Jeff Mackler.

Dr. Farrago (pronounced fa-RAY-go, like the word meaning hodgepodge) dreamed of being a professional boxer like his brother Matt until, he said, "I realized I wasn't that good."

He became a sports medicine trainer working with boxers, but after one of his boxers got pelted with urine-filled bottles while fighting in Mexico, "I kind of knew it was not my thing," he said, although he has remained close friends with the boxer Lou Savarese.

Then, before medical school, Dr. Farrago squatted to work on an electrical outlet, and to ease pain from a blown-out knee, "I put some towels behind my leg," he said. Voilà, a gizmo was born: the Knee Saver, a foam wedge to cushion one's crouch.

Thinking it would help baseball catchers, Dr. Farrago obsessively hawked it at spring training and to trainers, many of whom "were really rude," he said. (One said he would use it to defecate in the woods.) Then he read about the knee surgery of the Cleveland Indians catcher Sandy Alomar Jr. Dr. Farrago sent a Knee Saver to Mr. Alomar's orthopedic surgeon, and after first being told "he doesn't like it," he noticed Mr. Alomar using it during a division series game. It caught on, and was accepted in 2001 into the Baseball Hall of Fame.

Dr. Farrago went on to create a short-lived Web venture to stream university medical talks to doctors, and then, 10 years ago, he started Placebo Journal.

"I guess I was burning out in this job," he said. "Everybody's got a monkey on their back, and they want to give you their monkey. They'd leave and feel good, but I'd go home with 25 monkeys."

Fancying itself the Mad magazine of the medical world, Placebo Journal features "True Stories of Medicine" and odd-looking X-rays submitted by doctors, as well as sections like "My Favorite Munchausen," about patients who invent or exaggerate medical problems. It loves jabbing Big Pharma and insurers; in 2005 Cigna HealthCare complained to Dr. Farrago's then-employer, a health system, when he printed a physician survey from the fictitious SickNa HealthCare, its logo like Cigna's tree, but full of dead leaves.

Doctors and patients are fair game, too. A full-page movie ad reads: "He smokes. He drinks too much. He never stops eating. He rarely gets off the couch. He is *The American Patient*."

A doctor's want ad seeks "a corrupt pharmacologist," able to "create and mass-produce tablets made of useless and harmless compounds, and be willing to sell them labeled as narcotics and/or fibromyalgia treatments."

And in a parody of opponents of Gardasil, the vaccine given to girls to prevent the sexually transmitted human papillomavirus, Placebo Journal advertises "Godasil — the first and only faith-based vaccine," which "uses a higher power to bring about immunity for your little girl."

"It's sophomoric, it's black, it's dark," said Dr. Marc Grobman, an internist in Wilmington, Del., who displays the fake ads in his drug sample cabinet. One favorite: an ad for Sexapro, which erases sex drive. He has submitted several anecdotes of "silly things patients say," including the woman "who thought she had gotten diverticulitis after being stuck by the needles of a Christmas tree."

Dr. Theresa Langdon, a family practitioner in Portland, Ore., collects every installment, calling it an "adult medicine comic book" (her husband tracked down the debut issue for her birthday). "I balance it out by reading The New England Journal compulsively," she said.

Nonetheless, not every doctor loves it, she said, adding, “I could see where someone could be offended.” She also finds it “a little horrifying” that her teenage son reads it. “He thinks it’s funny and a little forbidden,” she said. Still, “it’s better than Hustler.”

Dr. Farrago also does Placebo Television, a fake Web newscast with him playing often-ludicrous parts, donning wigs and facial hair.

When producers suggested the reality show, having seen Dr. Farrago on YouTube, he set ground rules. His home life, including his wife and three children, was off limits. “As big as my ego is,” he said, “I don’t want to put my family at risk.”

Eager to highlight family practitioners, he resisted suggestions that he “go in like the Dog Whisperer and fix something in three minutes” because “that’s not really family medicine” and a doctor should not “one-up another physician.”

And when the executive of another hit show said, “ ‘How about if he drives around and treats people in his van?,’ we said no,” Dr. Farrago said. “Who does that? What’ll I do, start IV insulin and then move on?”

In the demo, shot last winter in Milo, an old Maine mill town, Dr. Farrago saw patients of the only doctor there, Dr. Kathleen Thibault. He visited Danielle Pilon, raising four children, including twins with respiratory problems, and informed Dr. Thibault that Ms. Pilon was smoking and that her home had some safety hazards. He trekked two hours to Mexico, Me., to see Bill Johnston, a firefighter who was experiencing residual problems from an injury caused when a roof fell on him. Producers subsequently filmed him examining Mr. Johnston at Dr. Thibault’s office, and asked Dr. Farrago to pretend they had not met so the home visit would appear to come later.

“That’s like acting, and I’m not entirely comfortable with it,” said Dr. Farrago, but he attempted to comply.

With patients, he displays none of Placebo Journal’s smart-alecky tone. He is unvarnished and direct.

“How are you possibly surviving financially?” he asked one of his own patients, Mark Verrill, an unemployed electrician’s apprentice getting a checkup soon after his mother’s death. “Not working, mother died. Honestly, through all this, other stuff aside, depression?”

After Mr. Verrill left, Dr. Farrago said he was concerned and would check up on him. “His monkey’s now on my back.”

As for the reality show, which was initially called “Doc Holiday” but after the first round of pitching was retooled and renamed “Tough Medicine,” he is philosophical.

“I’m not so blind that I’m going to leave my practice to take meetings in Hollywood,” he said. “If the TV show works, great. If not, I’ll survive. I’ll think of something else.”

http://www.nytimes.com/2010/09/21/health/21placebo.html?_r=1&nl=health&emc=healthupdateema2

Studying the Big-Brained Dolphin

By CLAUDIA DREIFUS

Brendan Smialowski for The New York Times
DAY AT THE OFFICE Diana Reiss at the National Aquarium in Baltimore.

Diana Reiss, 61, a professor of psychology at Hunter College in New York, grew up wanting to be an artist and a stage designer. Instead, she has ended up spending most of her adult life trying to figure out what whales and dolphins know. Some of what Dr. Reiss knows came to light in two separate two-hour interviews. An edited version of the conversations follows:

Q. DID CHILDHOOD VIEWING OF THE "FLIPPER" TELEVISION SERIES MAKE YOU WANT TO BECOME A DOLPHIN RESEARCHER?

A. No, it was The New York Times! In the 1970s, I was working as a set designer for an avant-garde theater company in Philadelphia. One Sunday, I read The Times and saw this photograph of a baby whale being killed. Something in me just snapped. "It's a shame we're slaughtering these animals when we know so little about them," I said. I then got a Ph.D. I've been devoting myself to studying the abilities and the behaviors of whales and dolphins since.

Q. DOLPHINS SPEND MUCH OF THEIR LIVES UNDERWATER. HOW CAN YOU OBSERVE THEIR BEHAVIOR?

A. Well, I observe captive dolphins in aquariums. At the moment, my laboratory is an underwater glass booth in the dolphin pool at the National Aquarium in Baltimore. I climb into it with a video camera. The animals are used to me. My goal is to understand their behaviors well enough so that I can find ways to help them tell us about their cognitive capacities.

Dolphins, they have these really large, complex brains. The question is: what are they doing with them? These animals look like fish, but the behavior patterns are more like primates and elephants. They are vocal learners, like parrots and humans. What do the sounds they make mean?

Q. ONE OF YOUR MOST INTERESTING FINDINGS IS THAT DOLPHINS RECOGNIZE THEMSELVES IN MIRRORS. WHAT PROMPTED YOU TO TEST FOR THIS ABILITY?

A. I was called by the psychologist Gordon Gallup, who'd found that chimps could recognize themselves in mirrors. He thought we should see if other big-brained animals could do it, too. So I built this very big mirror and placed it in the pool at an aquarium in Northern California. Well, the dolphins got very excited. We saw them acting like the mirror was another dolphin. Then, they started slowing down and stopping in front of the mirror, like Harpo Marx and Lucille Ball in that famous routine. That changed to behavior that looked like they were looking at themselves. We then marked zinc oxide on a part of their body they couldn't see. Well,

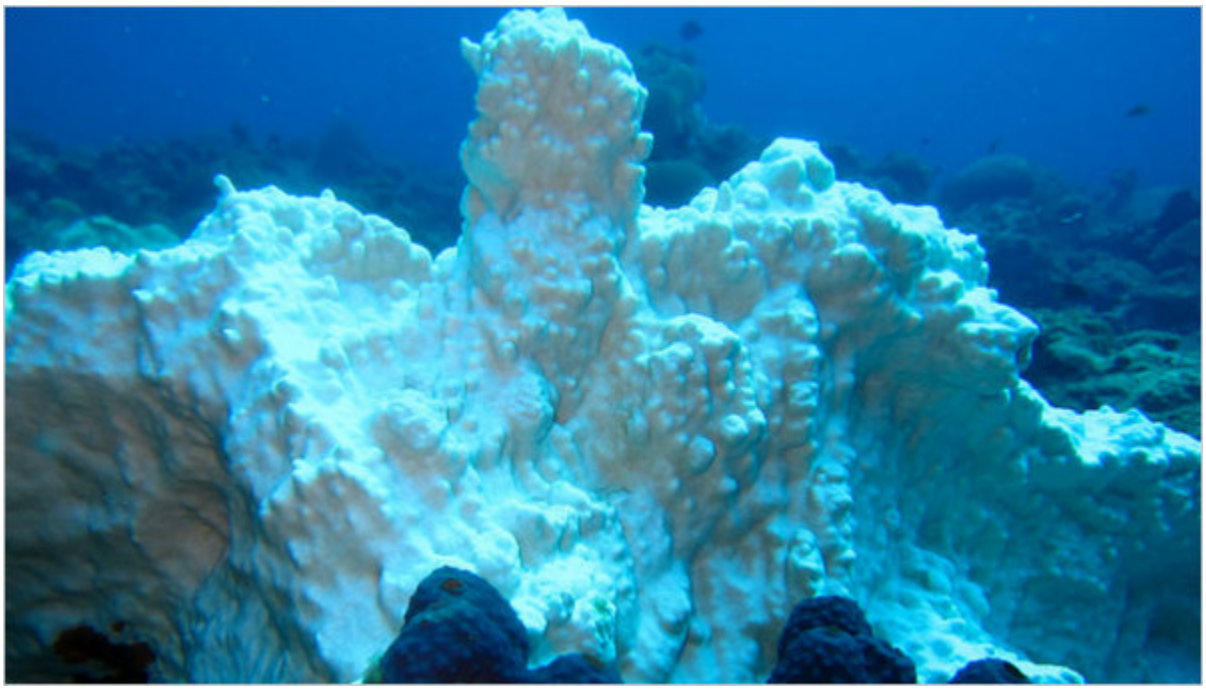
they seemed to position their bodies so that they could see the marks in the mirror, though they didn't do it often enough for us to feel certain they were responding to the marks themselves.
A decade later, I was at the New York Aquarium and noted how the dolphin pool there was made of reflective materials. One of the dolphins appeared to be using that to look at himself. I got mirrors and put them alongside the pool. This dolphin swam right up to the mirrors. Through testing, my colleague Lori Marino and I showed that two male dolphins, when marked on eight different parts of their body they couldn't see without mirrors, would race to the mirrors. They'd actually position themselves so that they could see the marked parts. They even learned that if they wanted to see all of their bodies, they had to move back.

Q. What was the point of knowing this?
A. Because we used to think that humans were the only beings to look in a mirror and understand that the face there was theirs. And the fact that these dolphins were interested in looking at themselves shows that dolphins think. And it helps us understand that humans share higher thinking abilities with some other animals. If you put most animals in front of mirrors, they don't even pay attention.
Q. WE KNOW THAT DOLPHINS ARE HIGHLY TRAINABLE. BUT HOW SMART ARE THEY, REALLY?
A. Let me tell you a story. One of the first dolphins I ever worked with was Circe. I'd bring her a fish when I wanted her to do certain things. If she didn't do them, I did a "time-out" where I turned my back and walked away. Well, there was a certain type of fish that Circe loathed because it had a spiny tail. So I accommodated her by cutting the spines off of the tail. One day, I forgot to do that. Circe spit it out, swam to the other side of the pool and placed herself into a vertical position that mimicked my time-out. I wanted to test this. I gave her untrimmed fish on four different days. Whenever I gave her fish with spiny tails, she gave me a time-out. What that suggested was that she saw time out as a correction and used it back on me. Well, that's how we learn to communicate.
Q. YOU WERE THE SCIENTIFIC ADVISER TO THE OSCAR-WINNING FILM "THE COVE." HOW DID YOU GET INVOLVED WITH THAT?
A. I had learned about this fishing village in Japan, Taiji, where dolphins are herded into a small inlet and brutally slaughtered. These animals were being eviscerated and just left there to slowly die, flailing about in the sun. Well, these are the same type of dolphins I work with. I know how sensitive they are, how much pain they can feel, how a mere scratch bothers them.
Few scientists were speaking out about this. So I got biologists and aquarium professionals together and we started Act for Dolphins. We went to the Japanese Embassy in D. C. to bring them scientific information about the animals. Their attitude basically was, "anything we do in our waters is our business." I also began working with Louie Psihoyos, the film director, and that was the beginning of making the "The Cove." It's been shown in Japan, but that hasn't stopped the dolphin drive.
Q. HOW DO SOME OF YOUR FELLOW SCIENTISTS FEEL ABOUT YOUR ACTIVISM?
A. It used to be that you weren't supposed to do both. But when I went to a marine-mammal conference a couple of years ago, I brought a petition against the dolphin roundup in Japan. Three hundred scientists instantly signed.
My feeling is if we can't stop 34 fishermen from treating these animals so miserably, then what hope is there for fixing anything in this world? One reason I study dolphins is that I believe that knowing about them is one step in saving them. I hope I'm right.
Q. IN RECENT WEEKS, THERE HAS BEEN MUCH CONTROVERSY ABOUT THE WORK OF MARC HAUSER OF HARVARD. LIKE YOU, HE HAS STUDIED ANIMAL SELF-RECOGNITION. HAS THE NEWS COVERAGE CAST A SHADOW OVER THIS TYPE OF RESEARCH?
A. No. It has nothing to do with the field. Everyone wants to keep very good records of their data. We videotape everything we do. People who work with animals are very careful about our work because all you have is your credibility. This was an anomaly.

http://www.nytimes.com/2010/09/21/science/21conversation.html?ref=science

Extreme Heat Bleaches Coral, and Threat Is Seen

By JUSTIN GILLIS



Emma Hickerson/SGBNMS
Coral bleaching, like that seen in the Flower Garden Banks off the Texas-Louisiana border, is an indicator of heat stress.

This year's extreme heat is putting the world's coral reefs under such severe stress that scientists fear widespread die-offs, endangering not only the richest ecosystems in the ocean but also fisheries that feed millions of people.

From Thailand to Texas, corals are reacting to the heat stress by bleaching, or shedding their color and going into survival mode. Many have already died, and more are expected to do so in coming months. Computer forecasts of water temperature suggest that corals in the Caribbean may undergo drastic bleaching in the next few weeks.

What is unfolding this year is only the second known global bleaching of coral reefs. Scientists are holding out hope that this year will not be as bad, over all, as 1998, the hottest year in the historical record, when an estimated 16 percent of the world's shallow-water reefs died. But in some places, including Thailand, the situation is looking worse than in 1998.

Scientists say the trouble with the reefs is linked to climate change. For years they have warned that corals, highly sensitive to excess heat, would serve as an early indicator of the ecological distress on the planet caused by the buildup of greenhouse gases.

"I am significantly depressed by the whole situation," said Clive Wilkinson, director of the Global Coral Reef Monitoring Network, an organization in Australia that is tracking this year's disaster.

According to the National Oceanic and Atmospheric Administration, the first eight months of 2010 matched 1998 as the hottest January to August period on record. High ocean temperatures are taxing the organisms most sensitive to them, the shallow-water corals that create some of the world's most vibrant and colorful seascapes.

Coral reefs occupy a tiny fraction of the ocean, but they harbor perhaps a quarter of all marine species, including a profusion of fish. Often called the rain forests of the sea, they are the foundation not only of important fishing industries but also of tourist economies worth billions.

Drastic die-offs of coral were seen for the first time in 1983 in the eastern Pacific and the Caribbean, during a large-scale weather event known as El Niño. During an El Niño, warm waters normally confined to the western Pacific flow to the east; 2010 is also an El Niño year.

Serious regional bleaching has occurred intermittently since the 1983 disaster. It is clear that natural weather variability plays a role in overheating the reefs, but scientists say it cannot, by itself, explain what has become a recurring phenomenon.

"It is a lot easier for oceans to heat up above the corals' thresholds for bleaching when climate change is warming the baseline temperatures," said C. Mark Eakin, who runs a program called Coral Reef Watch for the National Oceanic and Atmospheric Administration. "If you get an event like El Niño or you just get a hot summer, it's going to be on top of the warmest temperatures we've ever seen."

Coral reefs are made up of millions of tiny animals, called polyps, that form symbiotic relationships with algae. The polyps essentially act as farmers, supplying the algae with nutrients and a place to live. The algae in turn capture sunlight and carbon dioxide to make sugars that feed the coral polyps.

The captive algae give reefs their brilliant colors. Many reef fish sport fantastical colors and patterns themselves, as though dressing to match their surroundings.

Coral bleaching occurs when high heat and bright sunshine cause the metabolism of the algae to speed out of control, and they start creating toxins. The polyps essentially recoil. "The algae are spat out," Dr. Wilkinson said.
The corals look white afterward, as though they have been bleached. If temperatures drop, the corals' few remaining algae can reproduce and help the polyps recover. But corals are vulnerable to disease in their denuded condition, and if the heat stress continues, the corals starve to death.

Even on dead reefs, new coral polyps will often take hold, though the overall ecology of the reef may be permanently altered. The worst case is that a reef dies and never recovers.

In dozens of small island nations and on some coasts of Indonesia and the Philippines, people rely heavily on reef fish for food. When corals die, the fish are not immediately doomed, but if the coral polyps do not recover, the reef can eventually collapse, scientists say, leaving the fishery far less productive.
Research shows that is already happening in parts of the Caribbean, though people there are not as dependent on fishing as those living on Pacific islands.

It will be months before this year's toll is known for sure. But scientists tracking the fate of corals say they have already seen widespread bleaching in Southeast Asia and the western Pacific, with corals in Thailand, parts of Indonesia and some smaller island nations being hit especially hard earlier this year.

Temperatures have since cooled in the western Pacific, and the immediate crisis has passed there, even as it accelerates in places like the Caribbean, where the waters are still warming. Serious bleaching has been seen recently in the Flower Garden Banks, a marine sanctuary off the Texas-Louisiana border.
In Thailand, "there some signs of recovery in places," said James True, a biologist at Prince of Songkla University. But in other spots, he said, corals were hit so hard that it was not clear young polyps would be available from nearby areas to repopulate dead reefs.

"The concern we have now is that the bleaching is so widespread that potential source reefs upstream have been affected," Dr. True said.

Even in a hot year, of course, climate varies considerably from place to place. The water temperatures in the Florida Keys are only slightly above normal this year, and the beloved reefs of that region have so far escaped serious harm.

Parts of the northern Caribbean, including the United States Virgin Islands, saw incipient bleaching this summer, but the tropical storms and hurricanes moving through the Atlantic have cooled the water there and may have saved some corals. Farther south, though, temperatures are still remarkably high, putting many Caribbean reefs at risk.

Summer is only just beginning in the Southern Hemisphere, but water temperatures off Australia are also above normal, and some scientists are worried about the single most impressive reef on earth. The best hope now, Dr. Wilkinson said, is for mild tropical storms that would help to cool Australian waters.
"If we get a poor monsoon season," he said, "I think we're in for a serious bleaching on the Great Barrier Reef."

http://www.nytimes.com/2010/09/21/science/earth/21coral.html?ref=science

Developing Nations to Get Clean-Burning Stoves

By JOHN M. BRODER

Adam Ferguson for The New York Times
Using a primitive stove in Koluha, India. An alliance that includes the United States wants to replace 100 million stoves by 2020.

WASHINGTON — Nearly three billion people in the developing world cook their meals on primitive indoor stoves fueled by crop waste, wood, coal and dung. Every year, according to the United Nations, smoke from these stoves kills 1.9 million people, mostly women and children, from lung and heart diseases and low birth weight.

The stoves also contribute to global warming as a result of the millions of tons of soot they spew into the atmosphere and the deforestation caused by cutting down trees to fuel them.

On Tuesday, Secretary of State Hillary Rodham Clinton is expected to announce a significant commitment to a group working to address the problem, with a goal of providing 100 million clean-burning stoves to villages in Africa, Asia and South America by 2020. The United States is providing about $50 million in seed money over five years for the project, known as the Global Alliance for Clean Cookstoves.

More than a dozen other partners, including governments, multilateral organizations and corporate sponsors, are to contribute an additional $10 million or more.

Mrs. Clinton called the problem of indoor pollution from primitive cookstoves a “cross-cutting issue” that affects health, the environment and women’s status in much of the world. “That’s what makes it such a good subject for a coordinated approach of governments, aid organizations and the private sector,” she said in a telephone interview on Monday.

She acknowledged that the American government’s contribution of $50 million was a modest commitment for a problem with enormous implications for billions of people worldwide.

“Like anything,” she said, “we have to start somewhere.”

Mrs. Clinton is to make the announcement at the annual aid conference sponsored by the Clinton Global Initiative, former President Bill Clinton’s health, development and environmental organization. She will be

joined by Lisa P. Jackson, administrator of the Environmental Protection Agency, and officials from a number of partner groups, including the United Nations Foundation.

Although the toxic smoke from the primitive stoves is one of the leading environmental causes of death and disease, and perhaps the second biggest contributor to global warming, after the industrial use of fossil fuels, it has long been neglected by governments and private aid organizations.

The World Health Organization says that indoor air pollution caused by such cooking methods is the fourth greatest health risk factor in developing countries, after unclean water and sanitation, unsafe sex and undernourishment. The gathering of fuel is mainly done by women and children, millions of whom are exposed daily to dangers in conflict-torn regions. The need to forage for fuel also keeps millions of children out of school.

Although researchers have been aware of the health and environmental risks caused by carbon-belching indoor cookstoves for decades, there has been little focus on replacing them until recently, and it is not clear that the alliance's high-profile initiative can pay the intended quick dividends. An estimated 500 million households depend on burning biomass for cooking and heating, some in the remotest places on earth, and it will not be easy to reach them with affordable and acceptable alternatives.

Even if the alliance's goal were fully met, it would address no more than a fifth of the problem, according to its sponsors.

Stoves that are coming on the market for as little as $20 are 50 percent more efficient than current cooking methods, which are often simply open fires or crude clay domes, backers of the project say. A $100 model can capture 95 percent of the harmful emissions while burning far less fuel to produce the same amount of energy.

Reid Detchon, vice president for energy and climate at the United Nations Foundation, one of the founding partners of the alliance, said that the plan was not simply to use donations to buy millions of new stoves and ship them out to the developing world.

Rather, he said, the group hopes to create an entrepreneurial model in which small companies manufacture or buy the stoves close to their markets, taking into account local fuel choices, food consumption patterns and methods of cooking. This microproject model is expected to provide business opportunities for women while reducing the fuel-gathering burden of women and children around the world.

"The idea is how to create a thriving global industry in cookstoves, driven by consumers' desire to have these products at a price they can afford," Mr. Detchon said.

"These stoves don't have a long lifetime," he said. "To produce low cost and high volume, you'll have to replace them relatively frequently, perhaps every two, three or five years. You'll need a supply chain and business model that delivers them, not on a one-time basis, but as a continuing enterprise."

Among the other founding partners of the alliance are the Shell Foundation, the Morgan Stanley Foundation, the World Health Organization, the United Nations Environment Program, the United Nations High Commissioner for Refugees and the governments of Germany, Norway and the Netherlands.

Aside from the State Department and the E.P.A., participating United States agencies include the Departments of Energy and Health and Human Services.

http://www.nytimes.com/2010/09/21/science/earth/21stove.html?ref=science

The Heart That Beats, Heats, Chills and Whips
By ROBERTA SMITH

Museum of Modern Art

"Counter Space: Design and the Modern Kitchen": A serving piece by Kenneth Brozen at the Museum of Modern Art. More Photos »

Sometimes a kitchen is just a kitchen, but not often. If a house is a machine for living, as Le Corbusier said, then the kitchen is its engine. If that machine is seen as a living organism — a house that is a home — then the kitchen is its heart and brain.

The many-splendored thing that is the modern kitchen — as a coherent workspace, object of study and model of efficiency — began to take shape sometime around 1900. It has been a leading indicator of the state of design ever since. It has also been a battlefield of conflicting belief systems, not least regarding the role of women in society. As the use of servants declined, housewives became at once early adopters of new products meant to free them from drudgery and targets of corporate advertising that relentlessly defined them as household fixtures themselves.

Which is to say, kitchens were heavily symbolic sites long before any of us became involved with the ones that bless or blight our individual lives. This is elaborately demonstrated by "Counter Space: Design and the Modern Kitchen" at the Museum of Modern Art.

Using a tantalizing sprawl of design objects, artifacts and artworks, this exhibition places the modern kitchen in a broad historical context. It is bound to invite personal memories: I rediscovered the Ekco vegetable peeler, Chemex coffeemaker and copper-bottomed Revere Ware saucepan of my mother's kitchen; the Terraillon plastic food scale and timer from my first New York apartment; and the old domed Magnalite tea kettle that an ex-boyfriend cherished.

But in the main, "Counter Space" sprints with dazzling speed and pinpoint precision across an amazing amount of social and aesthetic history, and shows how these histories are connected. The kitchen's design evolution meshed with the new availability of gas and electricity; with the rise of cities, the middle class and health consciousness; with early stabs at prefab housing; with the growing independence of women; and of course with the emergence of modern design itself, as a self-consciously forward-looking, socially minded discipline whose brief was to improve everyday life for all.
Two world wars fed innovation by making efficiency and conservation pressing matters, creating food and housing shortages and luring women into the work force. As cities grew, the kitchen's need for regular infusions of fresh foodstuffs, heating and cooling energy, and waste disposal connected it to urban networks that were themselves still taking shape. The kitchen was something like Rome, with nearly all a city's infrastructure leading to it or away from it.

"Counter Space" confirms that few museums can muster a show of this kind as effectively as the Modern. It been assembled by Juliet Kinchin, curator in the department of architecture and design, and Aidan O'Connor, a curatorial assistant, who have drawn entirely from the museum's collections. In addition to some 300 design objects clustered according to era, material or designer, it includes posters, paintings, films and film stills, prints and photographs — something from every department.

The museum's vision of and faith in modernism are a major subtext. MoMA's historic determination to encompass all that is emblematic of modern life is so breathtaking as to be almost self-congratulatory. "See?" the museum seems to say. "We have this, that and the other, and they're all relevant and they all fit together in this story."

But the Modern has the goods. Peter Behren's 1909 electric tea kettle is here, nickel-plated to resemble parlor-worthy silver, along with a poster he designed two years earlier encouraging the use of electricity. An American poster from 1917 encourages Americans to eat less meat and fat, more grains and vegetables, not for their health, but to save food for Allied troops.

The objects range chronologically from the brown paper bag that Charles Stillwell designed for the Union Paper Bag Machine Company of Philadelphia in 1883 through a Levittown kitchen's worth of pastel-colored Tupperware from the mid-1950s to Philippe Starck's overly sculptural Juicy Salif Lemon Squeezer of 1988 (a countertop Louise Bourgeois spider) and Smart Design's far more user-friendly Good Grips peeler of 1989. The show's centerpiece is a stupendous recent acquisition: one of the last surviving examples of a relatively complete Frankfurt Kitchen designed in 1926-27 by Margarete Schütte-Lihotzky (1897-2000), Austria's first female architect. It was mass produced for housing blocks built in Frankfurt to meet housing shortages caused by the devastation of World War I, and remains a model of cockpitlike clarity and purpose. Including a grid of small metal bins (for storing rice and the like) that resembles a hardware store, it was one of several determinedly modern kitchens designed mostly in Germany in the late 1920s. But it is probably alone in being the subject of a recent music video tribute by the Austrian musician Robert Rotifer, which is also in the show.
"Counter Space" proceeds in three sections. "The New Kitchen" centers on design up through World War II, when the kitchen was conceived of as a kind of no-nonsense laboratory. Form follows function here, as do metal and glass and a tensile sense of geometry. The mid-1930s brought such classics as Wilhelm Wagenfeld's Kubus stacking storage containers, made of textured glass; Sherman Kelly's cast aluminum ice-cream scoop, upon which Brancusi could not have improved; and a handy-looking one-shot cake cutter by an unknown designer that could be a Duchamp readymade. Also here are posters from wartime Britain: those by Frederick H. K. Henrion expound on the economies of raising rabbits for food; several more by Herbert Tomlinson single out the destructiveness of mice.

"Visions of Plenty," the second section, covers the explosion of new materials, especially colorful plastics, and expanding markets and growing residential footprints that followed the war, when one German designer presciently noted that "America has fat kitchens, Europe has thin ones." In 1968, when the Italian designer

Virgilio Forchiassin designed a mobile kitchen unit that folded up into something like a Minimalist cube, American kitchens were in the process of absorbing dining rooms, living rooms and the den.
Clever forms and pretty colors often superseded function. I, for one, can't imagine putting anything but decorative pieces of fruit in the bright transparent plastic serving dishes that Kenneth Brozen designed in 1963. But this was also the heyday of Braun's svelte appliances that made plastic seem as refined as porcelain, and signaled a Germany design resurgence; Kaj Franck's handsomely basic Kilta tableware for Arabia; and works of genius like the wasp-waisted Kikkoman soy sauce dispenser designed by the renowned Kenji Ekuan in 1961.

The final section, "Kitchen Sink Dramas," centers on the kitchen as grist for the artistic mill starting with Pop Art — Andy Warhol's Brillo boxes, paintings by James Rosenquist and Tom Wesselmann — and continuing nearly to the present. In a way it is too bad not to devote all the gallery space to design itself, especially since some objects are displayed on high shelves and are difficult to see. But the tradeoff is a sharpened sense of the organic relationship between art and its social context.

An especially vivid example of this relationship is provided by the veritable mother lode of short promotional films and television commercials from the Modern's holdings in which the presumption of female docility and devotion could not be clearer. Titles like "The Home Electric," a 1915 silent, and "A Word to the Wives," from 1955, barely require description. Along with other clips, they supply visual evidence of the stereotypes that artists like Martha Rosler, Cindy Sherman and Laurie Simmons began to dismantle in the 1970s as the women's movement got underway. Their works are seen in the show's final section.

The connection is of course boilerplate art history, but to see it made with real-life art and artifacts against the rich backdrop of this exhibition is something else. Art may not be the best revenge, but it certainly helps.
"Counter Space: Design and the Modern Kitchen" continues through March 14 at the Museum of Modern Art; (212) 708-9400, moma.org.

http://www.nytimes.com/2010/09/20/arts/design/20kitchen.html?ref=design

Putting Memories to New Use
By CAROL KINO

Christian Hansen for The New York Times
Sara VanDerBeek, whose first solo museum show is at the Whitney.

WHEN the photographer Sara VanDerBeek was growing up in Baltimore in the 1980s, she yearned for the vanished art world of 1960s New York, in which her father, the experimental filmmaker Stan VanDerBeek, had played an important role. Mr. VanDerBeek, who died when Sara was 7, had collaborated with artists like Claes Oldenburg and Merce Cunningham, and worked with Bell Labs to create some of the first computer animations. Before and after his death, Ms. VanDerBeek said, friends from the old days often visited and talked about the excitement and experimentation of that time.

Mr. VanDerBeek's first wife, Johanna, was a regular. An artist herself, she had participated in his films and in performance events, and "still has a paper dress and bra that Rauschenberg had printed for one of them," Ms. VanDerBeek recalled. "She would always tell us stories about their life in New York and the artists and the scene."

A hunger to reanimate that long gone scene helped lead Ms. VanDerBeek, 33, into the project that first made her name, the Guild & Greyshkul gallery in SoHo, which she founded and ran with her younger brother and a friend from 2003 to 2009. It was celebrated for nurturing young artists and providing a creative gathering spot that seemed a welcome antidote to the rampant commercialism of the time.

And some sort of hunger or longing also seems central to Ms. VanDerBeek's own work, which she began showing seriously four years ago. It's especially evident in the installation of about 30 photographs made this year that appear in her first solo museum exhibition, "To Think of Time," which just opened at the Whitney Museum of American Art and runs through Dec. 5.

Some works in the show depict three-dimensional still-life assemblages that she builds in her studio. In “We Will Become Silhouettes” two plaster casts of Ms. VanDerBeek’s face suggest a double-sided death mask, while “Blue Caryatid at Dusk” makes a pint-size Brancusi-esque column look like an outsize funerary monument.

Others show architectural details, like the close-ups of decaying windows and foundations she encountered on a recent trip to New Orleans. And many of the most poignant found their source in Ms. VanDerBeek’s childhood home in Baltimore, now up for sale. The show opens with “Blue Eclipse,” a photograph of a photograph of the 1969 lunar eclipse that she discovered while cleaning out the basement, and closes with a grouping that includes an enigmatic image of light falling through the house’s windows onto a wall.

Ms. VanDerBeek came to New York in 1994 to attend Cooper Union, her father’s alma mater. After graduation she worked in London as a commercial photographer for three years, shooting subjects like artfully composed stacks of toilet paper for the grocery chain ASDA. “There was a lot of tabletop work,” she said, “which somehow translates into these still lifes that I am doing now.” In her off hours she roamed East London, taking photographs of Brutalist postwar apartment blocks, which fascinated her, she said, because of “a disparity between the idealism of the architecture and the reality of living there.”

After returning to New York in 2001 Ms. VanDerBeek became interested in another sort of melancholic streetscape, the makeshift memorials that sprang up throughout the city after 9/11. The idea of making pictures of structures similarly studded with photographs and mementos began to infiltrate her imagination. In 2003 she and her brother, Johannes VanDerBeek, opened Guild & Greyshkul with the artist Anya Kielar, another Cooper Union student. They wanted to provide a locus for their friends from school, inspired by their “idealistic view of the art world of my father’s generation,” Ms. VanDerBeek said. “We saw among our peer group a similar need to gather and show.”

Until the gallery closed, it advanced many careers, including those of Ernesto Caivano, known for intricate drawings, and Mariah Robertson, whose photographs were included in the last “Greater New York” show at MoMA P.S. 1. And in 2008 they reintroduced Stan VanDerBeek to the art world by giving him a well-received retrospective. Ms. VanDerBeek and her brother now manage his estate.

At the same time Ms. VanDerBeek was making her own work. While producing the pictures for her first solo show, “Mirror in the Sky,” at d’Amelio Terras in 2006, she thought back to those impromptu Sept. 11 mementos mori, she said, and “the whole tradition of holding onto images of people and things that have been lost.” Many depict photographs and other objects suspended from metal structures that apparently float in space, as in “A Reoccurring Pattern,” for which Ms. VanDerBeek collaged magazine photographs, bits of fabric, her own family snapshots and other talismans against a chain-link fence.

Ms. VanDerBeek said that she saw the layering in those photographs as being similar to “the way our mind organizes our memories, at different depths, one superimposed over the other, and constantly shifting.” The resulting works, with their Dada and Surrealist overtones, struck a chord and curators began visiting her studio in the gallery basement.

One was Eva Respini of MoMA, who put Ms. VanDerBeek’s work in the “New Photography” show there last fall. “Although Sara is a photographer, I like to think of her practice as multidisciplinary,” Ms. Respini said, because she usually makes a multimedia sculpture before taking a photograph, and is “very interested in the space of sculpture, the space of theater.” And by opening a gallery and representing her father’s estate, she added, Ms. VanDerBeek was “involved in a larger artistic dialogue.”

For MoMA Ms. VanDerBeek created an installation of four photographs based on images of Detroit, a city she regards as embodying long-term change, good and bad, rather than urban decline. Similarly her new

Whitney project, loosely inspired by Walt Whitman's "Leaves of Grass," is something of a meditation on America during a time of social transformation. And like that poet, who reshaped and expanded on his opus throughout his life, Ms. VanDerBeek's intention was to create a project that could remain in flux.

She continued tweaking every aspect of "To Think of Time" until it opened, and intends to recombine the images and add new ones over the years. "My hope is to have it grow and evolve over time," she said.
The project also owes much to her personal history. Two years ago she and her siblings began cleaning out the family home so that their mother, Louise, who has multiple sclerosis, could move to a nursing home. As well as uncovering long-lost family mementos, like the plaster life masks her father encouraged them to make each year, they also found decades of his previously unknown work.

While their discoveries were "like sifting through history," the process of clearing them out was "like a physical manifestation of change," Ms. VanDerBeek said. "I hope my work is as much about the positive and inspirational aspects of change as it is about loss or melancholy."

http://www.nytimes.com/2010/09/19/arts/design/19kino.html?ref=design

Looking South, Not East, Into New York's Past

By EDWARD ROTHSTEIN

Chester Higgins Jr./The New York Times
"From Here to There," an installation by Antonio Martorell made to resemble the airplanes that brought many Puerto Ricans to New York, in "Nueva York (1613-1945)," at El Museo del Barrio.

Something unusual happens as you work through "Nueva York (1613-1945)," which opens on Friday at El Museo del Barrio. You enter feeling fairly sure of geographic bearings and leave less certain, curious, challenged. And can anything more be hoped for from a museum exhibition?

This show is a collaboration with the New-York Historical Society, whose home on Central Park West is now under renovation, and the society's conceptual ambitions and rigorous care are evident in the ways the displays subtly alter our understanding of New York City and its history simply by shifting our focus of attention.

Instead of viewing the city and its past along an East-West axis and seeing its conflicts and culture through interactions with European-born colonizers and immigrants, the exhibition rotates our attention 90 degrees. We look along the North-South axis, toward Mexico, the Caribbean and South America.

That is also the axis along which immigration and cultural influence have accumulated in recent decades, leading to a growing Hispanic presence in the city and in American life, which is what gives this exhibition more than historical importance. It also explains why it found its home in El Museo del Barrio, a museum established in 1969 by Puerto Rican radical nationalists and community activists that later broadened its scope to encompass Latino culture and art.

The show, whose curator is Marci Reaven of City Lore, with Mike Wallace, a professor of history at the City University of New York, as the chief historian, may even be meant to provide a context for understanding contemporary Hispanic life in New York. In that it is less successful; in fact, it comes to an end in 1945, just

before waves of immigration from Puerto Rico, the Dominican Republic, Cuba, Mexico and other countries began to alter the city's landscape. That may be just as well, because in a final gallery, a 30-minute documentary about those immigrations, made for the show by Ric Burns, almost seems drawn from a different intellectual and cultural universe.

But that hardly matters, because by then we have been fully engaged in the reinterpretation of New York's relationship to the Southern Hemisphere through an unusual accumulation of artifacts, paintings, political cartoons, clothing, music, books and photographs, which reshape the city's history. A catalog is also being published, edited by Edward J. Sullivan.

The Dutch, we learn, were interested in New Amsterdam not only because of furs, pelt and lumber: they also were countering their enemies (and onetime rulers) the Spanish, whose empire in the Western Hemisphere was vast and seemingly impregnable. One reason for elevating Peter Stuyvesant to overseer of the colony, we see, may have been that he had experience fighting the Spanish in St. Martin (where an injury caused the loss of a leg). His title became "director-general of New Netherland, Curaçao, Bonaire and Aruba," which puts the northern colony in context.

We even see examples of the Spanish treasure that inspired such rivalry. Silver mines in present-day Bolivia produced ingots like one on display here. By the mid-1500s, the Spanish had even cornered the market in Mexican cochineal insects, which fed on prickly pear cactus; they were dried and shipped home in leather bags, then ground into paints and dyes, creating the sumptuous scarlets and reds of Renaissance Europe. The British also had rivalries in mind when they transformed New Amsterdam into New York: Spanish power was the defining nemesis, even in the way the British shared the Dutch distaste for Spanish Roman Catholic culture. The show argues that this antipathy remained in later centuries, spurred by fearsome accounts of Spanish cruelties that were later characterized as a "Black Legend" — a slur on the Spanish record. A group of Jews from Brazil was reluctantly permitted to settle in New Amsterdam by Stuyvesant (the group's synagogue, Shearith Israel, still exists and lent the exhibition texts and artifacts), but the Dutch and British barred Catholic churches from the city.

The American Revolution marked a turning point. In opposition to Britain, the colonies attracted Spanish support; in return, Spain was rehabilitated. In 1786 New York's first Catholic church — St. Peter's on Barclay Street in Lower Manhattan — was built. (It too still exists, though it has been rebuilt.) And standing with George Washington at Federal Hall during his inauguration as president in 1789 was Don Diego Maria de Gardoqui. (A portrait of that Spanish official is shown here.)

But revolutionary ideals also inspired challenges to Spanish power. In 1784 the Venezuelan Francisco de Miranda arrived in New York to seek assistance (the exhibition quotes him) "for the liberty and independence of the entire Spanish-American Continent." His enterprise faltered, leaving it to others, like the Argentine José de San Martín and the Venezuelan Simón Bolívar, to lead wars of independence lasting from 1810 to 1825, in which Spain lost her hemispheric empire apart from Puerto Rico, Cuba and the Philippines. (Their statues, along with those of other liberational figures, can be seen in Central Park.)

We learn too of one New York celebration of South American independence at the City Hotel on March 23, 1825. One toast declared of the continent, "May her liberty be as permanently established as her Andes and as pure as the snow on their summit."

But commerce must have been a large factor in such support. An astounding 1865 photograph here shows a Peruvian mountain entirely made of sea-bird droppings; workers shoveled this guano into boats heading north, where it was prized as fertilizer. Brooklyn also became the world's center for the refining of South American sugar cane. New York businesses shipped products south as well; the American Bank Note Company even printed the currencies of Mexico, Brazil, Costa Rica, Ecuador and Haiti.

This was a strange relationship: joint advocacy of liberty was countered by a joint history of slavery and related allegiances; commerce led to both prosperity and considerable scars. But the cultures influenced each other. In New York throughout the 19th century, new immigrant communities were formed. The numbers were still small — in the early 1860s, we learn, about 1,300 Spaniards and Latin Americans lived in New York — but they grew. Poets, intellectuals and politicians joined the merchants. A Spanish publishing industry developed as well. (An 1872 Spanish guide to New York is shown here.)

The 19th century's Latin American revolutions even seemed to begin in New York, with many people fleeing oppression in Cuba and Puerto Rico. A red, white and blue flag hung here is a reproduction of the one raised by The Sun newspaper in Lower Manhattan in 1850 (the original is said to be in Havana): it was destined to become the flag of an independent Cuba, though in this case it was meant as a call for its conquest.

New York, we see, became a locus for Cuban debates for half a century, with advocates of liberation, Spanish loyalists and proponents of conquest jostling for supremacy, until the Spanish-American War overturned the playing board. Biographical sketches of major figures are imposing: José Martí, a supporter of Cuban independence, came to the city in 1880 and worked as a journalist, while establishing New York's Spanish-American Literary Society and writing poetry.

The exhibition cites a number of such cultural encounters while also showing their converse: the paintings of Frederic Edwin Church (like "Cayambe," shown here) led to a local fascination with the South American landscape, while Washington Irving's writings spurred a Romantic reinterpretation of Spanish culture. After the Spanish-American War, as a mutating demographic map of the city shows, Spanish-speaking populations in New York grew to 2,342,000 from 14,000 in 1910.

By the time we reach the show's end, we see that even if there hadn't been a demographic transformation, there is no way to understand the history of the city or the history of South America without the North-South axis. What is left unclear is just how that axis changed in the latter part of the 20th century under the pressures of immigration.
Although the exhibition technically ends in 1945, Mr. Burns's film is meant to fill the gap, as if ushering you into the contemporary Latino world of the hosting museum. The film is being shown inside an art installation/theater called "From Here to There," created by Antonio Martorell: a mock airplane resembling those that ferried hundreds of thousands of Puerto Ricans to New York in the 1940s and '50s.

Were such immigrations different from the more modest ones seen earlier, in which New York was viewed as a place of intellectual, artistic or commercial ferment and opportunity? The film makes it seem so. One New York speaker, the Daily News journalist Juan González, asks, "What propelled the people to come?" He suggests that "every one of those countries had major problems, very often as a result of our government's policies there." Immigrants were "basically forced to leave; they had no choice if they were to survive." Another speaker, the PBS journalist Ray Suarez, suggests that Puerto Ricans came in such numbers because United States policies "destroyed agriculture as an industry."

It is difficult to evaluate such assertions on the evidence here, and they go out of their way to overturn the traditional immigrant story: so many traveled to New York not because of liberties sought or prosperity wished for, but to escape evils done by the very country they were fleeing to. Moreover, the narrative continues, things were harder in the adopted nation than anticipated. Mr. Suarez suspects these newcomers might not have been "loved" the same way other immigrants, coming through Ellis Island, were — a strange notion, given the travails of those immigrant groups.
Such grievances, which echo contemporary identity politics, are particularly jarring because of what we have already learned. There is no claim made in this exhibition that the history of the North-South axis was untroubled or that anybody was unilaterally benevolent, but it is still a history of political inspiration,

mercantile energy and cultural interaction. The vision of the film is less widely embracing and less convincing, but a deeper examination must wait. The world has already been shifted on its axis.

NUEVA YORK (1613-1945)

WHERE AND WHEN El Museo del Barrio, 1230 Fifth Avenue, at 104th Street, East Harlem; through Jan. 9; (212) 831-7272, elmuseo.org.
IN THE AREA Graffiti Hall of Fame, 106th Street and Park Avenue; Taller Boricua/the Puerto Rican Workshop gallery, 1680 Lexington Avenue, between 105th and 106th Streets; tallerboricua.org.

THE MEXICAN BICENTENNIAL
The 200th anniversary of the start of Mexico's rebellion against Spain was observed on Thursday, and there are related events in the area through the end of the year. Details are at mciny.org and mexiconowfestival.org. These are some of this week's events:

DINING New York Authentic Mexican Restaurant Week runs through Sept. 30. Contact participating restaurants for details. For a list of restaurants: saboresautenticosdemexico.net/english.htm.

FILM SCREENINGS Winners of the 2009 Morelia International Film Festival, Friday, 7 p.m., School of Visual Arts, 209 East 23rd Street, Manhattan. All films in Spanish with English subtitles, free; (212) 592-2180, sva.edu.

ART "Paul Strand in Mexico" runs through Nov. 13, Aperture Bookstore and Gallery, 547 West 27th Street, fourth floor, Chelsea; (212) 505-5555, aperture.org/gallery.

http://www.nytimes.com/2010/09/17/arts/design/17nueva.html?ref=design

Odd Faces, Strange in Their Day, but Familiar in Our Time

By HOLLAND COTTER

From left: Museum of Fine Arts, Budapest; Metropolitan Museum of Art; Private Collection, Belgium
Nearly all of Franz Xaver Messerschmidt's portraits are marked by facial distortions. From left, his self-portrait cast in tin, "The Artist as He Imagined Himself Laughing"; "A Hypocrite and Slanderer"; and "Childish Weeping." None of the titles are by Messerschmidt himself; they were added after his death.

"Anything great in this world has come from neurotics," Marcel Proust wrote. He could easily have been referring to a string of manic, morose and sometimes quite mad artists who came and went over the centuries, creating a popular impression that creativity and craziness were inextricably linked.

Psychological quirks clearly shaped artists' careers long before van Gogh was on the scene. A detail-freak streak in Leonardo da Vinci's personality led him to leave many projects unfinished. The 16th-century painter Federico Barocci was plagued by a psychosomatic malaise so crippling that for 50 years he worked only two hours a day and spent the rest of the time, in agony, in bed. (He must have worked extra-hard in those hours because he turned out a lot of product.)

Leonardo and Barocci got off lightly, though, compared with suicidal peers. The Mannerist painter Francesco Bassano, in a frenzy of paranoia (he thought the police were after him), jumped out a window and died. The Dutch artist Emanuel de Witte, best known for his immaculate church interiors, is thought to have drowned himself. The architect Francesco Borromini, damned by a critic as "a complete ignoramus, a corrupter of architecture, and the shame of our century," ended it all with a sword.

To the annals of aesthetic pathology we can also add the slightly milder case of the 18th-century German sculptor Franz Xaver Messerschmidt, who is the subject of a small but potent retrospective at the Neue Galerie. As was not necessarily true of the artists mentioned above, his mental disturbance manifested itself in his art, specifically in a series of bizarrely conceived busts known as character heads.

Among the more outlandish artifacts of the Age of Reason, 19 of these sculptures have been brought together for the show "Franz Xaver Messerschmidt 1736-1783: From Neoclassicism to Expressionism," which has been organized in collaboration with the Louvre and travels to Paris from New York.

Messerschmidt was born in a small town in Bavaria and trained as a journeyman sculptor in Munich. At 18 he was at the Academy of Fine Arts in Vienna, where he caught the eye of its director, Martin van Meytens, who

was also official painter to the Habsburg court. Thanks to van Meytens's advocacy, the brilliant young sculptor soon had commissions for imperial portraits, including two of the Empress Maria Theresa.
Wanting further experience, he traveled to Rome to immerse himself in antiquities, paying particular attention to Roman Republican portraiture. After this, like most enterprising Enlightenment artists, he shifted his style from a Baroque-Rococo mélange to Neo-Classicism, evident in two of the earliest portraits in the show.
One, in cast metal, depicts the Viennese art theorist Franz von Scheyb, a close friend of van Meytens. The other, carved from alabaster, is of Gerard van Swieten, Maria Theresa's physician. In both portraits, the Baroque coiffeurs and draperies are stripped away. In their place we have, in a new plain style, unglamorous, face-forward images of two not-young, not-beautiful men looking much as they must have looked in life.
Around the time of these busts, Messerschmidt was hired to teach at the academy, with the understanding that he would inherit the position of professor of sculpture once a senior colleague had retired. A bright future seemed assured.
Then everything went awry, as damaging rumors circulated that he was mentally unbalanced. Academic politics can't be discounted, especially after his champion, van Meytens, died. But Messerschmidt's personality, commandingly idiosyncratic, had always set him apart, and by the early 1770s his eccentricities were more pronounced. Possibly after contact with secret societies, of a sort that proliferated at the time like a return of a Gothic repressed, he was having hallucinations, seeing ghosts.
Commissions dried up. When the academy professorship became available, it went to someone else. In anger he rejected the compensatory offering of a pension and left Vienna for good.
After some wandering he ended up not far from Vienna in 1777 in the city now called Bratislava, where he crashed with a younger brother, then found a home and studio of his own. In Vienna he had already begun producing his slightly larger-than-life and entirely self-commissioned "character heads." In Bratislava he made many more.
Some are obviously self-portraits; others may have been modeled on specific sitters, and still others are fanciful. Nearly all are marked by facial contortions. In one self-portrait cast in tin — an inexpensive and easily worked metal — Messerschmidt is wearing a Bratislava-style sheepskin cap and grinning so strenuously that his eyes are all but buried in folds of flesh.
In a second self-portrait the aggressive hilarity is gone; his features are bunched and twisted in a look of tearful, abject fear. In a third, he gives a vehement scowl, under thick, soldered-on eyebrows. This bust had traditionally been called "A Surly Old Soldier," but none of the titles on the heads are by Messerschmidt himself. They were added after his death, and most seem descriptively inaccurate.
A sculpture of a shaven-headed man with tightly shut eyes and a stretched-open mouth is called "The Yawner," though he seems to be screaming. And the moralizing label of "A Hypocrite and Slanderer" has little pertinence to the image of an elderly figure staring downward, his chin pressed into a collar of fleshly wrinkles at his neck, as if he were lost, even trapped in profound self-reflection.
In 1781 the staid but dauntless journalist Friedrich Nicolai visited Messerschmidt and asked him what had inspired the sculptures. The artist explained that he was periodically tormented by malign spirits, the most frightful of which he called the spirit of proportion. But if he greeted them with sculptural expressions of extreme emotions, the spirits could be kept at bay. (Had he told the same story to anyone back in Vienna? If so, that might explain a lot.)
It's tempting to view Messerschmidt in Bratislava as an outsider, isolated, strictly on his own track. But this wasn't so. His reputation as a former sculptor to the Viennese court brought him a prestigious new clientele, so that at the same time he was creating his character heads, he was working on commissions for aristocratic portraits.
These late portraits are a fascinating combination of accuracy and exaggeration. He depicts Duke Albert of Saxe-Teschen, one of Maria Theresa's sons-in-law, with flaring Norma Desmond eyes and a chin so large as to verge on being abnormal, like the protruding upper lip in his own "Beak Heads." Messerschmidt's 1782 image of the Enlightenment historian Martin Georg Kovachich is even more forcefully expressive. With its large, swollen features and scowl-creased forehead, it seems to be shoving its way through space.
In the Kovachich portrait, Messerschmidt welded together, much in the way his near-contemporary Francisco Goya did, two sides of his identity as an artist, the public and the private, the realist and the visionary.

In the character heads, he had long been doing the same. After his death, at 47, a group of more than 40 of these busts were sold en masse, shipped to Vienna and exhibited, accompanied by added names and a brochure, as a freak-show attraction in a carnival. Then gradually, with changes in taste, one by one they entered private collections, then museums, being valued most recently as precursors to the early-20th-century German Expressionist painting that is a Neue Galerie specialty.

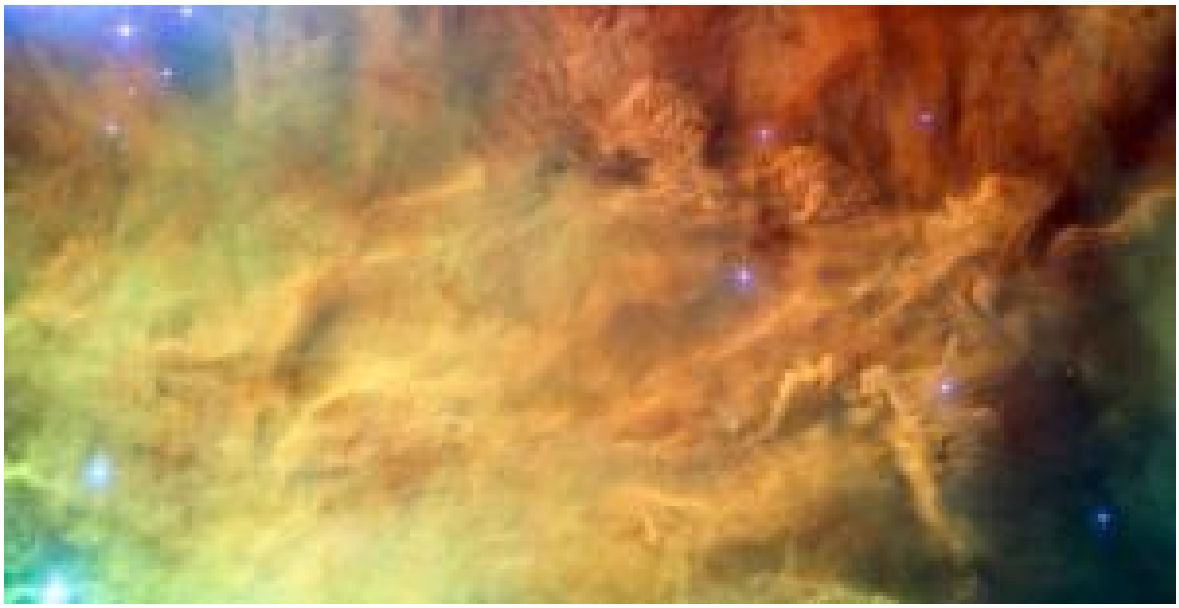
They fit effortlessly into the context of a contemporary art that encompasses images of physiognomic distortion by artists like Bruce Nauman, Tony Oursler, Arnulf Rainer, Cindy Sherman, Ashley Bickerton and Keith Edmier, among many others. (Mr. Edmier has made a limited-edition sculpture based on a Messerschmidt head to accompany the show.)

And Messerschmidt's sculptures, which once struck audiences as alien and nuts, simply make some human sense in our century, when everyone could use some psychotherapy. Even the uptight Nicolai eventually became comfortable with his reclusive subject's art. The journalist kept a portrait bust that Messerschmidt made of him on his work desk for the rest of his life, in memory, he wrote, "of a strange and really great artist." Proust might not have agreed with this evaluation, but he understood that the descriptive terms can be one and the same.

"Franz Xaver Messerschmidt 1736-1783: From Neoclassicism to Expressionism" remains though Jan. 10 at the Neue Galerie New York, 1048 Fifth Avenue, at 86th Street; neuegalerie.org.

http://www.nytimes.com/2010/09/17/arts/design/17messerschmidt.html?ref=design

Breaking Waves in the Lagoon Nebula



This close-up shot of the centre of the Lagoon Nebula (Messier 8) clearly shows the delicate structures formed when the powerful radiation of young stars interacts with the hydrogen cloud they formed from. (Credit: NASA, ESA)

ScienceDaily (Sep. 22, 2010) — A spectacular new NASA/ESA Hubble Space Telescope image reveals the heart of the Lagoon Nebula. Seen as a massive cloud of glowing dust and gas, bombarded by the energetic radiation of new stars, this placid name hides a dramatic reality.

The Advanced Camera for Surveys (ACS) on the NASA/ESA Hubble Space Telescope has captured a dramatic view of gas and dust sculpted by intense radiation from hot young stars deep in the heart of the Lagoon Nebula (Messier 8). This spectacular object is named after the wide, lagoon-shaped dust lane that crosses the glowing gas of the nebula.

This structure is prominent in wide-field images, but cannot be seen in this close-up. However the strange billowing shapes and sandy texture visible in this image make the Lagoon Nebula's watery name eerily appropriate from this viewpoint too.

Located four to five thousand light-years away, in the constellation of Sagittarius (the Archer), Messier 8 is a huge region of star birth that stretches across one hundred light-years. Clouds of hydrogen gas are slowly collapsing to form new stars, whose bright ultraviolet rays then light up the surrounding gas in a distinctive shade of red.

The wispy tendrils and beach-like features of the nebula are not caused by the ebb and flow of tides, but rather by ultraviolet radiation's ability to erode and disperse the gas and dust into the distinctive shapes that we see. In recent years astronomers probing the secrets of the Lagoon Nebula have found the first unambiguous proof that star formation by accretion of matter from the gas cloud is ongoing in this region.

Young stars that are still surrounded by an accretion disc occasionally shoot out long tendrils of matter from their poles. Several examples of these jets, known as Herbig-Haro objects, have been found in this nebula in

the last five years, providing strong support for astronomers' theories about star formation in such hydrogen-rich regions.

The Lagoon Nebula is faintly visible to the naked eye on dark nights as a small patch of grey in the heart of the Milky Way. Without a telescope, the nebula looks underwhelming because human eyes are unable to distinguish clearly between colours at low light levels.

Charles Messier, the 18th century French astronomer, observed the nebula and included it in his famous astronomical catalogue, from which the nebula's alternative name comes. But his relatively small refracting telescope would only have hinted at the dramatic structures and colours now visible thanks to Hubble.

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **European Space Agency**.

http://www.sciencedaily.com/releases/2010/09/100922091451.htm

Human-Powered Ornithopter Becomes First Ever to Achieve Sustained Flight

Successful flight of the Snowbird ornithopter. (Credit: Photo courtesy of Todd Reichert, University of Toronto Institute for Aerospace Studies (UTIAS))

ScienceDaily (Sep. 22, 2010) — Aviation history was made when the University of Toronto's human-powered aircraft with flapping wings became the first of its kind to fly continuously.

The "Snowbird" performed its record-breaking flight on August 2 at the Great Lakes Gliding Club in Tottenham, Ont., witnessed by the vice-president (Canada) of the Fédération Aéronautique Internationale (FAI), the world-governing body for air sports and aeronautical world records. The official record claim was filed this month, and the FAI is expected to confirm the ornithopter's world record at its meeting in October.

For centuries engineers have attempted such a feat, ever since Leonardo da Vinci sketched the first human-powered ornithopter in 1485.

But under the power and piloting of Todd Reichert, an Engineering PhD candidate at the University of Toronto Institute for Aerospace Studies (UTIAS), the wing-flapping device sustained both altitude and airspeed for 19.3 seconds, and covered a distance of 145 metres at an average speed of 25.6 kilometres per hour.

"The Snowbird represents the completion of an age-old aeronautical dream," says lead developer and project manager Reichert. "Throughout history, countless men and women have dreamt of flying like a bird under their own power, and hundreds, if not thousands have attempted to achieve it. This represents one of the last of the aviation firsts."

The Snowbird weighs just 94 lbs. and has a wing span of 32 metres (105 feet). Although its wingspan is comparable to that of a Boeing 737, the Snowbird weighs less than all of the pillows on board. Pilot Reichert lost 18 lbs. of body weight this past summer to facilitate flying the aircraft.

With sustainability in mind, Aerospace Engineering graduate students of UTIAS learned to design and build lightweight and efficient structures. The research also promoted "the use of the human body and spirit," says Reichert.

"The use of human power, when walking or cycling, is an efficient, reliable, healthy and sustainable form of transportation. Though the aircraft is not a practical method of transport, it is also meant to act as an inspiration to others to use the strength of their body and the creativity of their mind to follow their dreams."

The Snowbird development team is comprised of two University of Toronto Engineering graduate students: Reichert, and Cameron Robertson (MASc 2009) as the chief structural engineer; UTIAS Professor Emeritus James D. DeLaurier as faculty advisor; and community volunteers Robert and Carson Dueck. More than 20 students from the University of Toronto and up to 10 exchange students from Poitiers University, France, and Delft Technical University, Netherlands, also participated in the project.

"This achievement is the direct result of Todd Reichert's dedication, perseverance, and ability and adds to the already considerable legacy of Jim DeLaurier, UTIAS's great ornithopter pioneer," said Professor David Zingg, Director of UTIAS. "It also reflects well on the rigorous education Todd received at the University of Toronto. We're very proud of Todd and the entire team for this outstanding achievement in aviation history."

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Toronto**, via EurekAlert!, a service of AAAS.

http://www.sciencedaily.com/releases/2010/09/100922155112.htm

Amazing Horned Dinosaurs Unearthed on 'Lost Continent'; New Discoveries Include Bizarre Beast With 15 Horns

Artist's rendering of two new species of dinosaur -- Utahceratops gettyi and Kosmoceratops richardsoni -- discovered in the Grand Staircase-Escalante National Monument of southern Utah. (Credit: Courtesy of Utah Museum of Natural History)

ScienceDaily (Sep. 22, 2010) — Two remarkable new species of horned dinosaurs have been found in Grand Staircase-Escalante National Monument, southern Utah. The giant plant-eaters were inhabitants of the "lost continent" of Laramidia, formed when a shallow sea flooded the central region of North America, isolating the eastern and western portions of the continent for millions of years during the Late Cretaceous Period.

The newly discovered dinosaurs, close relatives of the famous *Triceratops*, were announced in *PLoS ONE*, the online open-access journal produced by the Public Library of Science.

The study, funded in large part by the Bureau of Land Management and the National Science Foundation, was led by Scott Sampson and Mark Loewen of the Utah Museum of Natural History (UMNH) and Department of Geology and Geophysics, University of Utah. Additional authors include Andrew Farke (Raymond Alf Museum), Eric Roberts (James Cook University), Joshua Smith (University of Utah), Catherine Forster (George Washington University), and Alan Titus (Grand Staircase-Escalante National Monument).

The bigger of the two new dinosaurs, with a skull 2.3 meters (about 7 feet) long, is *Utahceratops gettyi* (U-tah-SARA-tops get-EE-i). The first part of the name combines the state of origin with ceratops, Greek for "horned face." The second part of the name honors Mike Getty, paleontology collections manager at the Utah Museum of Natural History and the discoverer of this animal. In addition to a large horn over the nose, *Utahceratops* has short and blunt eye horns that project strongly to the side rather than upward, much more like the horns of modern bison than those of *Triceratops* or other ceratopsians. Mark Loewen, one of the authors on the paper, likened *Utahceratops* to "a giant rhino with a ridiculously supersized head."

Second of the new species is *Kosmoceratops richardsoni* (KOZ-mo-SARA-tops RICH-ard-SON-i). Here, the first part of the name refers to kosmos, Latin for "ornate," and ceratops, once again meaning "horned face." The latter part of the name honors Scott Richardson, the volunteer who discovered two skulls of this animal. *Kosmoceratops* also has sideways oriented eye horns, although much longer and more pointed than in

Utahceratops. In all, *Kosmoceratops* possesses a total of 15 horns -- one over the nose, one atop each eye, one at the tip of each cheek bone, and ten across the rear margin of the bony frill -- making it the most ornate-headed dinosaur known. Scott Sampson, the paper's lead author, claimed that, "*Kosmoceratops* is one of the most amazing animals known, with a huge skull decorated with an assortment of bony bells and whistles." Although much speculation has ensued about the function of ceratopsian horns and frills -- from fighting off predators to recognizing other members of the same species or controlling body temperature -- the dominant idea today is that these features functioned first and foremost to enhance reproductive success. Sampson added, "Most of these bizarre features would have made lousy weapons to fend off predators. It's far more likely that they were used to intimidate or do battle with rivals of the same sex, as well as to attract individuals of the opposite sex."

The dinosaurs were discovered in Grand Staircase-Escalante National Monument (GSENM), which encompasses 1.9 million acres of high desert terrain in south-central Utah. This vast and rugged region, part of the National Landscape Conservation System administered by the Bureau of Land Management, was the last major area in the lower 48 states to be formally mapped by cartographers. Today GSENM is the largest national monument in the United States. Sampson added that, "Grand Staircase-Escalante National Monument is now one of the country's last great, largely unexplored dinosaur boneyards."

For most of the Late Cretaceous, exceptionally high sea levels flooded the low-lying portions of several continents around the world. In North America, a warm, shallow sea called the Western Interior Seaway extended from the Arctic Ocean to the Gulf of Mexico, subdividing the continent into eastern and western landmasses, known as Appalachia and Laramidia, respectively. Whereas little is known of the plants and animals that lived on Appalachia, the rocks of Laramidia exposed in the Western Interior of North America have generated a plethora of dinosaur remains. Laramidia was less than one-third the size of present day North America, approximating the area of Australia.

Most known Laramidian dinosaurs were concentrated in a narrow belt of plains sandwiched between the seaway to the east and mountains to the west. Today, thanks to an abundant fossil record and more than a century of collecting by paleontologists, Laramidia is the best known major landmass for the entire Age of Dinosaurs, with dig sites spanning from Alaska to Mexico. Utah was located in the southern part of Laramidia, which has yielded far fewer dinosaur remains than the fossil-rich north. The world of dinosaurs was much warmer than the present day; *Utahceratops* and *Kosmoceratops* lived in a subtropical swampy environment about 100 km from the seaway.

Beginning in the 1960's, paleontologists began to notice that the same major groups of dinosaurs seemed to be present all over this Late Cretaceous landmass, but different species of these groups occurred in the north (for example, Alberta and Montana) than in the south (New Mexico and Texas). This finding of "dinosaur provincialism" was very puzzling, given the giant body sizes of many of the dinosaurs together with the diminutive dimensions of Laramidia. Currently, there are five giant (rhino-to-elephant-sized) mammals on the entire continent of Africa. Seventy-six million years ago, there may have been more than two dozen giant dinosaurs living on a landmass about one-quarter that size.

Mark Loewen asks, "How could so many different varieties of giant animals have co-existed on such a small chunk of real estate?" One option is that there was a greater abundance of food during the Cretaceous. Another is that dinosaurs did not need to eat as much, perhaps because of slower metabolic rates more akin to those of modern day lizards and crocodiles than to those of mammals and birds. Whatever the factors permitting the presence of so many dinosaurs, it appears that some kind of barrier near the latitude of northern Utah and Colorado limited the exchange of dinosaur species north and south. Possibilities include physical barriers such as mountains, or climatic barriers that resulted in distinct northern and southern plant communities. Testing of these ideas have been severely hampered by a dearth of dinosaurs from the southern part of Laramidia. The new fossils from GSENM are now filling that major gap.

During the past decade, crews from the University of Utah and several partner institutions (e.g., the Utah Geologic Survey, the Raymond Alf Museum of Paleontology, and the Bureau of Land Management) have unearthed a new assemblage of more than a dozen dinosaurs in GSENM. In addition to *Utahceratops* and *Kosmoceratops*, the collection includes a variety of other plant-eating dinosaurs -- among them duck-billed hadrosaurs, armored ankylosaurs, and dome-headed pachycephalosaurs -- together with carnivorous dinosaurs

great and small, from "raptor-like" predators to mega-sized tyrannosaurs (not *T. rex* but rather its smaller-bodied relatives). Also recovered have been fossil plants, insect traces, clams, fishes, amphibians, lizards, turtles, crocodiles, and mammals, offering a direct glimpse into this entire ancient ecosystem. Most remarkable of all is that virtually every identifiable dinosaur variety found in GSENM turns out to be new to science, offering dramatic confirmation of the dinosaur provincialism hypothesis. Many of these animals are still under study, but two have been previously named: the giant duck-billed hadrosaur Gryposaurus monumentensis and the raptor-like theropod *Hagryphus giganteus*.
Utahceratops and *Kosmoceratops* are part of a recent spate of ceratopsian dinosaur discoveries. Andrew Farke, another of the paper's authors, stated, "The past year has been a remarkable one for horned dinosaurs, with several new species named. The new Utah creatures are the icing on the cake, showing anatomy even more bizarre than typically expected for a group of animals known for its weird skulls."
Clearly many more dinosaurs remain to be unearthed in southern Utah. "It's an exciting time to be a paleontologist," Sampson added. "With many new dinosaurs still discovered each year, we can be quite certain that plenty of surprises still await us out there."

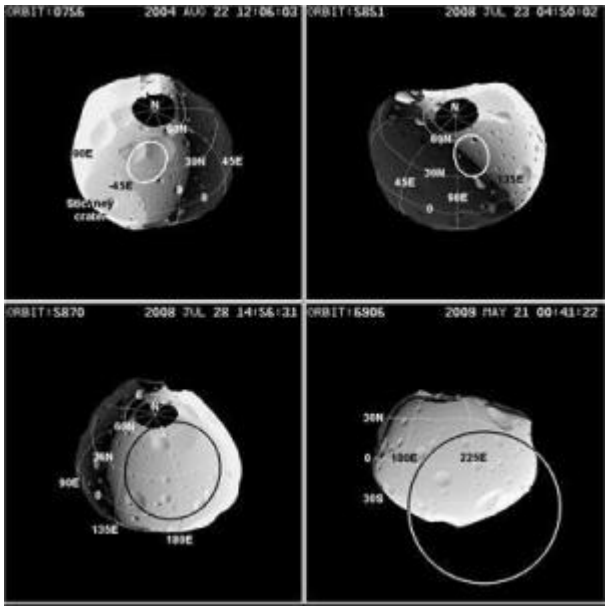
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Utah**.

Journal Reference:

1. Anna Stepanova, Scott D. Sampson, Mark A. Loewen, Andrew A. Farke, Eric M. Roberts, Catherine A. Forster, Joshua A. Smith, Alan L. Titus. **New Horned Dinosaurs from Utah Provide Evidence for Intracontinental Dinosaur Endemism**. *PLoS ONE*, 2010; 5 (9): e12292 DOI: 10.1371/journal.pone.0012292

http://www.sciencedaily.com/releases/2010/09/100922121943.htm

Martian Moon Phobos May Have Formed by Catastrophic Blast



Spatial locations of (a) PFS and (b) TES observations of Phobos used for the compositional analysis. Note that PFS orbit 0756 and TES yellow class observations correspond to almost the same area on the surface.

ScienceDaily (Sep. 21, 2010) — Scientists now have firm indications that the Martian satellite Phobos formed relatively near its current location via re-accretion of material blasted into Mars' orbit by some catastrophic event. Two independent approaches of compositional analyses of thermal infrared spectra, from ESA's Mars Express and NASA's Mars Global Surveyor missions, yield very similar conclusions. The re-accretion scenario is further strengthened by the measurements of Phobos' high porosity from the Mars Radio Science Experiment (MaRS) on board Mars Express.

These results are being presented by Dr. Giuranna and Dr. Rosenblatt at the European Planetary Science Congress in Rome.

The origin of the Martian satellites Phobos and Deimos is a long standing puzzle. It has been proposed that both moons may be asteroids formed in the outer part of the main asteroid belt (between Mars and Jupiter) and were subsequently captured by Mars' gravity. Alternative scenarios suggested that both moons were formed in situ by the re-accretion of rocky-debris blasted into Mars's orbit after a large impact or by re-accretion of remnants of a former moon which was destroyed by Mars's tidal force. "Understanding the composition of the Martian moons is the key to constrain these formation theories," says Dr. Giuranna of the Istituto Nazionale di Astrofisica in Rome, Italy.

Previous observations of Phobos at visible and near-infrared wavelengths have been interpreted to suggest the possible presence of carbonaceous chondritic meteorites, carbon-rich "ultra primitive" materials, commonly associated with asteroids dominant in the middle part of the asteroid belt. This finding would support the early asteroid capture scenario. However recent thermal infrared observations from the Mars Express Planetary Fourier Spectrometer, show poor agreement with any class of chondritic meteorite. They instead argue in favor of the in-situ scenarios.

"We detected for the first time a type of mineral called phyllosilicates on the surface of Phobos, particularly in the areas northeast of Stickney, its largest impact crater," says Dr. Giuranna.

"This is very intriguing as it implies the interaction of silicate materials with liquid water on the parent body prior to incorporation into Phobos. Alternatively phyllosilicates may have formed in situ, but this would mean that Phobos required sufficient internal heating to enable liquid water to remain stable. More detailed

mapping, in-situ measurements froma lander, or sample return would ideally help to settle this issue unambiguously," he added.
Other observations appear to match the types of minerals identified on the surface of Mars. Thus, the derived composition on Phobos appears more closely related to Mars than objects from other relatively locations in the solar system.
"The asteroid capture scenarios also have difficulties in explaining the current near-circular and near-equatorial orbit of both Martian moons," says Dr Rosenblatt of the Royal Observatory of Belgium.
The MaRS team, led by Dr. Martin Pätzold of the Rheinisches Institut für Umweltforschungh an der Universität zu Köln, Germany, has used the frequency variations of the radio-link between the spacecraft and the Earth-based tracking stations, in order to precisely reconstruct the motion of the spacecraft when it is perturbed by the gravitational attraction of Phobos. From this the team was able to reduce Phobos's mass. "We obtained the best measurement of its mass to date, with a precision of 0.3%," relates Dr. Rosenblatt. Phobos's volume past estimations were also improved thanks to the cameras onboard MEx. The MaRS team was thus able to derive the best-ever estimate of Phobos' density as 1.86 ± 0.02 g/cm^3. "This number is significantly lower than the density of meteoritic material associated with asteroids. It implies a sponge-like structure with voids making up 25-45% in Phobos' interior," says Dr. Rosenblatt. "High porosity is required in order to absorb the energy of the large impact that generated Stickney crater without destroying the body," confirms Dr. Giuranna. "In addition a highly porous interior of Phobos, as proposed by the MaRS team, supports the re-accretion formation scenarios."
A highly porous asteroid would have probably not survived if captured by Mars. Alternatively, such a highly porous Phobos can result from the re-accretion of rocky-blocks in Mars' orbit. During re-accretion, the largest blocks re-accrete first because of their larger mass, forming a core with large boulders. Then, the smaller debris re-accrete but do not fill the gaps left between the large blocks because of the low self-gravity of the small body in formation. Finally, a relatively smooth surface masks the space of voids inside the body, which then can only be indirectly detected. Thus, a highly porous interior of Phobos, as proposed by the MaRS team, supports the re-accretion formation scenarios.
The origin of both Martian moons is not, however, definitively elucidated since the density alone cannot provide the true composition of their interior. The future Russian Phobos-Grunt mission (Phobos Sample Return), to be launched in 2011, will certainly contribute to our understanding regarding the origin of Phobos. The full text has been submitted for publication to the Planetary and Space Science journal's Special Issue on Comparative Planetology: Venus-Earth-Mars.

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The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Europlanet Media Centre**, via AlphaGalileo.

http://www.sciencedaily.com/releases/2010/09/100920094804.htm

Neanderthals More Advanced Than Previously Thought: They Innovated, Adapted Like Modern Humans, Research Shows

Model of Neanderthal man. (Credit: iStockphoto/Klaus Nilkens)

ScienceDaily (Sep. 22, 2010) — For decades scientists believed Neanderthals developed `modern' tools and ornaments solely through contact with *Homo sapiens*, but new research from the University of Colorado Denver now shows these sturdy ancients could adapt, innovate and evolve technology on their own.

The findings by anthropologist Julien Riel-Salvatore challenge a half-century of conventional wisdom maintaining that Neanderthals were thick-skulled, primitive `cavemen' overrun and outcompeted by more advanced modern humans arriving in Europe from Africa.

"Basically, I am rehabilitating Neanderthals," said Riel-Salvatore, assistant professor of anthropology at UC Denver. "They were far more resourceful than we have given them credit for."

His research, to be published in December's *Journal of Archaeological Method and Theory*, was based on seven years of studying Neanderthal sites throughout Italy, with special focus on the vanished Uluzzian culture.

About 42,000 years ago, the Aurignacian culture, attributed to modern *Homo sapiens*, appeared in northern Italy while central Italy continued to be occupied by Neanderthals of the Mousterian culture which had been around for at least 100,000 years. At this time a new culture arose in the south, one also thought to be created by Neanderthals. They were the Uluzzian and they were very different.

Riel-Salvatore identified projectile points, ochre, bone tools, ornaments and possible evidence of fishing and small game hunting at Uluzzian archeological sites throughout southern Italy. Such innovations are not traditionally associated with Neanderthals, strongly suggesting that they evolved independently, possibly due

to dramatic changes in climate. More importantly, they emerged in an area geographically separated from modern humans.

"My conclusion is that if the Uluzzian is a Neanderthal culture it suggests that contacts with modern humans are not necessary to explain the origin of this new behavior. This stands in contrast to the ideas of the past 50 years that Neanderthals had to be acculturated to humans to come up with this technology," he said. "When we show Neanderthals could innovate on their own it casts them in a new light. It `humanizes' them if you will."

Thousands of years ago, southern Italy experienced a shift in climate, becoming increasingly open and arid, said Riel-Salvatore. Neanderthals living there faced a stark choice of adapting or dying out. The evidence suggests they began using darts or arrows to hunt smaller game to supplement the increasingly scarce larger mammals they traditionally hunted.

"The fact that Neanderthals could adapt to new conditions and innovate shows they are culturally similar to us," he said. "Biologically they are also similar. I believe they were a subspecies of human but not a different species."

The powerfully built Neanderthals were first discovered in Germany's Neander Valley in 1856. Exactly who they were, how they lived and why they vanished remains unclear.

Research shows they contributed between 1 and 4 percent of their genetic material to the people of Asia and Europe. Riel-Salvatore rejects the theory that they were exterminated by modern humans. *Homo sapiens* might simply have existed in larger groups and had slightly higher birthrates, he said.

"It is likely that Neanderthals were absorbed by modern humans," he said. "My research suggests that they were a different kind of human, but humans nonetheless. We are more brothers than distant cousins."

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Colorado Denver**.

Journal Reference:

1. Julien Riel-Salvatore. **A Niche Construction Perspective on the Middle–Upper Paleolithic Transition in Italy**. *Journal of Archaeological Method and Theory*, 2010; DOI: 10.1007/s10816-010-9093-9

http://www.sciencedaily.com/releases/2010/09/100921171412.htm

Learning to Live on Land: How Some Early Plants Overcame an Evolutionary Hurdle

This is reproductive Sphagnum peat moss, showing dark brown sporophytes that explosively discharge spores, perched on green gametophytes. (Credit: Lee Wilcox, University of Wisconsin, Madison /)

ScienceDaily (Sep. 22, 2010) — The diversity of life that can be seen in environments ranging from the rainforests of the Amazon to the spring blooms of the Mohave Desert is awe-inspiring. But this diversity would not be possible if the ancestors of modern plants had just stayed in the water with their green algal cousins.

Moving onto dry land required major lifestyle changes to adapt to this new "hostile" environment, and in turn helped change global climate and atmospheric conditions to conditions we recognize today. By absorbing carbon while making food, and releasing oxygen, early plants shaped ecosystems into a more hospitable environment, paving the way for animals to make a parallel journey onto land.

New research by Dr. Linda Graham and colleagues at the University of Wisconsin, Madison focuses on this transition and adaptive changes in the uptake of carbon-based compounds, such as sugars. This work, which is published in the September issue of the *American Journal of Botany*, suggests a basis for incorporating evolutionary/paleontological information into global carbon cycling models.

All plants descended from a group of ancestral green algae, whose modern representatives thrive in aqueous environments. The simplest of modern land plants -- several groups of bryophytes -- are the closest living relatives to the first plants to colonize land. By comparing green algae and bryophytes, Graham and her co-researchers obtained insight into the evolutionary hurdles that plants needed to overcome to transition successfully to life on land, and how early plants' success influenced carbon cycling.

The researchers quantified and compared growth responses to exogenously (externally) supplied sugars in two green algae, Cylindrocystis brebissoni and Mougeotia sp., and one peat moss species, Sphagnum compactum. They found that sugar/carbon uptake in peat moss was not restricted to the products of photosynthesis. Rather, addition of sugars to the growth media increased biomass by almost 40-fold. This ability to utilize sugars not only from photosynthesis but also from the environment is called mixotrophy, not previously thought to play

a significant role in the growth of mosses. The two green algae also responded to external sugar, though less so than the peat moss.
Peat mosses "store a large percentage of global soil carbon, thereby helping to stabilize Earth's atmospheric chemistry and climate," stated Graham.
This has far-ranging implications to global carbon cycling because previous work examining the response of mosses to carbon availability assumed that carbon dioxide was the only carbon source available to peat mosses and ancestral plants. The new results indicate that efforts to model global atmospheric and climate changes, both in the present and millions of years ago during the colonization of land, should take mixotrophic behavior of early diverging plants into account.
Graham and her co-researchers have enjoyed a cross-hemispheric partnership, from Wisconsin north to Canada and south to Chile, and look forward to comparing the biology of Northern and Southern hemisphere peat mosses. In particular, they would like to "explore in more depth the role of sugars in the establishment of ecologically important microbial symbioses, particularly nitrogen-fixing cyanobacteria living with peat mosses," explained Graham.

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **American Journal of Botany**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. L. E. Graham, E. Kim, P. Arancibia-Avila, J. M. Graham, L. W. Wilcox. **Evolutionary and ecophysiological significance of sugar utilization by the peat moss Sphagnum compactum (Sphagnaceae) and the common charophycean associates Cylindrocystis brebissonii and Mougeotia sp. (Zygnemataceae)**. *American Journal of Botany*, 2010; 97 (9): 1485 DOI: 10.3732/ajb.0900341

http://www.sciencedaily.com/releases/2010/09/100915094346.htm

Quantum Computing Closer Than Ever: Scientists Using Lasers to Cool and Control Molecules

A new method for laser cooling could help pave the way for using individual molecules as information bits in quantum computing. (Credit: iStockphoto/Brian Adducci)

ScienceDaily (Sep. 21, 2010) — Ever since audiences heard Goldfinger utter the famous line, "No, Mr. Bond; I expect you to die," as a laser beam inched its way toward James Bond and threatened to cut him in half, lasers have been thought of as white-hot beams of intensely focused energy capable of burning through anything in their path.

Now a team of Yale physicists has used lasers for a completely different purpose, employing them to cool molecules down to temperatures near what's known as absolute zero, about -460 degrees Fahrenheit. Their new method for laser cooling, described in the online edition of the journal *Nature*, is a significant step toward the ultimate goal of using individual molecules as information bits in quantum computing.

Currently, scientists use either individual atoms or "artificial atoms" as qubits, or quantum bits, in their efforts to develop quantum processors. But individual atoms don't communicate as strongly with one another as is needed for qubits. On the other hand, artificial atoms -- which are actually circuit-like devices made up of billions of atoms that are designed to behave like a single atom -- communicate strongly with one another, but are so large they tend to pick up interference from the outside world. Molecules, however, could provide an ideal middle ground.

"It's a kind of Goldilocks problem," said Yale physicist David DeMille, who led the research. "Artificial atoms may prove too big and individual atoms may prove too small, but molecules made up of a few different atoms could be just right."

In order to use molecules as qubits, physicists first have to be able to control and manipulate them -- an extremely difficult feat, as molecules generally cannot be picked up or moved without disturbing their

quantum properties. In addition, even at room temperature molecules have a lot of kinetic energy, which causes them to move, rotate and vibrate.
To overcome the problem, the Yale team pushed the molecules using the subtle kick delivered by a steady stream of photons, or particles of light, emitted by a laser. Using laser beams to hit the molecules from opposite directions, they were able to reduce the random velocities of the molecules. The technique is known as laser cooling because temperature is a direct measurement of the velocities in the motion of a group of molecules. Reducing the molecules' motions to almost nothing is equivalent to driving their temperatures to virtually absolute zero.
While scientists had previously been able to cool individual atoms using lasers, the discovery by the Yale team represents the first time that lasers have just as successfully cooled molecules, which present unique challenges because of their more complex structures.
The team used the molecule strontium monofluoride in their experiments, but DeMille believes the technique will also prove successful with other molecules. Beyond quantum computing, laser cooling molecules has potential applications in chemistry, where near absolute zero temperatures could induce currently inaccessible reactions via a quantum mechanical process known as "quantum tunneling." DeMille also hopes to use laser cooling to study particle physics, where precise measurements of molecular structure could give clues as to the possible existence of exotic, as of yet undiscovered particles.
"Laser cooling of atoms has created a true scientific revolution. It is now used in areas ranging from basic science such as Bose-Einstein condensation, all the way to devices with real-world impacts such as atomic clocks and navigation instruments," DeMille said. "The extension of this technique to molecules promises to open an exciting new range of scientific and technological applications."
Other authors of the paper include Edward Shuman and John Barry (both of Yale University).

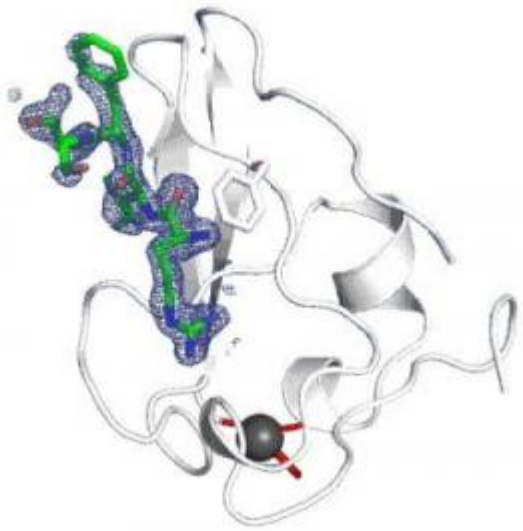
Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Yale University**.

Journal Reference:

1. E. S. Shuman, J. F. Barry, D. DeMille. **Laser cooling of a diatomic molecule**. *Nature*, 2010; DOI: 10.1038/nature09443

http://www.sciencedaily.com/releases/2010/09/100921171349.htm

Your Body Recycling Itself -- Captured on Film



This image shows UBR-box recognition of an arginine residue at the beginning of a protein (blue) targeted for degradation. The structural integrity of the UBR box depends on zinc (grey) and a histidine residue (red) that is mutated in Johanson-Blizzard syndrome. (Credit: Department of Biochemistry, McGill University.)

ScienceDaily (Sep. 21, 2010) — Our bodies recycle proteins, the fundamental building blocks that enable cell growth and development. Proteins are made up of a chain of amino acids, and scientists have known since the 1980s that first one in the chain determines the lifetime of a protein. McGill researchers have finally discovered how the cell identifies this first amino acid -- and caught it on camera.

"There are lots of reasons cells recycle proteins -- fasting, which causes loss of muscle, growth and remodeling during development, and normal turnover as old proteins are replaced to make new ones," explained lead researcher, Dr. Kalle Gehring, from McGill's Department of Biochemistry. "One way that cells decide which proteins to degrade is the presence of a signal known as an N-degron at the start of the protein. By X-ray crystallography, we discovered that the N-degron is recognized by the UBR box, a component of the cells' recycling system."

The powerful technique can pinpoint the exact location of atoms and enabled the team to capture an image of the UBR box, providing insight to this incredibly tiny yet essential part of our bodies' chemical mechanics. Aside from representing a major advance in our understanding of the life cycle of proteins, the research has important repercussions for Johanson-Blizzard syndrome, a rare disease that causes deformations and mental retardation. This syndrome is caused by a mutation in the UBR box that causes it to lose an essential zinc atom. Better understanding of the structure of the UBR box may help researchers develop treatments for this syndrome.

The research was published in *Nature Structural & Molecular Biology* and received funding from the Canadian Institutes of Health Research.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **McGill University**.

Journal Reference:

1. Edna Matta-Camacho, Guennadi Kozlov, Flora F Li, Kalle Gehring. **Structural basis of substrate recognition and specificity in the N-end rule pathway**. *Nature Structural & Molecular Biology*, 2010; DOI: 10.1038/nsmb.1894

http://www.sciencedaily.com/releases/2010/09/100913093038.htm

Parting the Waters: Computer Modeling Applies Physics to Red Sea Escape Route

The physics of a land bridge. This illustration shows how a strong wind from the east could push back waters from two ancient basins--a lagoon (left) and a river (right)--to create a temporary land bridge. New research that such a physical process could have led to a parting of waters similar to the description in the biblical account of the Red Sea. (Credit: Illustration by Nicolle Rager Fuller)

ScienceDaily (Sep. 21, 2010) — The biblical account of the parting of the Red Sea has inspired and mystified people for millennia. A new computer modeling study by researchers at the National Center for Atmospheric Research (NCAR) and the University of Colorado at Boulder (CU) shows how the movement of wind as described in the book of Exodus could have parted the waters.

The computer simulations show that a strong east wind, blowing overnight, could have pushed water back at a bend where an ancient river is believed to have merged with a coastal lagoon along the Mediterranean Sea. With the water pushed back into both waterways, a land bridge would have opened at the bend, enabling people to walk across exposed mud flats to safety. As soon as the wind died down, the waters would have rushed back in.

The physics of a land bridge.

The study is intended to present a possible scenario of events that are said to have taken place more than 3,000 years ago, although experts are uncertain whether they actually occurred. The research was based on a reconstruction of the likely locations and depths of Nile delta waterways, which have shifted considerably over time.

"The simulations match fairly closely with the account in Exodus," says Carl Drews of NCAR, the lead author. "The parting of the waters can be understood through fluid dynamics. The wind moves the water in a way that's in accordance with physical laws, creating a safe passage with water on two sides and then abruptly allowing the water to rush back in."

The study is part of a larger research project by Drews into the impacts of winds on water depths, including the extent to which Pacific Ocean typhoons can drive storm surges. By pinpointing a possible site south of the Mediterranean Sea for the crossing, the study also could be of benefit to experts seeking to research whether such an event ever took place. Archeologists and Egyptologists have found little direct evidence to substantiate many of the events described in Exodus.

The work, published in the online journal, *PLoS ONE*, arose out of Drews' master's thesis in atmospheric and oceanic sciences at CU. The computing time and other resources were supported by the National Science Foundation.

Wind on the water

The Exodus account describes Moses and the fleeing Israelites trapped between the Pharaoh's advancing chariots and a body of water that has been variously translated as the Red Sea or the Sea of Reeds. In a divine miracle, the account continues, a mighty east wind blows all night, splitting the waters and leaving a passage of dry land with walls of water on both sides. The Israelites are able to flee to the other shore. But when the Pharaoh's army attempts to pursue them in the morning, the waters rush back and drown the soldiers.

Scientists from time to time have tried to study whether the parting of the waters, one of the famous miracles in the Bible, can also be understood through natural processes. Some have speculated about a tsunami, which would have caused waters to retreat and advance rapidly. But such an event would not have caused the gradual overnight divide of the waters as described in the Bible, nor would it necessarily have been associated with winds.

Other researchers have focused on a phenomenon known as "wind setdown," in which a particularly strong and persistent wind can lower water levels in one area while piling up water downwind. Wind setdowns, which are the opposite of storm surges, have been widely documented, including an event in the Nile delta in the 19th century when a powerful wind pushed away about five feet of water and exposed dry land.

A previous computer modeling study into the Red Sea crossing by a pair of Russian researchers, Naum Voltzinger and Alexei Androsov, found that winds blowing from the northwest at minimal hurricane force (74 miles per hour) could, in theory, have exposed an underwater reef near the modern-day Suez Canal. This would have enabled people to walk across. The Russian study built on earlier work by oceanographers Doron Nof of Florida State University and Nathan Paldor of Hebrew University of Jerusalem that looked at the possible role of wind setdown.

The new study, by Drews and CU oceanographer Weiqing Han, found that a reef would have had to be entirely flat for the water to drain off in 12 hours. A more realistic reef with lower and deeper sections would have retained channels that would have been difficult to wade through. In addition, Drews and Han were skeptical that refugees could have crossed during nearly hurricane-force winds.

Reconstructing ancient topography

Studying maps of the ancient topography of the Nile delta, the researchers found an alternative site for the crossing about 75 miles north of the Suez reef and just south of the Mediterranean Sea. Although there are uncertainties about the waterways of the time, some oceanographers believe that an ancient branch of the Nile River flowed into a coastal lagoon then known as the Lake of Tanis. The two waterways would have come together to form a U-shaped curve.

An extensive analysis of archeological records, satellite measurements, and current-day maps enabled the research team to estimate the water flow and depth that may have existed 3,000 years ago. Drews and Han then used a specialized ocean computer model to simulate the impact of an overnight wind at that site.

They found that a wind of 63 miles an hour, lasting for 12 hours, would have pushed back waters estimated to be six feet deep. This would have exposed mud flats for four hours, creating a dry passage about 2 to 2.5 miles long and 3 miles wide. The water would be pushed back into both the lake and the channel of the river, creating barriers of water on both sides of newly exposed mud flats.

As soon as the winds stopped, the waters would come rushing back, much like a tidal bore. Anyone still on the mud flats would be at risk of drowning.

The set of 14 computer model simulations also showed that dry land could have been exposed in two nearby sites during a windstorm from the east. However, those sites contained only a single body of water and the wind would have pushed the water to one side rather than creating a dry passage through two areas of water.

"People have always been fascinated by this Exodus story, wondering if it comes from historical facts," Drews says. "What this study shows is that the description of the waters parting indeed has a basis in physical laws."

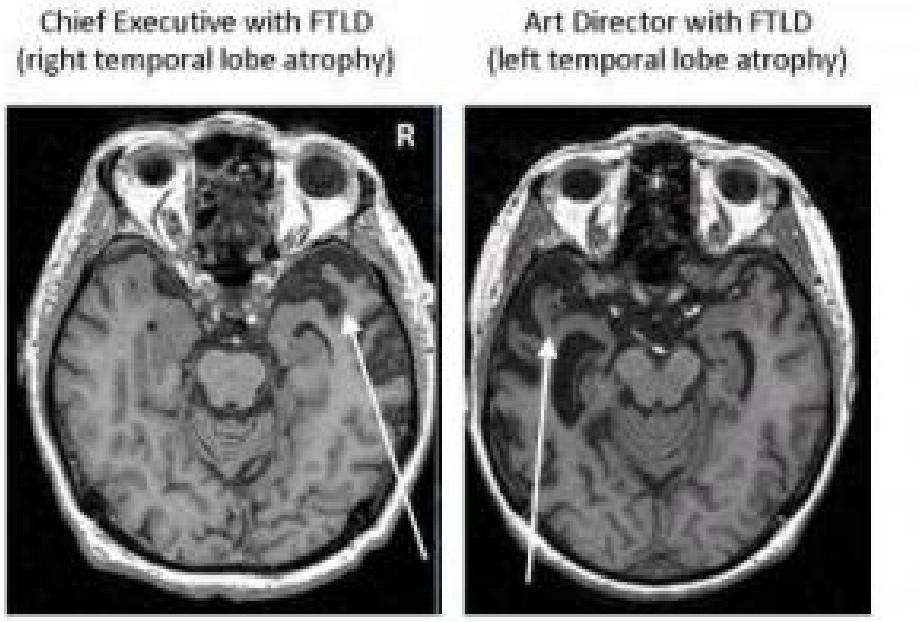
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **National Center for Atmospheric Research/University Corporation for Atmospheric Research**.

Journal Reference:

1. Juan A. Añel, Carl Drews, Weiqing Han. **Dynamics of Wind Setdown at Suez and the Eastern Nile Delta**. *PLoS ONE*, 2010; 5 (8): e12481 DOI: 10.1371/journal.pone.0012481

http://www.sciencedaily.com/releases/2010/09/100921143930.htm

For Sufferers of an Early-Onset Dementia, Career Choice May Determine Location of Disease in Brain



FTLD patients with professions ranked highly for verbal skills, such as chief executive, showed atrophy in right temporal lobe. In those with professions ranked lower for verbal skills, such as art director, atrophy was identified in left temporal lobe. (Credit: Baycrest)

ScienceDaily (Sep. 22, 2010) — In an international study of patients with a devastating type of dementia that often strikes in middle age, researchers have found intriguing evidence that career choice may influence where the disease takes root in the brain.

The study was led by Baycrest's Rotman Research Institute in collaboration with the Memory and Aging Centre at the University of California, San Francisco and several U.S. and European clinical sites. It appears online today in the Article in Press section of the journal *Neuropsychologia*, ahead of publication.

Researchers conducted a multi-centre, retrospective chart review of brain imaging and occupation data from 588 patients diagnosed with frontotemporal lobar degeneration (FTLD), sometimes referred to as frontotemporal dementia (FTD). Among the dementias affecting those 65 years and younger, FTLD is as common as Alzheimer's disease. Like Alzheimer's, it is progressive and fatal. Unlike Alzheimer's, which tends to affect both sides of the brain equally, FTLD often manifests on either the left or the right side of the brain, then becomes more widespread as the disease progresses. Typical symptoms include changes in personality and behaviour, and a decline in language skills.

For this study, each patient's occupation was rated with scores derived from an occupation database published by the U.S. Department of Labor. The scores indicated the skills required for the occupation, including verbal, physical and visuospatial skills. For example, a school principal would receive a higher rating for verbal skills than for visuospatial skills, whereas a flight engineer would show the opposite pattern. Both of these professions would score lower on physical skills than a firefighter.

The researchers correlated each patient's occupation scores with the location of brain tissue loss as determined from brain imaging results. They found that patients with professions rated highly for verbal skills, such as school principals, had greater tissue loss on the right side of the brain, whereas those rated low for verbal skills, such as flight engineers, had greater tissue loss on the left side of the brain. This effect was expressed most clearly in the temporal lobes of the brain.

"The disease appeared to attack the side of the brain that was the least used in the patient's professional life," said Dr. Nathan Spreng, who conducted the study as a psychology graduate student at Baycrest and is now a post doctoral fellow in the Department of Psychology at Harvard University.
The brain's left hemisphere, particularly the temporal lobe, is specialized for language and verbal skills. In occupations ranked highly for verbal skills, tens of thousands of hours of applying these skills may build reserve capacity by strengthening connections in the brain's left hemisphere, making it more resistant to damage due to FTLD, suggested Dr. Spreng. This process may also make the right hemisphere, which is less concerned with verbal tasks, more vulnerable to dementia through disuse.
Yet the researchers could not rule out an alternative explanation. "There may be an undetected functional impairment related to FTLD in these patients that biases them toward a certain career path decades before they get sick," said Dr. Brian Levine of the Rotman Research Institute and senior author on the study.
What is common to both explanations is that the patients' selection and practice of an occupation early in life was related to their brain changes later in life. The authors cautioned that the results were limited to FTLD and may not hold for other brain diseases or conditions.
There is no evidence that someone with a particularly verbal or non-verbal profession is vulnerable to brain disease. However, if that person were to develop FTLD (affecting approximately 250,000 Americans and 25,000 Canadians a year), the location of the disease may relate to occupational practice. Further research will be needed to determine how strong a predictor occupation may be for hemispheric localization of the disease.
The study was funded by the Canadian Institutes of Health Research and the National Institute of Child Health and Human Development.

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Baycrest Centre for Geriatric Care**.

Journal Reference:

1. R. Nathan Spreng, Howard J. Rosen, Stephen Strother, Tiffany W. Chow, Janine Diehl-Schmid, Morris Freedman, Neill R. Graff-Radford, John R. Hodges, Anne M. Lipton, Mario F. Mendez. **Occupation attributes relate to location of atrophy in frontotemporal lobar degeneration**. *Neuropsychologia*, 2010; DOI: 10.1016/j.neuropsychologia.2010.08.020

http://www.sciencedaily.com/releases/2010/09/100922124348.htm

Higher Dairy Calcium Intake and Increased Serum Vitamin D Are Related to Greater Diet-Induced Weight Loss, Israeli Study Finds

ScienceDaily (Sep. 21, 2010) — A new study conducted by Ben-Gurion University of the Negev (BGU) researchers reveals that higher dairy calcium intake and increased serum vitamin D are related to greater diet-induced weight loss.

Regardless of diet, researchers also found participants with the highest dairy calcium intake -- equal to 12 oz. of milk or other dairy products (580 mg of dairy calcium) -- lost about 12 pounds (6 kg.) at the end of the two years. In comparison, those with the lowest dairy calcium intake -- averaging about 150 mg dairy calcium, or about half of a glass -- only lost seven pounds on average. The study was published in the current issue of the *American Journal of Clinical Nutrition*.

Beyond calcium, the researchers also found that blood levels of vitamin D independently affected weight loss success. Vitamin D levels increased among those who lost more weight. The dietary intervention study also confirmed other research that overweight participants have lower blood levels of vitamin D.

More than 300 overweight men and women, aged 40 to 65, participated in the study evaluating low fat, Mediterranean or low-carb diets for two years. Dr. Danit Shahar, of BGU's S. Daniel Abraham Center for Health and Nutrition and the Faculty of Health Sciences, led the study. It was part of the Dietary Intervention Randomized Control Trial (DIRECT) conducted at the Nuclear Research Center in Israel.

According to Dr. Shahar, "It was known that over-weight people had lower levels of serum vitamin D but this is the first study that actually shows that serum Vitamin D increased among people who lost weight. This result lasted throughout the two years that the study was conducted, regardless of whether they were on a low-carb, low fat or Mediterranean diet."

Vitamin D increases calcium absorption in the bloodstream and in addition to sun exposure can be obtained from fortified milk, fatty fish and eggs. Americans generally consume less than the recommended daily requirement of Vitamin D which is found in four glasses of milk (400 international units).

The study was supported by the Israel Ministry of Health and the Israel Dairy Council, the Israel Chief Scientist Office, German Research Foundation and the Dr. Robert C. and Veronica Atkins Research Foundation.

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **American Associates, Ben-Gurion University of the Negev**.

Journal Reference:

1. D. R. Shahar, D. Schwarzfuchs, D. Fraser, H. Vardi, J. Thiery, G. M. Fiedler, M. Bluher, M. Stumvoll, M. J. Stampfer, I. Shai. **Dairy calcium intake, serum vitamin D, and successful weight loss**. *American Journal of Clinical Nutrition*, 2010; DOI: 10.3945/ajcn.2010.29355

http://www.sciencedaily.com/releases/2010/09/100921084551.htm

Inner Voice Plays Role in Self Control

ScienceDaily (Sep. 21, 2010) — Talking to yourself might not be a bad thing, especially when it comes to exercising self control.

New research out of the University of Toronto Scarborough -- published in this month's edition of *Acta Psychologica* -- shows that using your inner voice plays an important role in controlling impulsive behaviour.

"We give ourselves messages all the time with the intent of controlling ourselves -- whether that's telling ourselves to keep running when we're tired, to stop eating even though we want one more slice of cake, or to refrain from blowing up on someone in an argument," says Alexa Tullett, PhD Candidate and lead author on the study. "We wanted to find out whether talking to ourselves in this 'inner voice' actually helps."

Tullett and Associate Psychology Professor Michael Inzlicht, both at UTSC, performed a series of self control tests on participants. In one example, participants performed a test on a computer. If they saw a particular symbol appear on the screen, they were told to press a button. If they saw a different symbol, they were told to refrain from pushing the button. The test measures self control because there are more "press" than "don't press" trials, making pressing the button an impulsive response.

The team then included measures to block participants from using their "inner voice" while performing the test, to see if it had an impact on their ability to perform. In order to block their "inner voice," participants were told to repeat one word over and over as they performed the test. This prevented them from talking to themselves while doing the test.

"Through a series of tests, we found that people acted more impulsively when they couldn't use their inner voice or talk themselves through the tasks," says Inzlicht. "Without being able to verbalize messages to themselves, they were not able to exercise the same amount of self control as when they could talk themselves through the process."

"It's always been known that people have internal dialogues with themselves, but until now, we've never known what an important function they serve," says Tullett. "This study shows that talking to ourselves in this 'inner voice' actually helps us exercise self control and prevents us from making impulsive decisions."

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Toronto**. The original article was written by April Kemick.

Journal Reference:

1. Tullett. **The voice of self-control: Blocking the inner voice increases impulsive responding**. *Acta Psychologica*, 2010 [link]

http://www.sciencedaily.com/releases/2010/09/100921110956.htm

Man's Best Friend Keeps Children on the Move

New research from the UK finds that children whose families own dogs are more active than those without. (Credit: iStockphoto/Catherine Yeulet)

ScienceDaily (Sep. 21, 2010) — Children whose families own dogs are more active than those without, according to new research. Researchers from St George's, University of London studied 2,065 children aged nine to ten, and found that children from dog-owning families have higher levels of physical activity compared to children without.

The team says owning a dog could encourage more children to be active, and help combat rising childhood obesity.

The researchers, led by Dr Christopher Owen, senior lecturer in epidemiology at St George's, used activity monitors to record the children's daily movement levels over seven days. They studied children aged nine and ten in 78 schools in London, Birmingham and Leicester. Of the total participants, 202 (around ten per cent) owned dogs.

The results -- published in the *American Journal of Public Health* -- showed that the children with dogs spent an average of 325 minutes doing physical activity per day, 11 more than those without dogs. This included time spent in light, moderate, moderate to vigorous, and vigorous activity. Dog owners also spent 11 minutes less (562 altogether) in sedentary behaviour each day. They were found to take 360 more steps (four per cent) than the others.

Dr Owen said: "The more active lifestyles of children from dog-owning families is really interesting -- is it that owning a dog makes you more active or that more active families choose to have a dog? It's a bit of a chicken and egg question. Long-term studies are needed to answer it, but it may be a bit of both."

"Previous studies have compared adult activity levels before and after getting a dog, and found that they do become more active afterwards. This study is novel in showing that children who have a dog are more active, but, again, long term studies are needed to see if the effect is seen before and after owning a dog."
Adults who own dogs take 1,700 more steps a day on average than non-dog owners -- a 25 per cent difference. The latest study says that the smaller difference in children with dogs compared to adults with dogs is 'unsurprising', and suggests that the physical activity they take with their dogs probably makes up less of their overall level of activity than adults'. Dr Owen added that further work is needed to determine how much of dog-owning children's physical activity is actually undertaken with their pet.
He said: "If children really are going for walkies with their dog, this may be one way to encourage more kids to be active."
The study was carried out as part of the Child Heart And health Study in England (CHASE), a St George's project examining the health of about 5,000 primary school children living in London and the Midlands. The study is being undertaken with the support of the Wellcome Trust.

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of St George's London**, via AlphaGalileo.

Journal Reference:

1. C. G. Owen, C. M. Nightingale, A. R. Rudnicka, U. Ekelund, A. M. McMinn, E. M. F. van Sluijs, S. J. Griffin, D. G. Cook, P. H. Whincup. **Family Dog Ownership and Levels of Physical Activity in Childhood: Findings From the Child Heart and Health Study in England**. *American Journal of Public Health*, 2010; 100 (9): 1669 DOI: 10.2105/AJPH.2009.188193

http://www.sciencedaily.com/releases/2010/09/100921084919.htm

Complex Brain Landscape Controls Speech

ScienceDaily (Sep. 21, 2010) — Broca's region is classically regarded as the motor centre for speech. Our ability to form phonemes and words is controlled here. According to the maps of the cerebral cortex developed by Korbinian Brodmann, which are still in use today, Broca's region is composed of two areas. Over the last few years, however, researchers have begun to question this subdivision as a result of experience gained in clinical studies and the findings of magnetic resonance imaging analyses.

"Lesions in Broca's region could result in a dozen different language problems," says Professor Katrin Amunts, brain researcher at Forschungszentrum Jülich and first author of the study. "For example, in articulation but also in comprehension or in grammar, as linguistic studies have shown. This tends to suggest a much more complexly structured centre of language than was previously believed."

The scientists therefore decided to take a closer look at the cytoarchitecture and distribution of different receptors in Broca's region. Receptor molecules are the key to signal transduction between neurons -- and can therefore help to further classify structurally similar regions. If the distribution of receptors is different in these regions, then the functions of the brain at these locations must also be different. "We discovered that Broca's region does not just comprise two areas, but rather several -- all of which form a highly differentiated mosaic," says Professor Karl Zilles, co-author of this study. "It's a complex world that's dedicated to our faculty of speech."

The study shows, for example, a clear difference in the distribution of one receptor between the Broca areas of the two cerebral hemispheres and slight differences in the case of the other receptors. Further studies are required to determine whether this is the molecular basis for the different clinical findings in patients with lesions in Broca's region either exclusively in the left or right brain hemisphere. Patients with lesions in the left brain hemisphere completely lose their ability to speak, while those with lesions in the right-hand side can still articulate correctly but lose their speech melody.

"One of the tasks for the future is to conduct a detailed functional analysis of the new organization of Broca's region and to investigate the interaction of the previously unknown areas," says Amunts. A new project has already begun on the analysis of the second region in the brain responsible for the faculty of speech -- Wernicke's area. Classically, this area is thought to be involved in the understanding of language.

The discovery in question of several molecularly and cellularly different cortical areas in Broca's language region and in neighbouring areas shows that our faculty of speech is actually embedded in a much more differentially developed brain landscape than we have believed for the past 150 years. The findings are not just important for language research and the diagnosis and treatment of strokes. They also alter the neurobiological basis for current discussions on the evolutionary development of language, speech training and language disorders.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Helmholtz Association of German Research Centres**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. David Poeppel, Katrin Amunts, Marianne Lenzen, Angela D. Friederici, Axel Schleicher, Patricia Morosan, Nicola Palomero-Gallagher, Karl Zilles. **Broca's Region: Novel Organizational Principles and Multiple Receptor Mapping**. *PLoS Biology*, 2010; 8 (9): e1000489 DOI: 10.1371/journal.pbio.1000489

http://www.sciencedaily.com/releases/2010/09/100921171341.htm

New Drug Could Help Stop the Spread of Disease from Coughs, Researchers Believe

Researchers have worked to create a drug that could completely eliminate airborne disease transmission that occurs when someone coughs. (Credit: iStockphoto/Idris Esen)

ScienceDaily (Sep. 22, 2010) — What if there was a drug that could completely eliminate airborne disease transmission that occurs when someone coughs? Researchers at the University of Alberta believe they have found a way to achieve this.

The idea behind this work came from Malcolm King and his research associate Gustavo Zayas, who work in the Division of Pulmonary Medicine at the U of A's Faculty of Medicine & Dentistry. King and Zayas developed a drug that, when inhaled, would reduce or eliminate the amount of droplets, called bioaerosol, coming out of the mouth when a disease-infected person coughs. These airborne particles can stay in the air for minutes and sometimes even hours.

In order to help perfect this drug King and Zayas enlisted in the expertise of PhD student Anwarul Hasan and associate professor Carlos Lange, both from the Faculty of Engineering's mechanical engineering department. It was Hasan and Lange's role to find out how the size and amount of the cough-emitted droplets are affected by the new drug.

After five years of research, using a simulated cough machine, Hasan discovered how the new drug can manipulate the properties of the lung fluid to almost completely suppress the emission of droplets, a research first. This discovery provides a clear target for the new drug in its early phases of development.

King and Zayas are moving forward to develop the drug in the form of a spray and plan to perform clinical trials in hopes that one day this drug could not only help stop the spread of a pandemic outbreak, but also protect nurses, doctors and other front-line health care professionals.

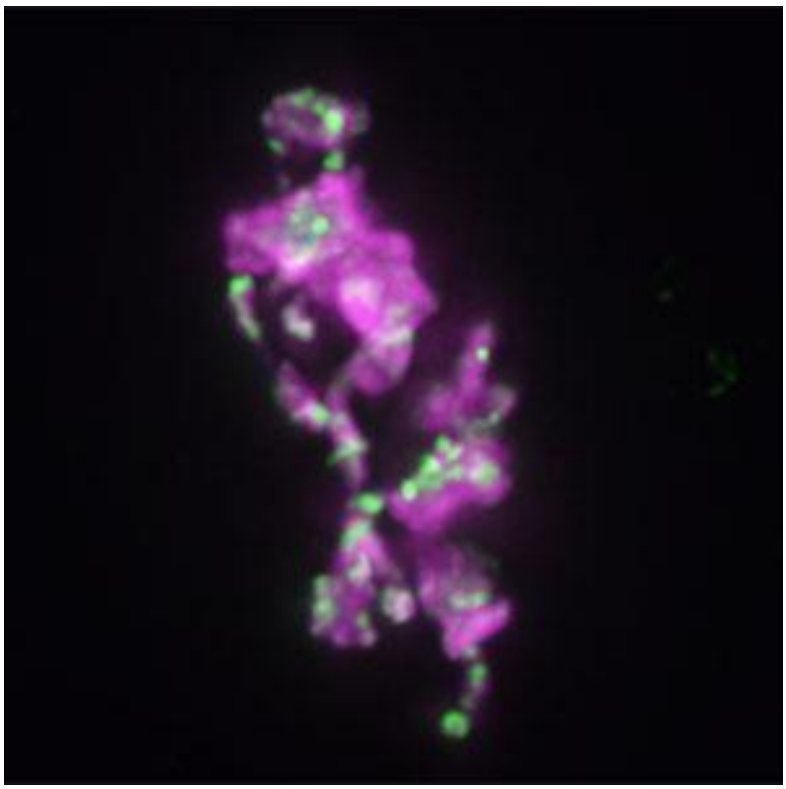
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Alberta**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. MD. Anwarul Hasan, Carlos F. Lange, Malcolm L. King. **Effect of artificial mucus properties on the characteristics of airborne bioaerosol droplets generated during simulated coughing**. *Journal of Non-Newtonian Fluid Mechanics*, 2010; DOI: 10.1016/j.jnnfm.2010.07.005

http://www.sciencedaily.com/releases/2010/09/100922111438.htm

Experiments Decipher Key Piece of the 'histone Code' In Cell Division



Modify and divide. New research suggests a chemical modification to the DNA packaging protein site H3T3 (purple) is necessary for the recruitment of the chromosomal passenger complex (green) which helps segregate chromosomes in preparation for cell division. (Credit: Image courtesy of Rockefeller University)

ScienceDaily (Sep. 20, 2010) — Reproduce or perish. That's the bottom line for genes. Because nothing lives forever, reproduction is how life sustains itself, and it happens most fundamentally in the division and replication of the cell, known as mitosis. Now new research at Rockefeller University has detailed a key role in mitosis for a chemical modification to histone proteins that package lengthy strings of DNA into compact chromosomes. The experiments, recently published in *Science*, add to an increasingly intricate picture of the precisely timed events that separate new copies of chromosomes to opposite ends of a cell just before the cell divides, one of the most fundamental processes involved in the reproduction of life.

"We've known that histones become decorated during mitosis for more than 30 years, but we haven't really understood their function," says Hironori Funabiki, head of the Laboratory of Chromosome and Cell Biology. "Now we've finally decoded exactly how one of these marks works."

Funabiki says the findings provide hard evidence for the "histone code hypothesis," advanced by Rockefeller's C. David Allis and colleagues, which suggests that combinations of histone modifications attract or remove specific proteins, controlling the immediate environment of chromosomes in the cell. The orchestration of the exact timing and localization of the vast array of molecules and processes involved in reproducing the chromosomes is one of the basic wonders of biology and is at the core of both healthy living and diseases such as cancer, that arise when the process goes awry.

Funabiki, postdoctoral associate Alex Kelly, graduate student Cristina Ghenoiu and their colleagues focused on the addition of a phosphate group to histone H3 at the site theronine 3 (H3T3); it was first identified in 1980, but its function has remained a mystery. The researchers built on their previous work singling out the chromosomal passenger complex, a group of proteins in the cell that includes the enzyme Aurora B. This

complex must be brought to chromosomes and activated to facilitate the assembly of cellular scaffolding called spindle microtubules, which are required to separate chromosomes in a dividing cell. In a series of new experiments, they showed that another member of the complex, Survivin (it's highly similar to a class of proteins known to stem the process of programmed cell death, or apoptosis) recognizes the phosphate group at H3T3 and, in turn, activates Aurora B.

The researchers found that the phosphate group must be removed after the chromosomes are segregated so that the chromosomes can be properly repackaged to repeat the process over again, and they showed that the enzyme Haspin plays a role in adding the phosphate group that Survivin recognizes and is necessary for the chain of events to come off smoothly. Since both Survivin and Aurora B have been implicated in many cancers, molecules that disrupt the interaction between histone H3 and Survivin could allow for a new avenue for targeted therapeutics.

The study also shows that how Survivin recognizes H3T3 phosphorylation is very similar to how "inhibitor of apoptosis" proteins (IAPs) bind to their own ligands, whose mimetics have been investigated as anti-cancer drugs. "It brings a lot of fields together. I think it will be exciting to a lot of people working on epigenetics, apoptosis and the cell cycle," Kelly says. "We cracked one code," Funabiki says, "but there are yet many to be decoded to understand how chromosomes orchestrate mitosis."

Story Source:

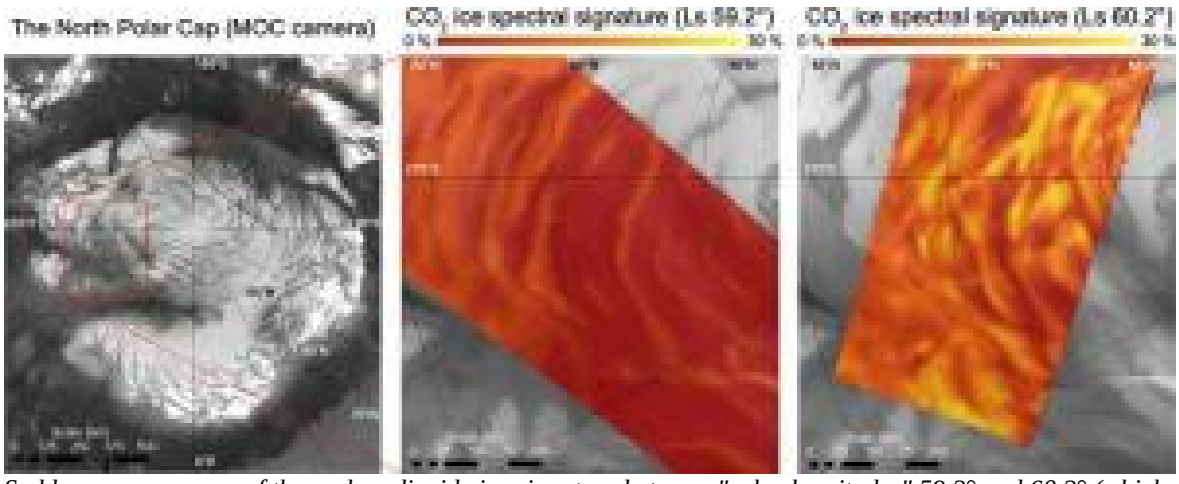
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Rockefeller University**.

Journal Reference:

1. A. E. Kelly, C. Ghenoiu, J. Z. Xue, C. Zierhut, H. Kimura, H. Funabiki. **Survivin Reads Phosphorylated Histone H3 Threonine 3 to Activate the Mitotic Kinase Aurora B**. *Science*, 2010; DOI: 10.1126/science.1189505

http://www.sciencedaily.com/releases/2010/09/100920211118.htm

Mystery of Disappearing Martian Carbon Dioxide Ice Solved?



Sudden reappearance of the carbon dioxide ice signature between "solar longitudes" 59.2° and 60.2° (which corresponds to a time lapse of approximately two Martian days) in the spiral troughs structure of the North polar cap. (Credit: Image courtesy of Europlanet Media Centre)

ScienceDaily (Sep. 22, 2010) — Scientists may have solved the mystery of the carbon dioxide ice disappearance early in the Northern Martian springs followed later by its sudden reappearance, revealing a very active water cycle on the planet. Dr. Bernard Schmitt and Mr. Thomas Appéré are reporting their results about water ice mobility during Martian Year 28, at the European Planetary Science Congress in Rome.

Seasonal ice deposits are one of the most important Martian meteorological processes, playing a major role in the water cycle of the planet. Every Martian year, alternatively during northern and southern winter, a significant part of the atmosphere condenses on the surface in the form of frost and snow. These seasonal ice deposits, which can be up to one meter thick, are mainly composed of carbon dioxide with minor amounts of water and dust. During spring, the deposits sublimate (vaporize), becoming a substantial source of water vapour, in particular in the northern hemisphere of the planet.

Dr. Schmitt and his colleagues Thomas Appéré and Dr. Sylvain Douté at the Laboratoire de Planétologie de Grenoble, France, have analyzed data taken with the OMEGA instrument on board Mars Express, for two northern Martian regions. Before the Mars Express mission (ESA), the evolution of the seasonal deposits has been monitored by the albedo (reflectivity) and temperature changes of the surface, as the ice deposits appear much brighter and are colder than the surrounding defrosted terrains."But we couldn't resolve their exact composition and how they were distributed on the planet. Near-infrared observations, such as the OMEGA data, are much better for detecting strong signatures of water and carbon dioxide ice," says Mr Appéré.

The first Martian region that the scientists observed is located on Gemina Lingula, a Northern plateau, where peculiar evolution of the carbon dioxide ice deposits was observed. "During spring the ice signature disappeared from our data, but the surface temperature was still cold enough to sustain plenty of CO_2 ice. We concluded that a thick layer of something else, either dust or water ice was overlaid. If it was dust then it would also hide water ice and the surface of the planet would become darker. None of these happened so we concluded that a layer of water ice was hiding the CO_2 ice. We had to wait until the weather gets warm enough on Mars for the water to vaporize as well, and then the carbon dioxide signatures re-appeared in our data," explains Dr Schmitt.

But where does this layer of water ice come from? Soon after spring sunrise, the solar radiation hitting the surface of Mars warms enough the CO_2 ice lying on the top layer to cause it to vaporize. But the water ice needs higher temperatures to sublimate, so a fine grained layer of water ice gradually forms hiding the carbon dioxide ice still lying beneath it. "A layer only 2 tenths of a millimetre thick is enough to completely hide the CO_2 ice. Also some water that has been vaporized at lower, warmer, Martian latitudes condenses as it moves northward and may be cold trapped on top of the CO_2 ice," says Mr. Appéré.

The second region analysed by the team is located in the spiral troughs structure of the North permanent cap. A similar situation was observed but the carbon dioxide ice re-appeard very quickly here after its initial disappearance. "This hide-and-seek game didn't make much sense to us. It wasn't cold enough for CO_2 ice to condense again, neither warm enough for water ice to sublimate," explains Dr. Schmitt. "We concluded that somehow the water ice layer was removed. The topography of the North permanent Martian cap is well-suited to entail the formation of strong katabatic (downhill) winds. Aymeric Spiga used a model from the Laboratoire de Météorologie Dynamique du CNRS to simulate those winds and he indeed confirmed the sudden re-appearances of CO_2 ice where strong katabatic winds blow," says Mr. Appéré.
Dr. Schmitt concludes: "To decipher the present and past water cycles on Mars and improve our weather models on the planet one needs to have a good understanding of the seasonal ice deposits dynamics, how they change in space and time. We are confident that our results will make a significant contribution in this direction."

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Europlanet Media Centre**, via AlphaGalileo.

http://www.sciencedaily.com/releases/2010/09/100922124546.htm

An Elegant Galaxy in an Unusual Light

This striking new image, taken with the powerful HAWK-I infrared camera on ESO's Very Large Telescope at Paranal Observatory in Chile, shows NGC 1365. This beautiful barred spiral galaxy is part of the Fornax cluster of galaxies, and lies about 60 million light-years from Earth. The picture was created from images taken through Y, J, H and K filters and the exposure times were 4, 4, 7 and 12 minutes respectively. (Credit: ESO/P. Grosbøl)

ScienceDaily (Sep. 22, 2010) — A new image taken with the powerful HAWK-I camera on ESO's Very Large Telescope at Paranal Observatory in Chile shows the beautiful barred spiral galaxy NGC 1365 in infrared light. NGC 1365 is a member of the Fornax cluster of galaxies, and lies about 60 million light-years from Earth.

NGC 1365 is one of the best known and most studied barred spiral galaxies and is sometimes nicknamed the Great Barred Spiral Galaxy because of its strikingly perfect form, with the straight bar and two very prominent outer spiral arms. Closer to the centre there is also a second spiral structure and the whole galaxy is laced with delicate dust lanes.

This galaxy is an excellent laboratory for astronomers to study how spiral galaxies form and evolve. The new infrared images from HAWK-I are less affected by the dust that obscures parts of the galaxy than images in visible light and they reveal very clearly the glow from vast numbers of stars in both the bar and the spiral arms. These data were acquired to help astronomers understand the complex flow of material within the galaxy and how it affects the reservoirs of gas from which new stars can form. The huge bar disturbs the shape of the gravitational field of the galaxy and this leads to regions where gas is compressed and star formation is triggered. Many huge young star clusters trace out the main spiral arms and each contains hundreds or thousands of bright young stars that are less than ten million years old. The galaxy is too remote for single stars to be seen in this image and most of the tiny clumps visible in the picture are really star clusters. Over the whole galaxy, stars are forming at a rate of about three times the mass of our Sun per year. While the bar of the galaxy consists mainly of older stars long past their prime, many new stars are born in stellar nurseries of gas and dust in the inner spiral close to the nucleus. The bar also funnels gas and dust gravitationally into the very centre of the galaxy, where astronomers have found evidence for the presence of a super-massive black hole, well hidden among myriads of intensely bright new stars.

NGC 1365, including its two huge outer spiral arms, spreads over around 200 000 light-years. Different parts of the galaxy take different times to make a full rotation around the core of the galaxy, with the outer parts of the bar completing one circuit in about 350 million years. NGC 1365 and other galaxies of its type have come to more prominence in recent years with new observations indicating that the Milky Way could also be a barred spiral galaxy. Such galaxies are quite common -- two thirds of spiral galaxies are barred according to recent estimates, and studying others can help astronomers understand our own galactic home.

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **European Southern Observatory - ESO**.

http://www.sciencedaily.com/releases/2010/09/100922082336.htm

Structure of Dangerous Bacteria's Powerful Multidrug Resistance Pump Revealed

ScienceDaily (Sep. 22, 2010) — A team at The Scripps Research Institute has detailed the structure of a member of the only remaining class of multidrug resistance transporters left to be described. The work has implications for combating dangerous antibiotic resistant strains of bacteria, as well as for developing hardy strains of agricultural crops.

The study was published in an advance, online issue of the journal *Nature* on September 22, 2010.

"Now with our crystal structure, scientists can for the first time figure out exactly how this transporter works," said the study's senior investigator, Geoffrey Chang, Ph.D., associate professor in the Scripps Research Department of Molecular Biology. "This could lead to the design of drugs that evade or inhibit the transporter, or to reengineering the transporter to help some plants grow in soil they can't grow in now."

The protein described in the study, NorM, was found in the virulent bacteria *Vibrio cholerae*. *V. cholerae* causes cholera, a disease that affects the small intestine and is a common cause of death in developing nations. The NorM transporter is responsible for widespread resistance to ciprofloxacin and other fluoroquinolones (a broad-spectrum, inexpensive class of antibiotics) and to tigecycline, a new class of drug specifically designed to overcome that antibiotic resistance.

Importantly, NorM is a member of the multidrug and toxic compound extrusion (MATE) family that is involved in important biological functions across all kingdoms of life. These transporters defend plant, animal, and microbial cells by pumping out toxic chemicals before they can have any effect. In addition to antibiotic resistance, MATE transporters are associated with resistance to a commonly used diabetes drug, as well as resistance to anti-inflammatory and anti- arrhythmia agents. In plants, MATE transporters help to neutralize the acidity of soil, directly affecting crop yields worldwide.

"By showing how a key member of the [MATE transporter] family undergoes shape changes during the extrusion process, this work may lead to new ways to block the transporter, with possible applications in medicine and agriculture," said Jean Chin, Ph.D., who oversees this and other structural biology grants at the National Institutes of Health (NIH).

It took a "Herculean effort" to produce the high-resolution crystal structure of NorM, Chang noted. The researchers found it was difficult to produce enough protein to work with, and hard to purify the transporter in its natural state.

After the team found a way to produce and purify the protein, the scientists still needed to create crystals to be able to use a technique known as x-ray crystallography to solve its structure. In this method, scientists produce and purify large quantities of a protein that are crystallized. The crystal is then placed in front of a beam of x-rays, which diffract when they strike the atoms in the crystal. Based on the pattern of diffraction, scientists can reconstruct the shape of the original molecule. In this case, though, the NorM crystals were unusually fragile under an x-ray beam.

After many attempts, however, the research team succeeded in producing two crystal structures of the NorM transporter as it sat on the outside surface of *V. cholerae*. One showed the transporter by itself and the other provided a snapshot of how the pump is powered by sodium ions.

The NorM transporter normally sits, waiting, on the inside of the bacterial cell membrane for toxic chemicals -- in this case antibiotics -- that seep inside. The protein then changes shape in order to scoop the chemical up, and transport it back through the cell wall to the outside of the bacteria, keeping the bacteria safe from destruction.

The structure of this bacterial pump revealed a shape distinct from all other MDR transporter families, say co-authors Xiao He and Paul Szewczyk, graduate students at the University of San Diego, California, (UCSD) who worked with Chang to derive the structure. The pair also took the lead in the effort to verify the crystal structure -- a process of labeling 16 different amino acids on the protein and confirming their three-dimensional position. This part of the effort took 18 months.

On the outside of the bacteria, the transporter looks like an upside down "V" shaped lampshade, He said, and the chemical to be removed presumably fits inside the narrow part of the structure. She adds that the research

team is working to crystallize the transporter on the inside of the bacterium, as well as the structure with a chemical bound to it.
"Bacteria have a number of different transporter systems, so it is important to design antibiotics that will not be instantly pumped out," He noted.
With the atomic structure of NorM solved, the team continues to investigate other MATE transporters, including those found in plants and those that exist in human liver and kidney cells that can reduce the effectiveness of a wide variety of drugs.
In addition to Chang, He, and Szewczyk, authors of the study are Andrey Karyakin, Mariah Evin, Wen Xu Hong, and Qinghai Zhang of Scripps Research.
The study was funded by grants from the NIH, the Beckman Foundation, and the Skaggs Chemical Biology Foundation.

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Scripps Research Institute**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Xiao He, Paul Szewczyk, Andrey Karyakin, Mariah Evin, Wen-Xu Hong, Qinghai Zhang, Geoffrey Chang. **Structure of a cation-bound multidrug and toxic compound extrusion transporter**. *Nature*, 2010; DOI: 10.1038/nature09408

http://www.sciencedaily.com/releases/2010/09/100922131957.htm

Ocean Cooling Contributed to Mid-20th Century Global Warming Hiatus

Iceberg in the icefjord near the city of Ilulissat in Greenland. While the temperature drop was evident in data from all Northern Hemisphere oceans, it was most pronounced in the northern North Atlantic, a region of the world ocean thought to be climatically dynamic. (Credit: iStockphoto/Anders Peter Amsnæs)

ScienceDaily (Sep. 22, 2010) — The hiatus of global warming in the Northern Hemisphere during the mid-20th century may have been due to an abrupt cooling event centered over the North Atlantic around 1970, rather than the cooling effects of tropospheric pollution, according to a new paper appearing September 22 in *Nature*.

David W. J. Thompson, an atmospheric science professor at Colorado State University, is the lead author on the paper. Other authors are John M. Wallace at the University of Washington, and John J. Kennedy at the Met Office and Phil D. Jones of the University of East Anglia, both in the United Kingdom.

The international team of scientists discovered an unexpectedly abrupt cooling event that occurred between roughly 1968 and 1972 in Northern Hemisphere ocean temperatures. The research indicates that the cooling played a key role in the different rates of warming seen in the Northern and Southern Hemispheres in the middle 20th century.

"We knew that the Northern Hemisphere oceans cooled during the mid-20th century, but the sudden nature of that cooling surprised us," Thompson said.

While the temperature drop was evident in data from all Northern Hemisphere oceans, it was most pronounced in the northern North Atlantic, a region of the world ocean thought to be climatically dynamic.

"Accounting for the effects of some forms of natural variability -- such as El Nino and volcanic eruptions -- helped us to identify the suddenness of the event," Jones said.

The different rates of warming in the Northern and Southern Hemispheres in the middle 20th century are frequently attributed to the larger buildup of tropospheric aerosol pollution in the rapidly industrializing Northern Hemisphere. Aerosol pollution contributes to cooling of the Earth's surface and thus can attenuate the warming due to increasing greenhouse gases.

But the new paper offers an alternative interpretation of the difference in mid-century temperature trends.

"The suddenness of the drop in Northern Hemisphere ocean temperatures relative to the Southern Hemisphere is difficult to reconcile with the relatively slow buildup of tropospheric aerosols," Thompson said.
"We don't know why the Northern Hemisphere ocean areas cooled so rapidly around 1970. But the cooling appears to be largest in a climatically important region of the ocean," Wallace said.

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Colorado State University**, via EurekAlert!, a service of AAAS.

1. David W. J. Thompson, John M. Wallace, John J. Kennedy and Phil D. Jones. **An abrupt drop in Northern Hemisphere sea surface temperature around 1970**. *Nature*, September 22, 2010 DOI: 10.1038/nature09394

http://www.sciencedaily.com/releases/2010/09/100922132002.htm

Researchers Crack Cuckoo Egg Mystery

Female cuckoo at reed warbler. (Credit: O. Mikulica)

ScienceDaily (Sep. 22, 2010) — Researchers at the University of Sheffield have discovered that cuckoo eggs are internally incubated by the female bird for up to 24 hours before birth, solving for the first time the mystery as to how a cuckoo chick is able to hatch in advance of a host´s eggs and brutally evict them.
Published September 22, 2010 in the journal *Proceedings of the Royal Society of London, Series B*, the research shows that internal incubation allows the cuckoo chick to hatch before its nest mates, evict them, and monopolise the food brought by the foster parents.
Although previous studies have suggested early hatching is achieved partly through the cuckoo producing a small egg which develops faster, it has long been suspected that there might be another reason for this.
A team from Sheffield, headed up by Professor Tim Birkhead, from the University´s Department of Animal and Plant Sciences, worked with cuckoo researchers across Europe, to examine the newly laid eggs of eight cuckoos, and discovered that each one was at a more advanced stage than is normal among small birds. To test the idea that this advanced development was a result of the female cuckoo retaining the egg inside her, they simulated `internal incubation´ in another species; the zebra finch.
The researchers took recently laid finch eggs and incubated them for 24 hours at body temperature, which is 40oC in both the finch and the cuckoo. After this time, the zebra finch eggs were at the same stage as the cuckoo eggs at the time they were laid.
Superficially this suggested that the internal incubation gives the cuckoo a 24 hour head start over its host´s eggs, but the researchers discovered it is in fact more than this.
When eggs are incubated by the adult birds in the nest, their eggs are at about 36oC. Inside the female, the egg is at a body temperature of 40oC. This difference in temperature means that 24 hours at 40oC gives the cuckoo egg a 31 hour head start over the host eggs.
Most birds release their ovum or the yolk of the egg from the ovary 24 hours before it is laid. Fertilisation occurs within 15 minutes of ovulation, and the ovum then spends about 24 hours having the albumen, or egg white, and the shell put on to form a normal egg. This fully formed egg is laid 24 hours after ovulation.
Significantly, about six hours after the ovum is fertilised, the microscopic embryo begins to develop and by the time the egg is laid, the embryo contains some 10,000 cells. It is only after two days of incubation that there are any signs, visible to the naked eye, that the egg is developing and an embryo forming.
In the cuckoo however, the team demonstrated that the egg is ovulated and fertilised and then six hours later embryo development begins. As the egg passes down the oviduct, or egg tube, the white and shell are added, and once the egg is fully formed, about 24 hours after it was released from the ovary, it then sits in the female´s oviduct for a further 24 hours. In other words, by the time the cuckoo egg is laid, it has had 18 to 24 hours of internal incubation at 40oC and hatches 31 hours ahead of any host egg laid at the same time.

Professor Tim Birkhead, from the Department of Animal and Plant Sciences at the University of Sheffield, said: "The idea of internal incubation in birds has until now been considered impossible because it was assumed that female birds could not hold onto a fully formed egg. In fact, the idea of internal incubation by cuckoos was suggested as early as 1800, but then ignored. Our results show that internal incubation gives cuckoo chicks that crucial head start in life, allowing them to dispose of their nest mates -- a superb adaptation to being a brood parasite."

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Sheffield**.

Journal Reference:

1. Birkhead, T. R., Hemmings, N., Spottiswoode, C. N., Mikulica, O., Moskát, C., Bán, M. & Schulze-Hagen, J. **Internal incubation and early hatching in brood parasitic birds**. *Proceedings of the Royal Society of London, Series B,* 22 September 2010

http://www.sciencedaily.com/releases/2010/09/100922102247.htm

Inflammation Causes Some Postsurgical Neuropathies

ScienceDaily (Sep. 22, 2010) — A new Mayo Clinic study found that nerve inflammation may cause the pain, numbness and weakness following surgical procedures that is known as postsurgical neuropathy. The development of postsurgical neuropathies is typically attributed to compression or stretching of nerves during surgery. This new research shows that, in some cases, the neuropathy is actually caused by the immune system attacking the nerves and is potentially treatable with immunosuppressive drugs.

The study was published in this month's issue of *Brain*.

Postsurgical neuropathy is an uncommon complication of surgery. Peripheral nerves are the extensive network of nerves that link the brain and spinal cord (the central nervous system) to all other parts of the body. When damaged by stretching, compression or inflammation, the peripheral nerve injury can interfere with communication between the brain and the rest of the body (muscles and sensation are controlled by the nerve). Individuals with postsurgical neuropathy may experience loss of sensation, pain and muscles weakness.

"It is important that a person with postsurgical inflammatory neuropathy receive a diagnosis and treatment quickly. Understanding the role of inflammation in these patients' neuropathy can lead to appropriate immunotherapy and improvement of neurological symptoms and impairments," says P. James Dyck, M.D., a Mayo Clinic neurologist and senior author of this study.

As part of the research, Dr. Dyck and a team of Mayo Clinic researchers selected 23 patients who developed neuropathy within 30 days of a surgical procedure. According to Dr. Dyck, the neuropathy of these 23 patients did not make sense in terms of being caused by stretching or compression because the nerves damaged were usually in a different part of the body from the surgical site or the neuropathy occurred at least a few days after the surgery was over. The surgical procedures were orthopedic, abdominal, chest or dental. All the patients received a nerve biopsy, of which 21 demonstrated increased inflammation. Seventeen patients were treated over a three-month period with immunotherapy, and in all cases with follow-up the neuropathy impairments improved.

"This is exciting for patients because it allows for appropriate identification and accurate treatment of postsurgical neuropathy. Without showing inflammation on the nerve biopsies, we would have been unable to know the cause of the neuropathy," says Nathan Staff, M.D., Ph.D., a Mayo Clinic neurologist and the first author of this study.

"It is logical for patients to believe that it was the surgeon's fault that they developed a neuropathy because it occurred after the surgery," says Dr Dyck. "However, in these cases, we have strong evidence that the neuropathies were not the surgeon's fault but were caused by the immune system attacking the nerves."

Other members of the Mayo Clinic research team included JaNean Engelstad, Christopher Klein, M.D., Kimberly Amrami, M.D., Robert Spinner, M.D., Peter Dyck, M.D., Mark Warner, M.D., and Mary Warner, M.D.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Mayo Clinic**.

Journal Reference:

1. N. P. Staff, J. Engelstad, C. J. Klein, K. K. Amrami, R. J. Spinner, P. J. Dyck, M. A. Warner, M. E. Warner, P. J. B. Dyck. **Post-surgical inflammatory neuropathy**. *Brain*, 2010; DOI: 10.1093/brain/awq252

http://www.sciencedaily.com/releases/2010/09/100922111432.htm

Gulf Oil Spill's Vastness Confirmed: Largest Marine Oil Accident Ever

The researchers used high-resolution video clips of flow from the Deepwater Horizon well to measure volume. (Credit: Courtesy US Senate Committee on Environment and Public Works)

ScienceDaily (Sep. 23, 2010) — BP's leaking oil well in the Gulf of Mexico was conclusively sealed this week, but even now, questions remain about the amount of oil that actually came out of it. Initially after the April 20 explosion, officials claimed that the flow could not be measured. Then, as public pressure for information mounted, they looked for ways to measure it, and started producing estimates: at first, 1,000 barrels a day; then 5,000; then 12,000 to 19,000; then upward from there. Now, in the first independent, peer-reviewed paper on the leak's volume, scientists have affirmed heightened estimates of what is now acknowledged as the largest marine oil accident ever.

Using a new technique to analyze underwater video of the well riser, they say it leaked some 56,000 to 68,000 barrels daily--maybe more--until the first effective cap was installed, on July 15. Their estimate of the total oil escaped into the open ocean is some 4.4 million barrels--close to the most recent consensus of government advisors, whose methods have not been detailed publicly.

The paper appears in this week's early online edition of the journal *Science.*

"We wanted to do an independent estimate because people had the sense that the numbers out there were not necessarily accurate," said lead author Timothy Crone, a marine geophysicist at Columbia University's Lamont-Doherty Earth Observatory. After BP and government officials downplayed the possibility or importance of measurements, a wide spectrum of scientists, environmental groups and legal experts pointed out that the information was needed to determine both short- and long-term responses, and monetary liability.

The new study divides the flow rate into two periods: April 22 to June 3, when oil spurted from a jagged break in the riser; and after June 3, when the riser was cut, and oil temporarily spewed into the ocean unimpeded. Crone and his coauthor, Lamont marine geophysicist Maya Tolstoy, used a visual analysis technique Crone recently developed called optical plume velocimetry. They say video from the earlier period indicated a flow of about 56,000 barrels a day (a barrel is 42 gallons). After the pipe was cut, they say, the rate went to about 68,000. After accounting for time elapsed, the authors subtracted 804,877 barrels collected by BP at the site, to come up with a total of 4.4 million barrels that escaped. Given the study's stated 20 percent margin of error plus or minus, this roughly agrees with the federal government's Flow Rate Technical Group's most recent comparable estimate of 4.1 million barrels (after subtracting the oil collected by BP).

Attempts to get a handle on the size of the release have been fraught with high-profile problems. A week after the initial 1,000-barrel-a-day assertion, it became apparent that BP was collecting more than that, and far

more beside was escaping. On April 28, the National Oceanic and Atmospheric Administration hastily produced an estimate of 5,000 barrels, extrapolating this from the size of the surface plume. But scientists and journalists soon attacked this figure (for instance in a May 13 New York Times report). Crone became involved when National Public Radio asked him and other experts to come up with their own estimates; a May 14 NPR story based on their observations suggested that the rate was actually five or ten times higher. On May 21, the Times published an op-ed piece by Crone and colleagues from three other institutions outlining the case that existing scientific techniques could be used to form a realistic picture. On May 27, the government raised the estimate again, to 12,000-19,000 barrels per day. A variety of techniques went into this and the later, even higher, official estimates, but the government and its advisors have released only limited information on their techniques -- again, raising criticism from the scientific community . This new study is the first to lay out the details of an analysis publicly in a report independently reviewed by other researchers.
Crone started developing optical plume velocimetry in 2006, in order to study natural hydrothermal vents -- volcanically driven cracks and holes in the seafloor that shoot out buoyant, superheated jets of mineral-laden water. A jet from a leaking oil pipe is similar. The technique uses high-resolution video from underwater cameras to track the motion of turbulent billows and flows in the water, breaking down the movement pixel by pixel. Under a grant from the U.S. National Science Foundation, Crone tested it first in the lab, then at deep-sea vents in the eastern Pacific, and the Juan de Fuca ridge, off the U.S. Pacific northwest. He is currently developing a network of automatic cameras that will track vent activity on the Juan de Fuca. "This is a great example of how basic research that doesn't seem to have any immediate value suddenly gains huge immediacy for society," said Crone.
The scientists say their study is just a start. Other researchers have been trying to get at the same question using separate visual and acoustic techniques. Crone and Tolstoy say their conclusions rest on just a few short clips of high-resolution video -- almost all that has been released by BP and the government so far, and made available by members of Congress to the scientists. (A live publicly accessible webcam showing the leak as it continued week after week had extremely low resolution, insufficient for analysis.) The researchers point out that the flows could have varied day to day. And, the analysis did not include video of several other leaks from smaller holes further up the pipe, which are thought to have grown with time; thus, the true figures may be larger, if anything, said Crone. "We clearly acknowledge the limits of our technique; we're unlikely to ever know the exact figure," he said. Tolstoy added: "This is not the last word. It is the first peer-reviewed word. But we think it's a really good ballpark."
The researchers said they hope they and others will be able to refine their estimates if the government and BP release more video and other information to independent researchers. Ian MacDonald, a Florida State University oceanographer who has also studied the leak, but was not involved in the study, said: "This is a welcome paper in that it opens the door onto how the oil spill flow-rate estimates have been calculated. It provides a transparency of method and a foundation for peer review for what has until now been a confusing and uncertain process."

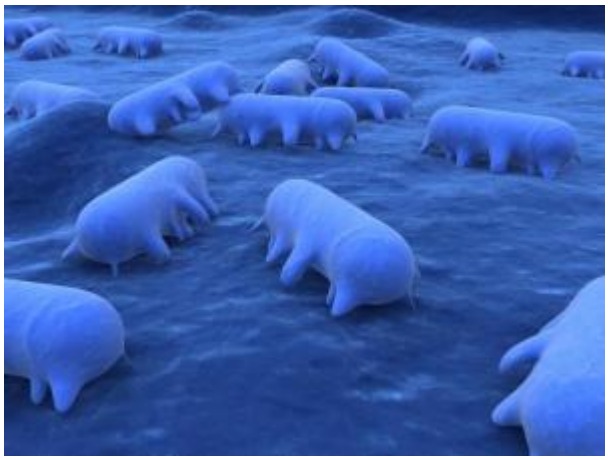
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **The Earth Institute at Columbia University**.

Journal Reference:

1. Timothy J. Crone, Maya Tolstoy. **Magnitude of the 2010 Gulf of Mexico Oil Leak**. *Science*, 2010; DOI: 10.1126/science.1195840

http://www.sciencedaily.com/releases/2010/09/100923142438.htm

Clues to Common Food Poisoning: Salmonella Creates Environment in Human Intestines to Foster Its Own Growth



Salmonella (rendering). When people ingest Salmonella, it invades the surface of the intestine. Our immune system responds by producing oxygen radicals to kill the bacteria. Although some Salmonella bacteria are killed by this response, many more benefit: the oxygen radicals create a sulfur compound called tetrathionate, which Salmonella are able to use instead of oxygen for respiration. (Credit: iStockphoto/Sebastian Kaulitzki)

ScienceDaily (Sep. 23, 2010) — A study led by researchers at UC Davis has found how the bacteria *Salmonella enterica* -- a common cause of food poisoning -- exploits immune response in the human gut to enhance its own reproductive and transmission success. The strategy gives *Salmonella* a growth advantage over the beneficial bacteria that normally are present in the intestinal tract and promotes the severe diarrhea that spreads the bacteria to other people.

The findings are published in the Sept. 23 issue of the journal *Nature*.

"The human body normally has 10 times more microbes than human cells that help protect us against infection from disease-causing bacteria," said Andreas Bäumler, professor of medical microbiology and immunology at the UC Davis School of Medicine and the principal investigator of the study. "We have discovered *Salmonella*'s cunning trick that allows it to quickly take over and outgrow the beneficial microbes in our intestine."

All bacteria must generate energy in order to live and reproduce, either by respiration -- which usually requires oxygen -- or fermentation. Because essentially no oxygen is available in our intestines, the beneficial bacteria that reside there tend to use fermentation, which is less efficient than respiration for obtaining energy.

When people ingest *Salmonella*, it invades the surface of the intestine. Our immune system responds by producing oxygen radicals to kill the bacteria. Although some *Salmonella* bacteria are killed by this response, many more benefit: the oxygen radicals create a sulfur compound called tetrathionate, which *Salmonella* are able to use instead of oxygen for respiration.

Interestingly, tetrathionate has been used since 1923 by microbiologists as a way to promote the growth of *Salmonella* in biological samples containing competing microbes. But because tetrathionate was not known to exist in living people, it was assumed prior to this study that this process had little relevance for food poisoning. Up until now, tetrathionate was believed to mainly exist naturally in decaying corpses or in thermal springs.

"Stimulating the host to produce tetrathionate enables *Salmonella* to 'breathe' in the intestine," said Sebastian E. Winter, who is a member of Bäumler's laboratory and lead author of the article. "This gives *Salmonella* a tremendous advantage over the gut bacteria that must grow by fermentation."

By stimulating an inflammatory response in the intestine, *Salmonella* also enhances its transmission to other hosts. The inflammatory response causes the severe diarrhea and vomiting that is the body's attempt to rid itself of the pathogenic bacteria, at the same time enabling *Salmonella*'s spread.
The investigators used a combination of experiments with mouse models and test tubes to study the effects of intestinal inflammation on *Salmonella* and pinpoint the role of tetrathionate respiration. They also used novel techniques from the burgeoning field of metabolomics, which allowed them to measure metabolites in living animals.
Salmonella is frequently in the news as a source of food poisoning outbreaks, usually from eating poorly cooked or unhygienically prepared eggs or meat. *Salmonella* was the cause of a recall of about half a billion eggs last August and sickened more than 1,500 people. In that case, the ovaries of the hens were contaminated, so the inside of the eggs carried the bacteria and were not safe to eat unless thoroughly cooked. Reptiles such as turtles, lizards and snakes also carry the bacteria on their skin, sometimes causing illness in people who keep them as pets.
Salmonella infection, known as salmonellosis, causes diarrhea, fever, vomiting and abdominal cramps. Although most people recover after several days, it may be fatal, especially in the elderly, infants, and people with an impaired immune system.
For most cases of salmonellosis, antibiotic treatment is counterproductive, as it actually prolongs disease by further inhibiting the growth of beneficial bacteria. Finding that tetrathionate is important in human *Salmonella* infection opens up new avenues for research in finding an effective treatment for salmonellosis. "Determining how *Salmonella* is so efficient in outcompeting resident beneficial bacteria is a critical first step in developing new drugs for treating food poisoning," said Bäumler, whose group is now pursuing this avenue of research. "We are hopeful that by targeting sulfur compounds we can stop the bacteria from establishing a foothold in the intestine."
Other UC Davis authors of the article are Parameth Thiennimitr, Maria G. Winter, Brian P. Butler, Douglas L. Huseby, Robert W. Crawford, Joseph M. Russell, Charles L. Bevins, Renée M. Tsolis, and John R. Roth. The other study author is L. Garry Adams from the College of Veterinary Medicine at Texas A&M University.

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of California -- Davis - Health System**.

Journal Reference:

1. Sebastian E. Winter, Parameth Thiennimitr, Maria G. Winter, Brian P. Butler, Douglas L. Huseby, Robert W. Crawford, Joseph M. Russell, Charles L. Bevins, L. Garry Adams, Renée M. Tsolis, John R. Roth & Andreas J. Bäumler. **Gut inflammation provides a respiratory electron acceptor for Salmonella**. *Nature*, 2010; 467 (7314): 426 DOI: 10.1038/nature09415

http://www.sciencedaily.com/releases/2010/09/100922131955.htm

Earth and Venus Lightning: Similar Mechanisms on the Two Planets

Artist's concept of lightning on Venus. (Credit: ESA)

ScienceDaily (Sep. 23, 2010) — Despite the great differences between the atmospheres of Venus and Earth, scientists have discovered that very similar mechanisms produce lightning on the two planets. The rates of discharge, the intensity and the spatial distribution of lightning are comparable, thus scientists hope to be able to better understand the chemistry, dynamics and evolution of the atmospheres of the two planets.
The results are being presented by Dr. Christopher Russell at the European Planetary Science Congress.

Early missions, such as the Venera orbiters and probes, followed later by the Pioneer Venus Orbiter and more recently by the Galileo spacecraft, have reported evidence for optical and electromagnetic waves from Venus that could be produced by lightning. This was also confirmed by ground telescopes capturing lighting flashes at Venus. Yet the differences in the two atmospheres led some to claim that lightning on Venus would be unlikely and the topic became controversial. The launch of Venus Express with its magnetometer built by the Space Research Institute in Graz, Austria, has provided a great opportunity to unambiguously confirm the occurrence of lightning on Venus and to study in detail its magnetic field at altitudes between 200 and 500 km.

"Short strong pulses of the signals expected to be produced by lightning were seen almost immediately upon arrival at Venus, despite the generally unfavorable magnetic field orientation for entry of the signals into the Venus ionosphere at the altitude of the Venus Express measurements," says Dr. Russell of the University of California, USA. The electromagnetic waves that Dr. Russell and his team observed are strongly guided by the Venusian magnetic field and they can only be detected by the spacecraft when the magnetic field tilts

away from the horizontal by more than 15°. This is quite unlike the situation on Earth, where the lightning signals are aided in their entry into the ionosphere by the nearly vertical magnetic field.

When clouds form, on Earth or Venus, the energy that the Sun has deposited in the air can be released in a very powerful electrical discharge. As cloud particles collide, they transfer electrical charge from large particles to small, and the large particles fall while the small particles are carried upward. The separation of charges leads to lightning strokes. This process is important for a planetary atmosphere because it raises the temperature and pressure of a small portion of the atmosphere to a very high value so that molecules can form, which would not otherwise occur at standard atmospheric temperatures and pressures. This is why some scientists have speculated that lightning may have helped life to arise on Earth

On our planet occur about 100 lightning discharges per second, but from any one location we see far fewer. Similarly on Venus we do not see the entire planet and we have to estimate the total occurrence rate with some assumptions about how far one can see. Thanks to the new datasets from Venus Express, Dr. Russel and colleagues were able to show that lightning is similar in strength on Earth and Venus at the same altitudes. "We have analyzed 3.5 Earth-years of Venus lightning data using the low-altitude Venus Express data (10 minutes per day). By comparing the electromagnetic waves produced at the two planets, we found stronger magnetic signals on Venus, but when converted to energy flux we found very similar lightening strength," reports Dr. Rusell. Also it seems that lightning is more prevalent on the dayside than at night, and happens more often at low Venusian latitudes where the solar input to the atmosphere is strongest.

"Venus and Earth are often called twin planets because of their similar size, mass, and interior structure. The generation of lightning is one more way in which Venus and Earth are fraternal twins," concludes Dr. Russell.

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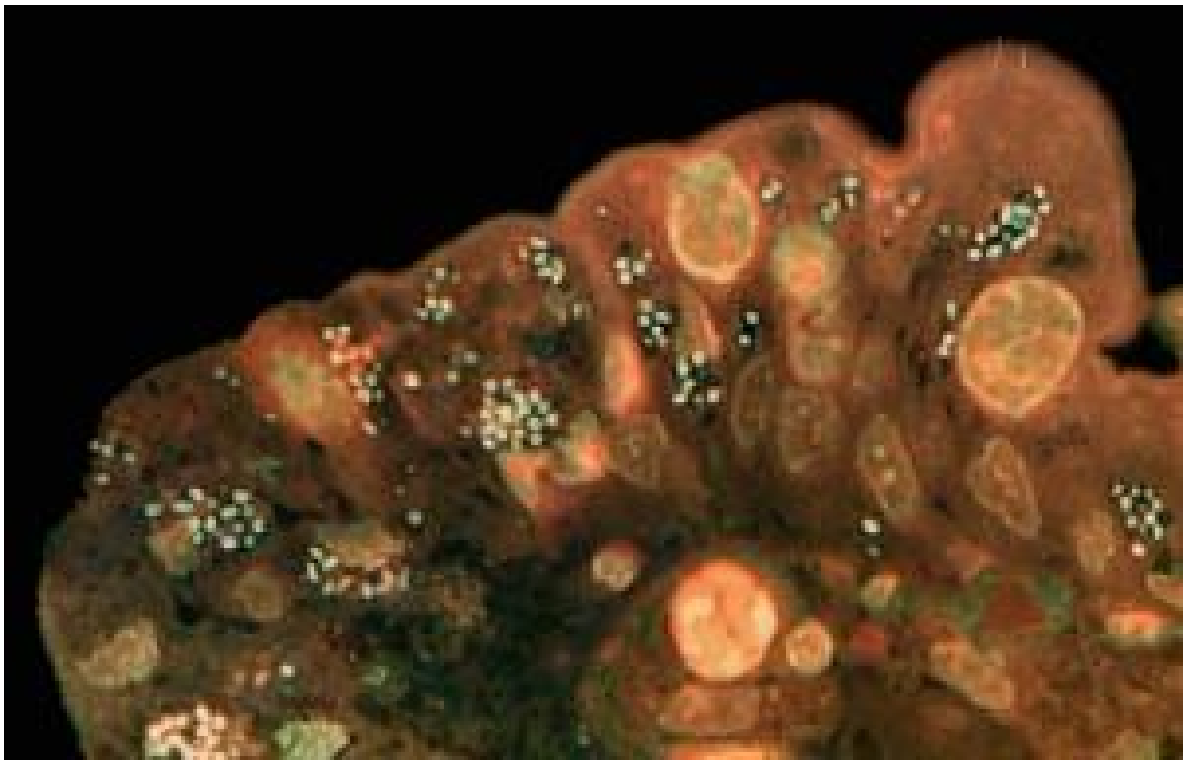
http://www.sciencedaily.com/releases/2010/09/100922183006.htm

Genomic 'Haircut' Makes World's Tiniest Genome Even Smaller



E. intestinalis (the little white dots) infecting human cells. (Credit: L. Weiss)

ScienceDaily (Sep. 21, 2010) — The world's tiniest nuclear genome appears to have "snipped off the ends" of its chromosomes and evolved into a lean, mean, genome machine that infects human cells, according to research published September 21 by University of British Columbia scientists.

Until recently, *E. cuniculi*, a parasitic fungus commonly found in rabbits that can also be fatal to immunocompromised humans, has been widely regarded as having the smallest known nuclear genome. At 2.9 millions base pairs (Mbp) and approximately 2,000 genes, the genome of *E. cuniculi* is less than one-two thousandth the size of the human genome.

But now, a team of researchers led by UBC Botany Prof. Patrick Keeling sequenced the genome of a closely related parasite that makes the *E. cuniculi* genome seem positively king-sized. The genome of *E. intestinalis*, a sister species of *E. cuniculi* that infects human intestines, is 20 per cent smaller, at only 2.3Mbp.

"On one end of the spectrum, genomes can get larger almost without limit, but there is a limit to how small they can get -- they can't be less than zero," says Keeling, whose work is published in the September 21 issue of the journal *Nature Communications*. "And the question that fascinated us was 'in an already tiny genome, what else can be lost'?"

Keeling and a team of researchers from Switzerland, Canada and the U.S. compared the genome of *E. cuniculi* and *E. intestinalis* and found little difference between the chromosome "cores" but that the ends were all "trimmed" in *E. intestinalis*.

"The chromosomes are long threads of DNA, and in *E. intestinalis* its almost as though it got a haircut, removing hundreds of genes, but all from the ends of the threads," says Keeling.

Keeling, director of the Centre for Microbial Diversity and Evolution and a member of Beaty Biodiversity Research Centre at UBC, says the discovery provides insights into how genomes evolve, especially in extreme conditions.

Keeling is also a scholar with the Canadian Institute for Advanced Research and a Michael Smith Foundation for Health Research Fellow.

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of British Columbia**.

Journal Reference:

1. Nicolas Corradi, Jean-François Pombert, Laurent Farinelli, Elizabeth S. Didier, Patrick J. Keeling. **The complete sequence of the smallest known nuclear genome from the microsporidian Encephalitozoon intestinalis**. *Nature Communications*, 2010; 1 (6): 1 DOI: 10.1038/ncomms1082

http://www.sciencedaily.com/releases/2010/09/100921101335.htm

Ecologists Find New Clues on Climate Change in 150-Year-Old Pressed Plants

Pressed flowers in an old book. (Credit: iStockphoto/Andrea Haase)

ScienceDaily (Sep. 23, 2010) — Plants picked up to 150 years ago by Victorian collectors and held by the million in herbarium collections across the world could become a powerful -- and much needed -- new source of data for studying climate change, according to research published in the British Ecological Society's *Journal of Ecology*.

The scarcity of reliable long-term data on phenology -- the study of natural climate-driven events such as the timing of trees coming into leaf or plants flowering each spring -- has hindered scientists' understanding of how species respond to climate change.

But new research by a team of ecologists from the University of East Anglia (UEA), the University of Kent, the University of Sussex and the Royal Botanic Gardens, Kew shows that plants pressed up to 150 years ago tell the same story about warmer springs resulting in earlier flowering as field-based observations of flowering made much more recently.

The team examined 77 specimens of the early spider orchid (*Ophrys sphegodes*) collected between 1848 and 1958 and held at the Royal Botanic Gardens, Kew and the Natural History Museum in London. Because each specimen contains details of when and where it was picked, the researchers were able to match this with Meteorological Office records to examine how mean spring temperatures affected the orchids' flowering.

They then compared these data with field observations of peak flowering of the same orchid species in the Castle Hill National Nature Reserve, East Sussex from 1975 to 2006, and found that the response of flowering time to temperature was identical both in herbarium specimens and field data. In both the pressed plants and the field observations, the orchid flowered 6 days earlier for every 1oC rise in mean spring temperature.

The results are first direct proof that pressed plants in herbarium collections can be used to study relationships between phenology and climate change when field-based data are not available, as is almost always the case.

According to the study's lead author, PhD student Karen Robbirt of UEA: "The results of our study are exciting because the flowering response to spring temperature was so strikingly close in the two independent sources of data. This suggests that pressed plant collections may provide valuable additional information for climate-change studies."

"We found that the flowering response to spring temperature has remained constant, despite the accelerated increase in temperatures since the 1970s. This gives us some confidence in our ability to predict the effects of further warming on flowering times."

The study opens up important new uses for the 2.5 billion plant and animal specimens held in natural history collections in museums and herbaria. Some specimens date back to the time of Linnaeus (who devised our system of naming plants and animals) 250 years ago.

Co-author Professor Anthony Davy of UEA says: "There is an enormous wealth of untapped information locked within our museums and herbaria that can contribute to our ability to predict the effects of future climate change on many plant species. Importantly it may well be possible to extend similar principles to museum collections of insects and animals."

Phenology -- or the timing of natural events -- is an important means of studying the impact of climate change on plants and animals.
"Recent climate change has undoubtedly affected the timing of development and seasonal events in many groups of organisms. Understanding the effects of recent climate change is a vital step towards predicting the consequences of future change. But only by elucidating the responses of individual species will we be able to predict the potentially disruptive effects of accelerating climate change on species interactions," he says.
Detecting phenological trends in relation to long-term climate change is not straightforward and relies on scarce long-term studies. "We need information collected over a long period to enable us confidently to identify trends that could be due to climate change. Unfortunately most field studies are relatively brief, so there are very few long-term field data available," Professor Davy explains

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Wiley-Blackwell**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Karen M Robbirt et al. **Validation of biological collections as a source of phenological data for use in climate change studies: a case study with the orchid Ophrys sphegodes**. *Journal of Ecology*, 2010; DOI: 10.1111/j.1365-2745.2010.01727.x

http://www.sciencedaily.com/releases/2010/09/100922081631.htm

Smoking During Pregnancy May Harm the Child's Motor Control and Coordination

ScienceDaily (Sep. 22, 2010) — Women who smoke during pregnancy run the risk of adversely affecting their children's coordination and physical control according to a new study from Örebro University, Sweden, published in the Journal of Epidemiology and Community Health.
"Moreover, we discovered that boys' abilities may be affected to a greater extent than those of girls," says Professor Scott Montgomery at Örebro University.
"There is a link between nicotine and testosterone. Nicotine can influence development of the brain and interacts with testosterone particularly during the foetal stage, and this could make boys extra susceptible to foetal nicotine exposure," says Matz Larsson, researcher in medicine and consultant physician at Örebro University Hospital.
The results are based on a study of over 13,000 children taking part in the National Child Development Study. The children, all born in Great Britain in the same week in March 1958, are followed throughout their lives. The smoking habits of the mothers during pregnancy were also recorded.
At the age of eleven, the children were tested by a school doctor in terms of physical control and coordination. They were set the task of picking up 20 matches against time -- both with their left and right hand. They had to tick up to 200 squares against time and copy a simple figure.
The children with mothers who had smoked at least nine cigarettes a day during pregnancy had greater difficulty completing the tests -- especially when using their non-dominant hand, which for most of us is the left hand.
"Our findings suggest that women who smoke during pregnancy run the risk of harming the child's motor ability. There may be several reasons behind this. The nicotine interacts with acetylcholine, which is an important neurotransmitter and messenger when the brain is developing during the foetal stage. But it might also be the case that the mother's smoking leads to a form of foetal malnutrition," says Matz Larsson.
"We believe this is an interesting study as it is based on physical tests rather than cognitive, which are dependent on, for example, elements of learning. That makes our results less sensitive to the influence of social and economic factors. Other factors linked to the mother's smoking may still have affected the result, but the difference in motor abilities remained even after a check for such factors," says Scott Montgomery.
"These findings also help us to understand why neurological function in childhood is linked with adverse health outcomes in later life such as obesity and type 2 diabetes, as these are also associated with maternal smoking during pregnancy. In addition, it is important to take note of even a slight impairment in childhood. Quite often it can be linked to a more rapid decline in motor function and health later on in life," says Scott Montgomery.

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Expertanswer**, via AlphaGalileo.

Journal Reference:

1. M. Larsson, S. M. Montgomery. **Maternal smoking during pregnancy and physical control and coordination among offspring**. *Journal of Epidemiology & Community Health*, 2010; DOI: 10.1136/jech.2008.085241

http://www.sciencedaily.com/releases/2010/09/100922081758.htm

Secret of Oysters' Ability to Stick Together Cracked Open

An oyster reef in the Baruch Marine Field Laboratory on the South Carolina coast. (Credit: Photo courtesy of Jonathan Wilker/Purdue University)

ScienceDaily (Sep. 20, 2010) — A Purdue University-led research team has uncovered the chemical components of the adhesive produced by oysters, providing information that could be useful for fisheries, boating and medicine.

A better understanding of oysters' ability to stick together to form complex reefs would help those trying to boost the dwindling oyster population, aid in the creation of materials to keep boat hulls clean without harming the environment, and bring researchers one step closer to creating wet-setting adhesives for use in medicine and construction.

Jonathan Wilker, a Purdue professor of chemistry and materials engineering, led the team that analyzed the most common oyster in the United States, Crassostrea virginica, known as the common Eastern oyster. A paper detailing the work is published in the current issue of the *Journal of the American Chemical Society.*

"With a description of the oyster cement in hand, we may gain strategies for developing synthetic materials that mimic the shellfish's ability to set and hold in wet environments," said Wilker, who has worked on the design of synthetic bioadhesives for more than 10 years. "Dentistry and medicine may benefit from such a material. For instance, it would be great to have a surgical adhesive that could replace staples and sutures, which puncture healthy tissue and create potential sites for infection."

By comparing oyster shells with the material that connects the animals to each other, the researchers were able to determine its chemical composition. The results showed that the adhesive had almost five times the amount of protein and more water than what is found in the shell.

"The adhesive material differed significantly in composition from the shell, which indicates that the oyster produces a chemically distinct substance for sticking together," Wilker said.

Wilker, who also studies mussel and barnacle adhesion, describes the oyster adhesive as more of an inorganic cementlike substance than the organic gluelike material produced by other marine animals.

"The oyster cement appears to be harder than the substances mussels and barnacles use for sticking to rocks," he said. "The adhesives produced by mussels and barnacles are mostly made of proteins, but oyster adhesive is about 90 percent calcium carbonate, or chalk. On its own, chalk is not sticky. So the key to oyster adhesion may be a unique combination of this hard, inorganic component with the remaining 10 percent of the material that is protein."

This 10 percent of oyster cement does bear some similarity to mussel glue in its composition of proteins and the presence of iron.

In earlier studies Wilker found that iron played a key role in the hardening, or curing, of mussel adhesive, and it may serve a similar purpose in the oyster adhesive, he said.

Finding common threads in the sticky substances produced by marine organisms is key to the development of both synthetic adhesives and treatments to prevent the accumulation of these animals on ships.

Hundreds of different marine species attach themselves to ships, increasing drag and reducing sailing speeds. Preventing and controlling their accumulation, called fouling, is a major expense for the world's shipping fleet, Wilker said.

"The current antifouling methods rely on toxicity and ship bottoms are often coated with a copper-based paint that kills marine organisms in their larval states," he said. "If we could figure out a non-toxic a way to defeat the adhesives, we could keep them off ships without harming the environment."
Oysters stick together to reproduce and to protect themselves from predators and large waves. The reefs can stretch for miles and filter large volumes of water, prevent erosion and create a storm wall that strengthens coastlines. In addition, the reefs create a habitat for hundreds of other species, Wilker said.
"Overfishing, pollution and disease have reduced the oyster population by 98 percent or more since the late 1800s," he said. "Many people are now trying to reintroduce the animals to their prior habitats. Perhaps our work will add to the understanding of this shellfish and what is needed for oysters and the larger coastal ecosystem to thrive."
The Office of Naval Research and the National Science Foundation funded this research. Co-authors of the paper include Purdue graduate students Jeremy Burkett and Lauren Hight, and Paul Kenny of the Baruch Marine Field Laboratory at the University of South Carolina.
Wilker and his team will next investigate the interaction of the different components within oyster cement and use this information for developing new synthetic materials.

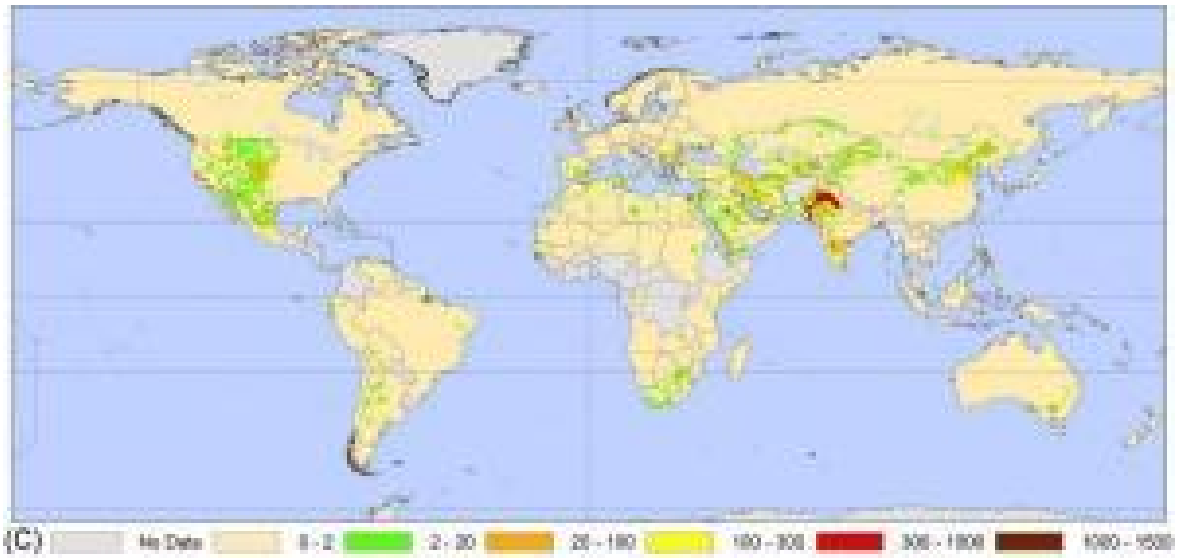
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Purdue University**. The original article was written by Elizabeth K. Gardner.

Journal Reference:

1. Jeremy R. Burkett, Lauren M. Hight, Paul Kenny, Jonathan J. Wilker. **Oysters Produce an Organic?Inorganic Adhesive for Intertidal Reef Construction**. *Journal of the American Chemical Society*, 2010; 132 (36): 12531 DOI: 10.1021/ja104996y

http://www.sciencedaily.com/releases/2010/09/100920142602.htm

Groundwater Depletion Rate Accelerating Worldwide



Global map of groundwater depletion, measured in cubic meters of water per year. (Credit: Image courtesy of American Geophysical Union)

ScienceDaily (Sep. 23, 2010) — In recent decades, the rate at which humans worldwide are pumping dry the vast underground stores of water that billions depend on has more than doubled, say scientists who have conducted an unusual, global assessment of groundwater use.

These fast-shrinking subterranean reservoirs are essential to daily life and agriculture in many regions, while also sustaining streams, wetlands, and ecosystems and resisting land subsidence and salt water intrusion into fresh water supplies. Today, people are drawing so much water from below that they are adding enough of it to the oceans (mainly by evaporation, then precipitation) to account for about 25 percent of the annual sea level rise across the planet, the researchers find.

Soaring global groundwater depletion bodes a potential disaster for an increasingly globalized agricultural system, says Marc Bierkens of Utrecht University in Utrecht, the Netherlands, and leader of the new study. "If you let the population grow by extending the irrigated areas using groundwater that is not being recharged, then you will run into a wall at a certain point in time, and you will have hunger and social unrest to go with it," Bierkens warns. "That is something that you can see coming for miles."

He and his colleagues will publish their new findings in an upcoming issue of *Geophysical Research Letters*, a journal of the American Geophysical Union.

In the new study, which compares estimates of groundwater added by rain and other sources to the amounts being removed for agriculture and other uses, the team taps a database of global groundwater information including maps of groundwater regions and water demand. The researchers also use models to estimate the rates at which groundwater is both added to aquifers and withdrawn. For instance, to determine groundwater recharging rates, they simulate a groundwater layer beneath two soil layers, exposed at the top to rainfall, evaporation, and other effects, and use 44 years worth of precipitation, temperature, and evaporation data (1958-2001) to drive the model.

Applying these techniques worldwide to regions ranging from arid areas to those with the wetness of grasslands, the team finds that the rate at which global groundwater stocks are shrinking has more than doubled between 1960 and 2000, increasing the amount lost from 126 to 283 cubic kilometers (30 to 68 cubic miles) of water per year. Because the total amount of groundwater in the world is unknown, it's hard to say how fast the global supply would vanish at this rate. But, if water was siphoned as rapidly from the Great Lakes, they would go bone-dry in around 80 years.

Groundwater represents about 30 percent of the available fresh water on the planet, with surface water accounting for only one percent. The rest of the potable, agriculture friendly supply is locked up in glaciers or the polar ice caps. This means that any reduction in the availability of groundwater supplies could have profound effects for a growing human population.

The new assessment shows the highest rates of depletion in some of the world's major agricultural centers, including northwest India, northeastern China, northeast Pakistan, California's central valley, and the midwestern United States.

"The rate of depletion increased almost linearly from the 1960s to the early 1990s," says Bierkens. "But then you see a sharp increase which is related to the increase of upcoming economies and population numbers; mainly in India and China."

As groundwater is increasingly withdrawn, the remaining water "will eventually be at a level so low that a regular farmer with his technology cannot reach it anymore," says Bierkens. He adds that some nations will be able to use expensive technologies to get fresh water for food production through alternative means like desalinization plants or artificial groundwater recharge, but many won't.

Most water extracted from underground stocks ends up in the ocean, the researchers note. The team estimates the contribution of groundwater depletion to sea level rise to be 0.8 millimeters per year, which is about a quarter of the current total rate of sea level rise of 3.1 millimeters per year. That's about as much sea-level rise as caused by the melting of glaciers and icecaps outside of Greenland and Antarctica, and it exceeds or falls into the high end of previous estimates of groundwater depletion's contribution to sea level rise, the researchers add.

Story Source:

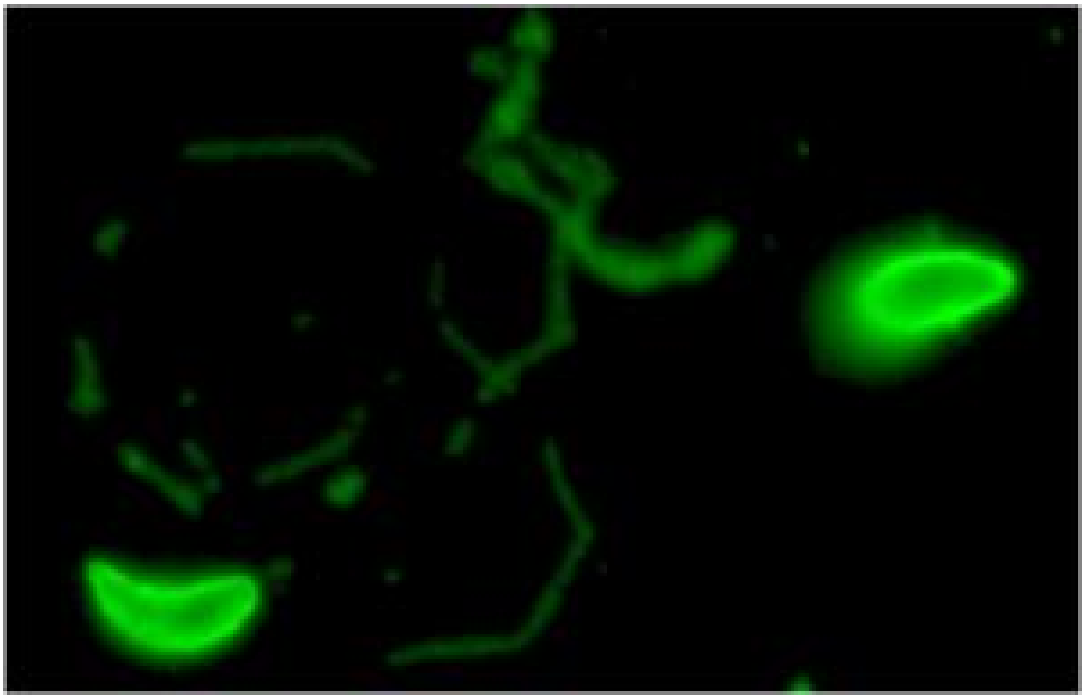
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **American Geophysical Union**.

Journal Reference:

1. Bierkens et al. **A worldwide view of groundwater depletion**. *Geophysical Research Letters*, 2010; (in press)

http://www.sciencedaily.com/releases/2010/09/100923142503.htm

Scientists Uncover Process Enabling Toxoplasmosis Parasite to Survive Homelessness



The image shows two Toxoplasma parasites outside of their host cell. The trails are proteins left behind when the parasite glides on the substrate used during the imaging process. (Credit: Courtesy Indiana University School of Medicine / Bradley Joyce)

ScienceDaily (Sep. 20, 2010) — The parasite responsible for toxoplasmosis requires a stress response system that helps it survive the move to infect new cells, Indiana University School of Medicine scientists have reported, a discovery that could lead to new treatments to control the disease.

Parasites such as *Toxoplasma gondii* invade host cells, replicate and then must exit to find new host cells to invade. Traveling outside their host cell exposes the parasites to environmental stresses that limit how long they can remain viable while searching for new host cells.

The researchers found that the parasite triggers a stress response mechanism that alters protein production through phosphorylation of a factor called eIF2, which the *Toxoplasma* parasite uses to survive periods when it finds itself without a host cell. Phosphorylation is a cellular process in which a phosphate compound is added to a protein to alter its activity.

"*Toxoplasma* does not like to be homeless," said William J. Sullivan Jr., Ph.D., associate professor of pharmacology and toxicology. "Being deprived of the nutrients and shelter provided by the host cell is a serious stress on the parasite. Our research uncovered a critical pathway the parasite uses to survive the journey from one host cell to another."

The report is being published in the online early edition of the *Proceedings of the National Academy of Sciences*. In addition to Sullivan, the researcher team included Ronald C. Wek, Ph.D., professor of biochemistry and molecular biology; lead author and postdoctoral fellow Bradley Joyce, Ph.D., and Sherry F. Queener, Ph.D., professor of pharmacology and toxicology.

Based on earlier research, the group previously reported that the same response system is employed by the parasite when its host cell is stressed, which enables *Toxoplasma* to transform into a cyst surrounded by a protective barrier that can resist drugs and the body's immune system. Later, however, the parasite can emerge from its dormant state to strike when a patient's immune system is weakened.

"Our latest findings indicate that if we design new drugs that target this stress response pathway, these drugs may be effective against both acute and chronic *Toxoplasma* infection," says Dr. Sullivan.
An estimated 60 million people in the United States are infected with the toxoplasmosis parasite, but for most infection produces flu-like symptoms or no symptoms at all. However, for people with an impaired immune system -- such as those undergoing chemotherapy, heart transplants, or people with AIDS -- the disease can cause life-threatening complications including cardiopulmonary problems, blurred vision and seizures. Also, if a woman becomes infected for the first time shortly before or during pregnancy, there is risk of miscarriage or congenital birth defects.
Support for this research was provided through grants from the American Heart Association and the National Institutes of Health.

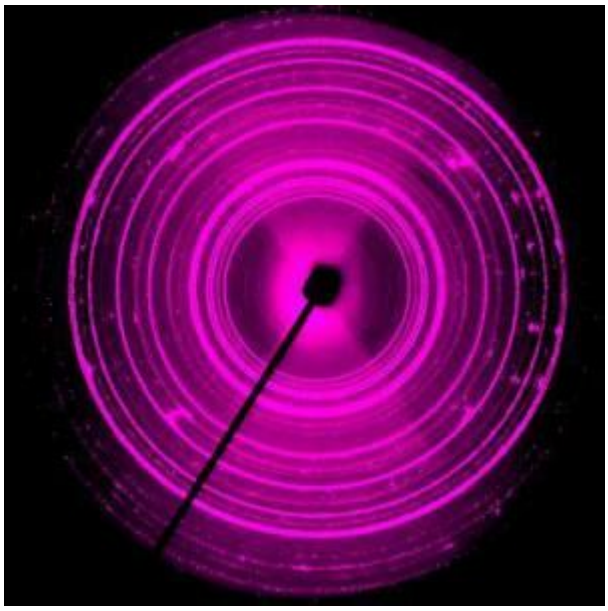
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Indiana University School of Medicine**.

Journal Reference:

1. Bradley R. Joyce, Sherry F. Queener, Ronald C. Wek, William J. Sullivan, Jr. **Phosphorylation of eukaryotic initiation factor-2α promotes the extracellular survival of obligate intracellular parasite Toxoplasma gondii**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.1007610107

http://www.sciencedaily.com/releases/2010/09/100920172740.htm

Extreme Conditions Deep in Earth's Interior Recreated



This X-ray diffraction image of a small sample of post-perovskite, which exists deep in the Earth's interior, was taken while the mineral was being compressed to pressures more than one million times atmospheric pressure. (Credit: Lowell Miyagi/Yale University)

ScienceDaily (Sep. 23, 2010) — University of California, Berkeley, and Yale University scientists have recreated the tremendous pressures and high temperatures deep in the Earth to resolve a long-standing puzzle: why some seismic waves travel faster than others through the boundary between the solid mantle and fluid outer core.

Below the earth's crust stretches an approximately 1,800-mile-thick mantle composed mostly of a mineral called magnesium silicate perovskite (MgSiO3). Below this depth, the pressures are so high that perovskite is compressed into a phase known as post-perovskite, which comprises a layer 125 miles thick at the core-mantle boundary. Below that lies the earth's iron-nickel core.

Understanding the physics of post-perovskite, and therefore the physics of the core-mantle boundary, has proven tough because of the difficulty of recreating the extreme pressure and temperature at such depths.

The researchers, led by Yale post-doctoral fellow Lowell Miyagi, a former UC Berkeley graduate student, used a diamond-anvil cell to compress an MgSiO3 glass to nearly 1.4 million times atmospheric pressure and heated it to 3,500 Kelvin (more than 3,000 degrees Celsius, or nearly 6,000 degrees Fahrenheit) to create a tiny rock of post-perovskite. They then further compressed this to 2 million times atmospheric pressure and zapped the substance with an intense X-ray beam from the Advanced Light Source (ALS) at Lawrence Berkeley National Laboratory to obtain a diffraction picture that reveals the deformation behavior of post-perovskite.

They found that the orientation of post-perovskite's crystals in the deformed rock allowed some seismic waves -- those polarized parallel to the core-mantle boundary -- to travel faster than those polarized perpendicular to it. This anisotropic structure may explain the observations of seismologists using seismic waves to probe the earth's interior.

"For the first time, we can use mineral physics with diamond-anvil cells at the ALS to get information about how this mineral, post-perovskite, performs under intense pressure," said co-author Hans-Rudolf Wenk, a Professor of the Graduate School in UC Berkeley's Department of Earth and Planetary Science and Miyagi's Ph.D. thesis advisor. "People had suggested this as an explanation for the anisotropy, but now we have experimental evidence."

"Understanding how post-perovskite behaves is a good start to understanding what's happening near the mantle's lower reaches," Miyagi said. "We can now begin to interpret flow patterns in this deep layer in the earth."

The study, which appears in the Sept. 24 issue of the journal *Science*, has important implications for understanding how the earth's internal heating and cooling processes work.

"This will give seismologists confidence in their models by matching what these observations predict with the seismic data they get," said coauthor Waruntorn "Jane" Kanitpanyacharoen, a UC Berkeley graduate student.

Post-perovskite was first recognized as a high-pressure phase in the mantle in 2004, and subsequent experiments in diamond-anvil cells have produced the mineral. Wenk and his colleagues in 2007 conducted experiments that they thought had determined the deformation behavior of post-perovskite, but which now appear to have been related to the phase transformation to post-perovskite. This transition takes place at about 1,300,000 times atmospheric pressure (127 gigaPascals) and 2,500 Kelvin (4,000 degrees Fahrenheit).

The current experiment showed that post-perovskite's crystal structure is deformed by pressure into a more elongated shape. Because seismic waves travel faster in the stretched direction, this matches the observed difference in velocity between seismic waves polarized horizontally and vertically traveling through the post-perovskite zone above the earth's core.

If scientists can gain a better understanding of the core-mantle boundary's behavior, it will give them clues as to how Earth's internal convection works there, where cool tectonic plates descend from the ocean floor through the mantle eventually nearing the dense, liquid-iron outer core, heat up, and begin moving upward again in a repeated cycle that mixes material and heat through the mantle.

"Understanding how post-perovskite behaves is a good start to understanding what's happening near the mantle's lower reaches," Miyagi said. "We can now begin to interpret flow patterns in this deep layer in the Earth."

The work was funded by the National Science Foundation, with support for the ALS from the U.S. Department of Energy.

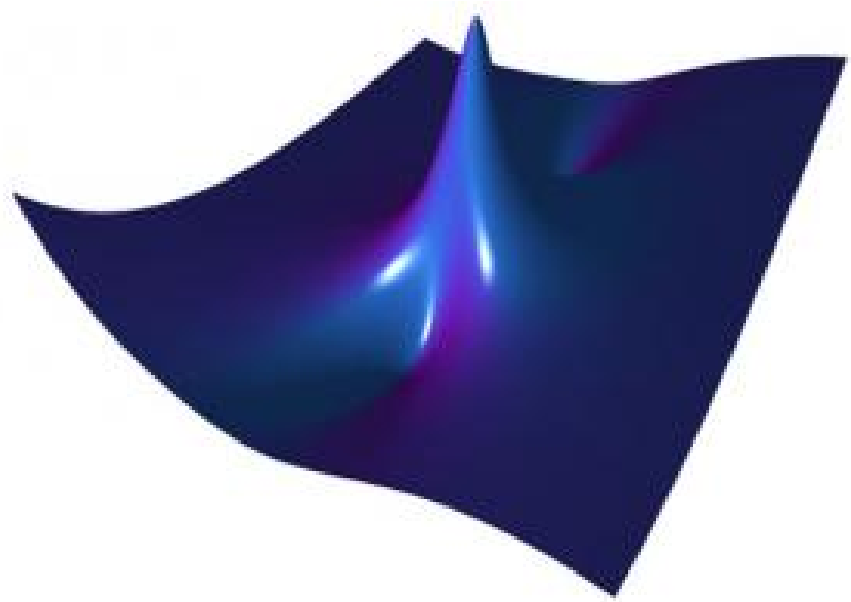
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of California -- Berkeley**.

Journal Reference:

1. Lowell Miyagi, Waruntorn Kanitpanyacharoen, Pamela Kaercher, Kanani K. M. Lee, and Hans-Rudolf Wen. **Slip Systems in $MgSiO_3$ Post-Perovskite: Implications for D'' Anisotropy**. *Science*, 2010; 329 (5999): 1639-1641 DOI: 10.1126/science.1192465

http://www.sciencedaily.com/releases/2010/09/100923142442.htm

New Light on Nonlinearity: Peregrine's Soliton Observed at Last



A figure showing a calculated Peregrine soliton upon a distorted background. This illustrates how such extreme wave structures may appear as they emerge suddenly on an irregular surface such as the open ocean. The destructive power of such a steep nonlinear wave on the ocean can be easily imagined. (Credit: Image courtesy of Suomen Akatemia (Academy of Finland))

ScienceDaily (Sep. 20, 2010) — Despite its central place as a defining object of nonlinear science for over 25 years, the unique characteristics of the Peregrine soliton have never been directly observed in a continuous physical system -- until now.

Howell Peregrine (1938-2007) was a visionary British scientist who made many fundamental contributions to applied mathematics and physics. In 1983, he discovered a particular class of mathematical solution describing giant nonlinear water waves that experience extremely rapid growth followed by just as rapid decay. His solution -- which is now known as the "Peregrine soliton" -- is derived from a complex partial differential equation known as the nonlinear Schrödinger equation (NLSE), but it has a remarkably simple mathematical structure that can be computed by any high school student. The Peregrine soliton is of great physical significance because its intense localisation has led it to be proposed as a prototype of the infamous ocean rogue waves responsible for many maritime catastrophes. It also represents a special mathematical limit of a wide class of periodic solutions to the NLSE.

Somewhat surprisingly, however, despite its central place as a defining object of nonlinear science for over 25 years, the unique characteristics of this very special nonlinear wave have never been directly observed in a continuous physical system. Until now. In a paper in the journal *Nature Physics* in August, an international research team from France, Ireland, Australia and Finland (Tampere University of Technology) reports the first observation of highly localized waves possessing near-ideal Peregrine soliton characteristics.

Interestingly, the researchers carry out their experiments using light not water, but they are able to rigorously test Peregrine's prediction by exploiting the mathematical equivalence between the propagation of nonlinear waves on water and the evolution of intense light pulses in optical fibers. Using light to perform these experiments has many advantages, not the least being that there is no physical danger to the experimenters themselves! Moreover, by building on decades of advanced development in fiber-optics and ultrafast optics instrumentation, the researchers have been able to explicitly measure the ultrafast temporal properties of the generated soliton wave, and directly and carefully compare their results with Peregrine's prediction.

The results of the international team represent the first direct measurements of Peregrine soliton localisation in a continuous wave environment in physics. In fact, the authors are careful to remark that a mathematically perfect Peregrine soliton may never actually be observable in practice, but they also show that its intense localisation appears even under non-ideal excitation conditions. This is an especially important result for understanding how high intensity rogue waves may form in the very noisy and imperfect environment of the open ocean.
Aside from their intrinsic interest in nonlinear wave theory, the results obtained by the team highlight the important role that experiments from optics can play in clarifying ideas from other domains of science. In particular, since related dynamics governed by the same NLSE propagation model are also observed in many other systems such as plasmas and Bose Einstein Condensates, the results are expected to stimulate new research directions in many other fields. They also highlight the lasting impact of Howell Peregrine's work.

Story Source:
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Journal Reference:

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Fibbing With Numbers
By STEVEN STROGATZ
PROOFINESS
The Dark Arts of Mathematical Deception

By Charles Seife
295 pp. Viking. $25.95
Charles Seife is steaming mad about all the ways that numbers are being twisted to erode our democracy. We're used to being lied to with words ("I am not a crook"; "I did not have sexual relations with that woman"). But numbers? They're supposed to be cold, hard and objective. Numbers don't lie, and they brook no argument. They're the best kind of facts we have.
And that's precisely why they can be so powerfully, persuasively misleading, as Seife argues in his passionate new book, "Proofiness." Seife, a veteran science writer who teaches journalism at New York University, examines the many ways that people fudge with numbers, sometimes just to sell more moisturizer but also to ruin our economy, rig our elections, convict the innocent and undercount the needy. Many of his stories would be darkly funny if they weren't so infuriating.
Although Seife never says so explicitly, the book's title alludes to "truthiness" — the Word of the Year in 2005, according to the American Dialect Society, which defined it as "the quality of preferring concepts or facts one wishes to be true, rather than concepts or facts known to be true." The term was popularized by Stephen Colbert in the first episode of "The Colbert Report." The numerical cousin of truthiness is proofiness: "the art of using bogus mathematical arguments to prove something that you know in your heart is true — even when it's not."
Seife emphasizes that numbers impress us. They carry authority. Joe McCarthy, for example, didn't simply allege that the government was infested with Communists; he held up a sheaf of papers and claimed it contained the names of 205 members of the Communist Party working in the State Department. The specificity of the accusation made it seem more believable. So what if the number soon went up to 207, then shrank to 57 a day later when McCarthy wrote to President Truman? What mattered is that the numbers intimidated McCarthy's critics. As it turned out, he never had any list and couldn't identify a single Communist working in the State Department. None of that stopped him from rising to national prominence on the back of his numerical lies.
Falsifying numbers is the crudest form of proofiness. Seife lays out a rogues' gallery of more subtle deceptions. "Potemkin numbers" are phony statistics based on erroneous or nonexistent calculations. Justice Antonin Scalia's assertion that only 0.027 percent of convicted felons are wrongly imprisoned was a Potemkin number derived from a prosecutor's back-of-the-envelope estimate; more careful studies suggest the rate might be between 3 and 5 percent.
"Disestimation" involves ascribing too much meaning to a measurement, relative to the uncertainties and errors inherent in it. In the most provocative and detailed part of the book, Seife analyzes the recounting process in the astonishingly close 2008 Minnesota Senate race between Norm Coleman and Al Franken. The winner, he claims, should have been decided by a coin flip; anything else is disestimation, considering that the observed errors in counting the votes were always much larger than the number of votes (roughly 200 to 300) separating the two candidates.
"Comparing apples and oranges" is another perennial favorite. The conservative Blue Dog Democrats indulged in it when they accused the Bush administration of borrowing more money from foreign governments in four years than had all the previous administrations in our nation's history, combined. True enough, but only if one conveniently forgets to correct for inflation.
Seife is evenhanded about exposing the proofiness on both sides of the political aisle, though we all know who's responsible for a vast majority of it: the other side.
He calls Al Gore to task for "cherry-picking" data about global warming. Although Seife doesn't dispute that the warming is real and that human activities are to blame for a sizable portion of it, he chastises Gore for showing terrifying simulations of what would happen to Florida and Louisiana if sea levels were to rise by 20 feet, as could occur if the ice sheets in Greenland or West Antarctica were to melt almost completely. That

possibility, while not out of the question, is generally considered an unlikely “very-worst-case” scenario, Seife writes.

Meanwhile, the Bush administration committed a more insidious form of proofiness when it crowed, in 2004, that its tax cuts would save the average family $1,586. This is technically correct, but deliberately misleading — a trick that Seife calls “apple polishing.” (Again with the fruit!) The average is the wrong measure to use when a set of numbers contains extreme outliers — in this case, the whopping refunds received by a very few, very wealthy families. In such situations, the average is far from typical. That’s why, paradoxical as it might seem, most families received less than $650.

In one of the book’s lighter moments, Seife even looks askance at the wholesome folks at Quaker Oats, who in addition to selling a “bland and relatively unappetizing product” once presented a graph that gave the visual impression that their “barely digestible oat fiber” was a “medicinal vacuum cleaner” that would reduce your cholesterol far more than it actually does. For the most part, though, he is deadly serious. A few other recent books have explored how easily we can be deceived — or deceive ourselves — with numbers. But “Proofiness” reveals the truly corrosive effects on a society awash in numerical mendacity. This is more than a math book; it’s an eye-opening civics lesson.

Steven Strogatz is a professor of applied mathematics at Cornell and a contributor to the Opinionator blog on NYTimes.com. He is the author, most recently, of “The Calculus of Friendship.”

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Evolving Circumstances, Enduring Values

By JEFF SHESOL
MAKING OUR DEMOCRACY WORK
A Judge's View

Chip Somodevilla/Getty Images

By Stephen Breyer
Illustrated. 270 pp. Alfred A. Knopf. $26.95

"If my fellow citizens want to go to hell," Justice Oliver Wendell Holmes once wrote, "I will help them. It's my job." This, for much of the last century, has stood as the purest (or at least the most pungent) distillation of "judicial restraint" — the idea that judges should, for better or worse, leave the business of governing to the people's duly elected representatives. As practiced by the jaundiced Holmes, restraint was often a shrug of the shoulders: lawmakers, in his view, were predisposed to foolishness, and the Constitution entitled them, in most cases, to be fools.

Justice Stephen Breyer, appointed to the Supreme Court by President Clinton in 1994, is also a believer in restraint. Statistics reveal that over the years, Breyer has been less willing than any of his fellow justices to overturn acts of Congress (a fact that belies the notion, peddled by conservative pundits, of liberal judges as legislators in robes, ruling the country by judicial whim). Yet Breyer, unlike Holmes, is optimistic about the outcome. He may, in fact, be the only American who still believes that members of Congress, as he has said, "really are mostly trying to do the right thing" — a faith he attributes to his years as a Congressional staff member.

That spirit pervades Breyer's provocative new book, "Making Our Democracy Work," which portrays judges not as aloof, indifferent observers of the American experiment, but as essential partners in that project. They fulfill that role, Breyer argues, by building "productive working relationships with other institutions" — Congress, the White House, states, independent agencies, school boards, lower courts and the like. He acknowledges a tension, but no contradiction, between helping these institutions operate more effectively and curbing their constitutional excesses.

In an era characterized by interbranch antagonisms, Breyer's call for cooperation may sound utopian to some. It also seems at odds with the independence of the judiciary. Yet it is neither a new nor a radical notion. In 1939, Chief Justice Charles Evans Hughes described the judicial branch as "a separate but not an independent arm of government." "In the great enterprise of making democracy workable," he argued, "we are all partners." Breyer traces this view back even further, to the nation's founding. "The Constitution's most basic objective," he writes, is "the creation of a single nation," a goal it advances "by creating political institutions strong enough to permit the 'people' to govern themselves."

The court, Breyer says, echoing Holmes, Louis Brandeis, Felix Frankfurter and other apostles of judicial restraint, keeps faith with the founders when it supports "local control and local experimentation" — when it gives other officials leeway to apply their expertise to questions of policy and law. He hastens to point out that the court need not — must not — grant them deference in every instance. It cannot abdicate its role as guardian of constitutional liberties. But it should, at the very least, "hesitate before substituting its own judgment for that of Congress" or other bodies.

When Breyer urges courts, starting with his own, to "recognize and respect the roles of other governmental institutions," one imagines Justice Antonin Scalia's eyes rolling. But Breyer's aim is not agreeability. His is not a hold-hands, link-arms, let's-be-friends jurisprudence. It is more purposeful than that. Again, Breyer's goal is for the system to work, to solve problems, to improve our national life.

Still, as a pragmatist, Breyer must know that words like "recognize" and "respect" can be as elusive in their meaning and as inexact in their application as, say, "due process," "equal protection" or any other such phrase in the Constitution. Readers of Breyer's book — whether judges, practitioners or, as the rest of us are charitably known, "nonlawyers" — will look here in vain for a quick-and-easy guide to the act of judging. Breyer sees nothing quick or easy about deciding a case. He offers no neat, pat, "grand view of law," as he puts it, no "all-encompassing theory" to match that of so-called originalists like Scalia and Justice Clarence Thomas.
Instead, Breyer embraces, indeed relishes, complexity. Like a law professor, he proceeds mostly by inductive reasoning, offering specific examples — including some of the most contentious Supreme Court cases of recent years — to show how judges can patrol constitutional boundaries while, at the same time, giving people room to govern themselves. Here, as in his previous book, "Active Liberty," Breyer places emphasis on the purposes of statutes and of constitutional provisions, the real-world consequences of judicial decisions and the need to apply the Constitution's basic values to changing circumstances.

"Making Our Democracy Work" does not ring forth with bold, rousing attestations. It is, like Breyer himself, deeply thoughtful and a little dry. But make no mistake: this is a brave book, not least because its author is a Supreme Court justice. Breyer strides right into a roiling debate — at a time when legal thinkers on the left are struggling to develop a jurisprudence with anything like the clarity (or, rather, the certainty) of that on the right. Alone among the liberal justices, Breyer has taken it upon himself to arm progressives with ideas, practical tools and, perhaps, a certain self-confidence.

They need all of the above. Though he is too civil to say so, Breyer and the court's liberals, including their newest member, Elena Kagan, are up against the most assertive and, let's just admit it, activist bloc of conservatives in modern memory. According to a recent analysis, even the right-leaning justices of the 1930s — the "Four Horsemen" who tried to derail the New Deal — are moderates when compared with John Roberts, Samuel Alito et al.

This gives Breyer's argument its edge. Restraint, he writes repeatedly — and with increasing force — is essential if the least democratic branch is to maintain its legitimacy. He opens the book, perhaps pointedly, with historical examples of outright defiance by presidents or states, of the bad old days when Supreme Court

decisions were frequently flouted. “Public acceptance is not automatic,” he warns, speaking, it seems, to the court’s conservatives. Breyer adds that “when the court proceeds down a wrong track too long,” as it did, for example, in its battle with Franklin Roosevelt over the fate of the New Deal, “the public can become aware and react,” putting the rule of law at risk.

It is surely too much to ask of a sitting justice, but one wishes Breyer would tell us just how far he thinks the Roberts court can go down its particular path before provoking a sustained political backlash like that of the 1930s — as opposed to scattered protests. Breyer’s admonitions aside, the risk of reprisal appears, at least at this point, remote. If history is any guide, the court can weather most storms of its own making. It has to get pretty far out on an ideological limb — and stay there awhile — before citizens become truly engaged. As Breyer himself notes, “the public has developed a habit” of accepting the court’s rulings, even egregious ones like Bush v. Gore. While he is right to add that the habit “cannot be taken for granted,” it, and thus the court itself, has proved pretty durable.

So the court’s conservative ascendancy has a wide margin of error. The five men in the majority seem certain to press their advantage in the term about to begin. They too believe they are making democracy work — not by helping other institutions but by frequently correcting, overriding and impeding them. Still, Breyer, it must be said, is building an argument for the ages, not a strategy for the coming term. In his mild way, he is issuing a clarion call to future generations. The Constitution, as Justice Robert H. Jackson once observed, “contemplated a really effective government,” and Breyer’s book makes clear that judges, however modest or restrained, have an indispensable role in making it work.

Jeff Shesol, the author of “Supreme Power: Franklin Roosevelt vs. the Supreme Court,” was a speechwriter for President Bill Clinton.

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Learning by Playing: Video Games in the Classroom

Gillian Laub for The New York Times
Class Media Nicole Dodson, Dakota Jerome Solbakken and Nadine Clements, students at Quest to Learn, a New York City public school, play a game they designed.

By SARA CORBETT
One morning last winter I watched a middle-school teacher named Al Doyle give a lesson, though not your typical lesson. This was New York City, a noncharter public school in an old building on a nondescript street near Gramercy Park, inside an ordinary room that looked a lot like all the other rooms around it, with fluorescent lights and linoleum floors and steam-driven radiators that hissed and clanked endlessly.
Doyle was, at 54, a veteran teacher and had logged 32 years in schools all over Manhattan, where he primarily taught art and computer graphics. In the school, which was called Quest to Learn, he was teaching a class, Sports for the Mind, which every student attended three times a week. It was described in a jargony flourish on the school's Web site as "a primary space of practice attuned to new media literacies, which are multimodal and multicultural, operating as they do within specific contexts for specific purposes." What it was, really, was a class in technology and game design.
The lesson that day was on enemy movement, and the enemy was a dastardly collection of spiky-headed robots roving inside a computer game. The students — a pack of about 20 boisterous sixth graders — were meant to observe how the robots moved, then chart any patterns they saw on pieces of graph paper. Later in the class period, working on laptops, they would design their own games. For the moment, though, they were spectators.
Doyle, who is thin and gray-haired with a neatly trimmed goatee, sat at a desk in the center of the room, his eyeglasses perched low on his nose, his fingers frenetically tapping the keyboard of a MacBook. The laptop was connected to a wall-mounted interactive whiteboard, giving the students who were sprawled on the floor in front of it an excellent view of his computer screen. Which was a good thing, because at least as they saw

it, Doyle was going to die an embarrassing death without their help. Doyle had 60 seconds to steer a little bubble-shaped sprite — a toddling avatar dressed in a royal blue cape and matching helmet — through a two-dimensional maze without bumping into the proliferating robots. In order to win, he would need to gobble up some number of yellow reward points, Pac-Man style.

"Go right! Go right! Go right!" the students were shouting. "Now down, down, down, downdowndown!" A few had lifted themselves onto their knees and were pounding invisible keyboards in front of them. "Whoa!" they yelled in unison, some of them instinctively ducking as Doyle's sprite narrowly avoided a patrolling enemy.

Beauchamp, a round-faced boy wearing a dark sweatshirt, watched Doyle backtrack to snap up more points and calmly offered a piece of advice. "That extra movement cost you some precious time, Al," he said, sounding almost professorial. "There are more points up there than what you need to finish."

"How much time do I have?" Doyle asked.

"Nineteen seconds."

"Thanks," said Doyle, his eyes not leaving the screen. He added, "See, us older people, we don't have the peripheral vision to check the time because we didn't grow up with these games."

For a few seconds, it was quiet. Doyle pinged through a row of reward points and then, hitting a little cul-de-sac in the maze, he paused. His avatar's tiny yellow feet pedaled uselessly against a wall. The students began to yowl. A girl named Shianne pressed her hand to her forehead in faux anguish.

"Go! Go! Turn around. Don't slow down. What are you *waiting for*?" someone called out.

"How much time do I have left?"

"Thirteen seconds!"

Doyle smiled. "All the time in the world," he said, before taking his sprite on a deliberate detour to get even more reward points. The move, like a premature touchdown dance, put his students in agony.

"To the goal! To the goal! Al, run to the goal!"

And as the clock wound down and the students hollered and the steam radiator in the corner let out another long hiss, Doyle's little blue self rounded a final corner, waited out a passing robot and charged into the goal at the end of the maze with less than two seconds to spare. This caused a microriot in the classroom. Cheers erupted. Fists pumped. A few kids lay back on the floor as if knocked out by the drama. Several made notes on their graph paper. Doyle leaned back in his chair. Had he taught anything? Had they learned anything? It depended, really, on how you wanted to think about teaching and learning.

WHAT IF TEACHERS GAVE UP the vestiges of their educational past, threw away the worksheets, burned the canon and reconfigured the foundation upon which a century of learning has been built? What if we blurred the lines between academic subjects and reimagined the typical American classroom so that, at least in theory, it came to resemble a typical American living room or a child's bedroom or even a child's pocket, circa 2010 — if, in other words, the slipstream of broadband and always-on technology that fuels our world became the source and organizing principle of our children's learning? What if, instead of seeing school the way we've known it, we saw it for what our children dreamed it might be: a big, delicious video game?

It is a radical proposition, sure. But during an era in which just about everything is downloadable and remixable, when children are frequently more digitally savvy than the adults around them, it's perhaps not so crazy to think that schools — or at least one school, anyway — might try to remix our assumptions about how to reach and educate those children. What makes Quest to Learn unique is not so much that it has been loaded with laptops or even that it bills itself expressly as a home for "digital kids," but rather that it is the brainchild of a professional game designer named Katie Salen. Salen, like many people interested in education, has spent a lot of time thinking about whether there is a way to make learning feel simultaneously more relevant to students and more connected to the world beyond school. And the answer, as she sees it, lies in games.

Quest to Learn is organized specifically around the idea that digital games are central to the lives of today's children and also increasingly, as their speed and capability grow, powerful tools for intellectual exploration. Salen, a professor of design and technology at Parsons the New School for Design, also directs a research-based organization called Institute of Play, which examines the connections between games and learning. Working with Robert Torres, a learning scientist who is a former school principal, and a small team of

curriculum and game designers, Salen spent two years planning Quest to Learn in conjunction with the education-reform group New Visions for Public Schools. Her work was financed by a research grant from the MacArthur Foundation, which is pouring $50 million into exploring the possibilities of digital media and learning in a variety of settings nationwide. The school was approved by New York City's schools chancellor, Joel Klein, as one of a handful of "demonstration sites" for innovative technology-based instructional methods and is part of a larger effort on the city's part to create and experiment with new models for schools. Quest to Learn is now beginning its second year, with about 145 sixth and seventh graders, all of whom were admitted by a districtwide lottery. (The intention is to add a grade level each year until it is a 6th-through-12th-grade school; Quest to Learn recently relocated to a larger but equally unmodern building in Chelsea.) Operating on a public-school budget but powered by additional grants from the MacArthur Foundation and the Bill and Melinda Gates Foundation, among others, it is a well-financed and carefully watched educational experiment concerning children, video games and the thrumming, largely unexplored force field between them.

Salen and Torres are at the forefront of a small but increasingly influential group of education specialists who believe that going to school can and should be more like playing a game, which is to say it could be made more participatory, more immersive and also, well, fun. Nearly every aspect of life at Quest to Learn is thus designed to be gamelike, even when it doesn't involve using a computer. Students don't receive grades but rather achieve levels of expertise, denoted on their report cards as "pre-novice," "novice," "apprentice," "senior" and "master." They are enlisted to do things like defeat villains and lend a hand to struggling aliens, mostly by working in groups to overcome multifaceted challenges, all created by a collection of behind-the-scenes game designers. The principles are similar to those used in problem-based learning, a more established educational method in which students collaborate to tackle broad, open-ended problems, with a teacher providing guidance though not necessarily a lot of instruction. But at Quest to Learn, the problems have been expertly aerated with fantasy.

Once it has been worked over by game designers, a lesson doesn't look like a lesson anymore. It is now a quest. And while students at the school are put through the usual rigors of studying pre-algebra, basic physics, ancient civilizations and writing, they do it inside interdisciplinary classes with names like Codeworlds — a hybrid of math and English class — where the quests blend skills from different subject areas. Students have been called upon to balance the budget and brainstorm business ideas for an imaginary community called Creepytown, for example, and to design architectural blueprints for a village of bumbling little creatures called the Troggles. There are elements of the school's curriculum that look familiar — nightly independent reading assignments, weekly reading-comprehension packets and plenty of work with pencils and paper — and others that don't. Quest to Learn students record podcasts, film and edit videos, play video games, blog avidly and occasionally receive video messages from aliens.

They also spend significant time building their own games. Sometimes they design board games using cardboard and markers and ungodly amounts of tape. Most of the time, though, they invent games for the computer. Salen's theory goes like this: building a game — even the kind of simple game a sixth grader might build — is equivalent to building a miniworld, a dynamic system governed by a set of rules, complete with challenges, obstacles and goals. At its best, game design can be an interdisciplinary exercise involving math, writing, art, computer programming, deductive reasoning and critical thinking skills. If children can build, play and understand games that work, it's possible that someday they will understand and design systems that work. And the world is full of complicated systems.

Does this educational approach actually work? And is it something that can, or should, find its way into schools in other parts of the country? As we fret about the perils of multitasking and digital distraction in adult life, the question arises: should a school provide practice with or relief from those things? It is still too early to say. But the introduction of Quest to Learn is tied to a continuing and sometimes heated national dialogue about what skills today's learners most need to prepare them for success in a rapidly evolving, digitally mediated world. There is, at least, growing support for experimentation: in March, Arne Duncan, the secretary of education, released a draft National Educational Technology Plan that reads a bit like a manifesto for change, proposing among other things that the full force of technology be leveraged to meet "aggressive goals" and "grand" challenges, including increasing the percentage of the population that graduates from

college to 60 percent from 39 percent in the next 10 years. What it takes to get there, the report suggests, is a "new kind of R.& D. for education" that encourages bold ideas and "high risk/high gain" endeavors — possibly even a school built around aliens, villains and video games.

SALEN IS 43, reddish-haired, hyperorganized and a quirky dresser. Some would consider her an unlikely prophet when it comes to education. Among Quest to Learn students, she is clearly beloved. Unlike most authority figures they know, she is a gifted player of Guitar Hero and has been spotted playing her Nintendo DSi on the subway. Until a few years ago she knew little about educational pedagogy and was instead immersed in doing things like converting an ice-cream truck into a mobile karaoke unit that traveled around San Jose, Calif., with a man dressed as a squirrel dispensing free frozen treats and encouraging city residents to pick up a microphone and belt out tunes. This was a community-building sort of game — or as Salen describes it, "an interactive play-based experience" — as was the race she helped design in Minneapolis and St. Paul, in which randomly organized groups of people carried 25-foot-high inflatable playing pieces modeled after those used in the board game Sorry through the streets of the cities.

A game, as Salen sees it, is really just a "designed experience," in which a participant is motivated to achieve a goal while operating inside a prescribed system of boundaries and rules. In this way, school itself is one giant designed experience. It could be viewed, in fact, as the biggest and most important game any child will ever play. To this end, Quest to Learn has three full-time game designers supporting the work of the school's 11 teachers — a ratio that reflects a trend more familiar to the business world, where designers and design-thinking have ascended to new and voguish heights.

Salen, like many designers, views things in terms of their ideal potential and also the physical space they occupy. She is thus less apt to refer to a school as "school" but rather as a "learning space" or a "discovery space" or sometimes as a "possibility space." She and her colleagues are wrapped up in the idea that technology is doing for learning what it has done for pretty much every other aspect of living, which is to say that it has dismantled the walls between spaces. As anyone who has ever checked e-mail from a bathroom stall or browsed eBay from a chairlift can attest, what once occurred in just one space now happens in practically every space. This has revolutionized design, media, most workplaces and especially the lives of children, who routinely tap into vast social and information pools outside school. Yet, generally speaking, it has hardly touched public education.

The traditional school structure strikes Salen as "weird." "You go to a math class, and that is the only place math is happening, and you are supposed to learn math just in that one space," she told me one day, sitting in the small room at the school that served as Quest to Learn's operational headquarters. She was dressed in a purple skirt with a hot pink scarf knotted around her neck. "There's been this assumption that school is the only place that learning is happening, that everything a kid is supposed to know is delivered between 8 a.m. and 3 p.m., and it happens in the confines of a building," she said. "But the fact is that kids are doing a lot of interesting learning outside of school. We acknowledge that, and we are trying to bring that into their learning here."

WAITING IN THE HALLWAY LINE to go into Sports for the Mind class one day last winter, I met a boy named Kai Goree. He was dressed in a red T-shirt, jeans and sneakers. He had a puckish mouth, vivid brown eyes and short dark hair, pieces of which had been dyed in vibrant shingles of blue and green, not unlike what you might expect to find on the roof of a fairy-tale house.

Kai was 11. He sometimes got into trouble with teachers for talking too much. In the next 10 minutes, as we wandered into class and found seats and waited for everybody else to settle in, plus a few minutes beyond that, Kai relayed the following bits of information: he lived with his parents and older brother in an apartment on East 56th Street. He was a huge fan of professional wrestling. At home he sometimes filmed and edited his own wrestling-news commentaries or demonstrated wrestling moves on a giant plush gorilla he had named Green Gangsta. Then he put them on YouTube, where he had several personal channels. At home, his family had a "very awesome big computer." He also had an Android phone, but at that point was lusting after a Flip camera and a MacBook as well. He preferred OS X, but his dad, alas, was "a die-hard Windows fan," so the prospects for a Mac were unclear. If I was interested, I could follow him on Twitter. (Sample post from Kai: "I AM SO ANGRY. My mom is not letting me get a coolatta from dunkin donuts…") He used to have a blog, but it took too much time so he dropped it.

What he cared about most was games. “Games and games and games,” he said. He had been playing games since he was about 18 months old, when his mother, who is a college professor, introduced him to a computer game called Reader Rabbit, intended to teach literacy skills. Like many of his friends, as he grew, he migrated from educational computer games to hand-held games to the Xbox 360.

At the start of middle school, Kai was almost a full decade into his digital life. This might have put him slightly ahead of his peers, but also, arguably, it made him more like the sixth grader of the near future. Research shows that, on average, children who have access to computers have mastered pointing and clicking with a mouse by the time they are 3½. They are also, thanks in part to mobile-phone apps, playing more games earlier in life. According to research by the Joan Ganz Cooney Center, an arm of the Sesame Workshop that explores the educational potential of interactive media, 60 percent of the top-selling iPhone apps on the education store are made for toddlers and preschoolers.

In the evenings, once he met the requirements for parental face time and homework, Kai could be found riding an armored dune buggy around a post-apocalyptic African landscape, blasting his machine gun at squads of alien jackals (Halo 3) or catching and juking for a touchdown (Madden NFL 09) or maybe adding wikki wikki scratches to a Jay-Z tune (DJ Hero). Sometimes he fired up the family Wii and did virtually assisted yoga. I came to learn that Kai could dissect, analyze and recommend video games with the acuity of a French sommelier. He was waiting anxiously, he said, to hear back from “some people at Lucas” who may or may not use him to beta test a multiplayer Star Wars game that wasn’t yet on the market.

Kai’s passion for games was unusual, but only a little. Earlier this year, the Kaiser Family Foundation released the results of a national survey in which 60 percent of children 8 to 18 reported that a typical day included playing games on hand-held or console devices. Their average daily investment was about two hours. According to Kaiser’s data, the percentage of children playing digital games has increased by more than 50 percent in the last 10 years, and the amount of time they spend playing games has almost doubled. This follows research showing that the more time children spend playing video games, the less time they spend on homework. For educators, it’s a sorry equation and one that mirrors a larger paradox when it comes to the divergent and often competing paths of children and their schools.

Even as technology spending in K-12 public education has risen steadily in the last 20 years, student performance — as measured by test results — has improved only incrementally. Meanwhile, children are proving to be wildly adaptive when it comes to using media outside school. They are fervently making YouTube videos, piloting avatars through complex game scenarios, sampling music, lighting up social networks and inventing or retooling (or purists would say, bludgeoning) language so that it better suits the text-messaging pay plan on their cellphones, only to show up to school to find cellphones outlawed, Internet access filtered and computers partitioned off from the rest of the classroom — at least in many cases. Michael H. Levine, who directs the Joan Ganz Cooney Center, acknowledges the conundrum. While there may be sound reasons behind limiting things like Internet browsing and social networking at school, he says, it does little to teach students how to live in the 21st century. It also may contribute to a broader relevancy issue. A 2006 study financed by the Bill and Melinda Gates Foundation set out to examine the reasons that almost a third of American public-high-school students fail to graduate with their class. Researchers surveyed high-school dropouts in 25 cities, suburbs and small towns across the country, where they were told again and again that school was boring. The final report recommended, among other things, that educators take steps to “make school more relevant and engaging.”

One way to do this, according to Levine, would be to stop looking so critically at the way children use media and to start exploring how that energy might best be harnessed to help drive them academically. “Kids are literally wearing digital media,” he says. “It’s present everywhere in their lives, except for in the learning environment.” A game-based approach like that used at Quest to Learn shows a lot of promise, he says, in part because it capitalizes on something kids already love. He is careful to note that there will be “huge challenges” in bringing the idea to schools nationally. Clearly, not every community is going to have the money for interactive whiteboards, laptops and PlayStation consoles. Someone will also need to figure out how to train teachers, develop curriculums, establish assessment measures and decide to what extent the focus on systems thinking and design skills used in game-based learning should be tied to common standards — and win over parents. “Odds are it will take a long time,” Levine says. “But I don’t know what the alternative is.

My view of it is that we will never get to the holy land in terms of educational performance unless we do something about the engagement factor."

Often, watching the students and teachers at Quest to Learn, I was struck by how enviably resource-rich the school was, with its game designers and curriculum specialists and a full-time technologist wheeling carts of netbooks up and down the hallway. Salen recently told me that she is hoping to find a corner of the school where she can set up Rock Band — a video game in which users play drums, guitar and bass — "for teachers to unwind around." The school functioned with the intensity of a high-stakes start-up. It was clear the staff members worked long hours. Still, if Quest to Learn was a "possibility space" — a sort of laboratory for the future of learning — you could also see how those possibilities might feel entirely out of reach to an educator working in a more typically cash-strapped, understaffed school.

Yet with the federal government focusing more on innovation, and given the deep pockets of similarly focused corporate foundations, it may be feasible to implement game-based learning, even modestly, into more schools. But not before it has been proved to work. Quest to Learn students who took federally mandated standardized tests last spring scored on average no better and no worse than other sixth graders in their district, according to Elisa Aragon, the school's executive director. Valerie Shute, an assessment specialist in the educational psychology and learning systems department at Florida State University, is working on a MacArthur-financed effort to develop and test new assessment measures for Quest to Learn, which are meant to look at progress in areas like systems thinking, teamwork and time management. The federal government is likewise sponsoring an overhaul of standardized tests to be introduced in the 2014-2015 school year, with added emphasis on "higher order" thinking and problem-solving skills.

Quest to Learn's most innovative piece of technology was set up in a corner of one classroom, looking something like an extremely wired stage set. This was the school's $18,000 Smallab, which stands for "situated multimedia art learning lab," a system now being used in a handful of schools and museums around the country. Created by a team led by David Birchfield, a media artist at Arizona State University, it is a 3-D learning environment, or in designspeak, a "hybrid physical-digital space."

In Smallab sessions, students hold wands and Sputnik-like orbs whose movements are picked up by 12 scaffold-mounted motion-capture cameras and have an immediate effect inside the game space, which is beamed from a nearby computer onto the floor via overhead projector. It is a little bit like playing a multiplayer Wii game while standing inside the game instead of in front of it. Students can thus learn chemical titration by pushing king-size molecules around the virtual space. They can study geology by building and shifting digital layers of sediment and fossils on the classroom floor or explore complementary and supplementary angles by racing the clock to move a giant virtual protractor around the floor.

As new as the Smallab concept is, it is already showing promise when it comes to improving learning results: Birchfield and his colleagues say that in a small 2009 study, they found that at-risk ninth graders in earth sciences scored consistently and significantly higher on content-area tests when they had also done Smallab exercises. A second study compared the Smallab approach with traditional hands-on lab experimentation, with the group that used mixed-reality again showing greater retention and mastery. As it is more generally with games, the cognitive elements at work are not entirely understood, but they are of great interest to a growing number of learning scientists. Did the students learn more using digital mixed-reality because the process was more physical than hearing a classroom lecture or performing a lab experiment? Because it was more collaborative or more visual? Or was it simply because it seemed novel and more fun?

HERE ARE SOME DIFFERENCES between Kai and me: Kai hates Justin Bieber whereas I only dislike him. Kai sends and receives about 50 text messages a day. My average is about 4. My idea of leisure involves wandering aimlessly and anonymously through the local bookstore whereas Kai — "not a fan of books" — can be found hanging around the Apple Store on Fifth Avenue, where he is on a first-name basis with employees. When I am sick with a cold, I sit at home flipping through magazines and not really wanting to be seen by anyone. When Kai is sick with a cold, he sits at home and makes YouTube videos. ("If I sneeze during this video," he tells the camera, "don't yell at me.") We also feel very differently, it turns out, about the game Halo. Kai sees it as having amazing graphics and a great story line and violence, "but only against aliens," he says. I see it mostly as violent.

One night at Kai's apartment, we turned on the Xbox and played Halo 3 as teammates. He played the role of Master Chief, the ultimate superwarrior, and I was a friendly alien who liked to fight. It started like this: I sat on the couch, and Kai sat on the floor in front of the TV. He said, "You get the machine gun, and I'll drive the car." I'm not really sure what happened after that. I would call it a nine-minute-long, jackhammering bloodbath, in which we (me poorly, Kai deftly) killed a lot of bad aliens until my lack of experience almost cost our team the game, and — a little sweaty and yes, totally excited — I handed my controller off to Kai's 14-year-old brother, Sam.

It was, for me, a reminder of how confusing it can be to think about video games and schools in the same frame. Not only has excessive gaming — much like excessive TV watching — been associated with obesity and depression, but playing violent games has been linked in some studies to an increase in aggressive behavior. Advocates of game-based learning concede that these games can be spectacularly gory, amoral and loud, even when they are artful and complicated. They like to point out that the majority of games sold commercially are not particularly violent and are rated "E" — for "everyone."

And then this: Brain researchers have found that playing first-person shooter games like Call of Duty does seem to have some neurological benefits, including improving peripheral vision and the ability to focus attention. The playing of shooter games has also been shown to enhance something called visual-spatial thinking — for example, the ability to rotate objects in one's mind — which, it turns out, is a cognitive building block for understanding concepts in science and engineering. Women, who tend to score lower when tested for visual-spatial skills, apparently gain more from virtual machine-gun outings than men: a 2007 study done at the University of Toronto showed that women who played just 10 hours of an action-oriented video game (Medal of Honor: Pacific Assault) not only improved their spatial attention and mental-rotation abilities more significantly than their male counterparts, but the game-play also appeared to substantially reduce any sex-related gaps in visual-spatial thinking abilities. Five months later, the effects still held. (Bad news for pacifists: a control group that played a stimulating but nonviolent 3-D video puzzle game showed no measurable improvement.)

Unsurprisingly, no one I spoke with who works in the field of games and learning says that first-person shooter games are the key to building future scientists and engineers. One topic under discussion is the broader question of "transfer," whether a skill developed by playing a game actually translates to improved abilities in other areas. They also note that we are only just beginning to tease apart the mechanisms that make game play so powerful. And inside those mechanisms, there is at least potential to advance our country's educational aims — if only we can sort out how we feel about games. Even the first family has sent mixed messages: President Obama has criticized video games for displacing family time and physical activity — urging parents, for example, to "turn off the TV, put away the video games and read to your child" — but he has also encouraged the development of new games to bolster the all-important science, technology, engineering and math (STEM) skills in young Americans. In March, Michelle Obama helped introduce a government-sponsored design contest to reward those who create mobile-phone games and apps to combat obesity, lamenting at a national Parent Teacher Association conference that "we know our kids spend way too much time with these games," but that at least the time could be spent more productively. The cognitive dissonance is likely familiar to any parent: she has also admitted, cheerfully, to owning a Wii.

WHEN IT COMES TO CAPTURING and keeping the attention of children, game designers appear to be getting something right that schools, in many cases, are getting wrong. James Paul Gee, a professor of literacy studies at Arizona State University who grew interested in video games when his son began playing them years ago, has written several seminal books on the power of video games to inspire learning. He says that in working through the levels of a complex game, a person is decoding its "internal design grammar" and that this is a form of critical thinking. "A game is nothing but a set of problems to solve," Gee says. Its design often pushes players to explore, take risks, role-play and strategize — in other words putting a game's informational content to use. Gee has advocated for years that our definition of "literacy" needs to be widened to better suit the times. Where a book provides knowledge, Gee says, a good game can provide a learner with knowledge and also experience solving problems using that knowledge.

Slowly, this idea has won some unlikely converts. The retired Supreme Court Justice Sandra Day O'Connor recently introduced a Web site called iCivics, which features a series of interactive games meant to animate

and revive the lost art of learning civics. “She was relatively hostile toward games,” says Gee, who collaborated with her on the project, “and now she’s a fan.” E. O. Wilson, the renowned Harvard evolutionary biologist, has lauded digital games for their ability to immerse and challenge players in vivid, virtual environments. “I think games are the future in education,” Wilson said in an interview with the game designer Will Wright last year. “We’re going through a rapid transition now. We’re about to leave print and textbooks behind.”

In a speech given the day before the start of the 2009 G-20 economic summit, Eric Schmidt, the chief executive of Google, offered his own tacit approval, suggesting that playing video games, especially online multiplayer games, fosters collaboration, and that collaboration, in turn, fosters innovation — making it good training for a career in technology. “Everything in the future online is going to look like a multiplayer game,” Schmidt said. “If I were 15 years old, that’s what I’d be doing right now.”

All this goes back to the debate over what constitutes “21st-century skills.” How do schools manage to teach new media without letting go of old media? Is it possible to teach game design and still find time for “The Catcher in the Rye”? One afternoon at Quest to Learn, I sat with Al Doyle in an empty office. Doyle had been teaching Sports for the Mind for only a few months — and at the end of the school year, he would end up leaving Quest to Learn to teach game design at a private school elsewhere in Manhattan — but the experience was causing him to think differently about what schools should be teaching. His students were building 3-D computer games and had also just finished a unit on podcasting. “Ten years ago, it would have taken a week to get kids to learn the difference between ‘save’ and ‘save as,’ ” he said. “Now I show them GarageBand” — a digital audio sequencer produced by Apple — “and five minutes later they’re recording and editing sound.” Doyle made a point that others had also made: whatever digital fluidity his students possessed, it hadn’t been taught to them, at least not by adults.

Here, perhaps, was a paradigm shift. As Doyle saw it, his role was moving from teaching toward facilitating, building upon learning being done outside school. He talked about all the wasted energy that goes into teaching things that students don’t need so much anymore, thanks to the tools now available to them. Why memorize the 50 states and their capitals? Why, in the age of Google and pocket computers, memorize anything? “Handwriting?” Doyle said. “That’s a 20th-century skill.” Realizing this sounded radical, he amended his thought, saying that students should learn to write, but that keyboarding was far more important. He took aim at spelling, calling it “outmoded.” Then he went back to podcasting, saying that after a student has written, revised, scripted and recorded a podcast, “it’s just as valid as writing an essay.”

I must have been wearing the shocked expression of an old-guard English major, because Doyle tried to put a finer point on it. “We feel like we’re preparing these kids to be producers of media — whether they become graphic designers, video designers, journalists, publishers, communicators, bloggers, whatever,” he said. “The goal is that they’re comfortable expressing themselves in any media, whether it’s video, audio, podcast, the written word, the spoken word or the animated feature.” He added: “Game design is the platform that we can hook them into because this is where they live. Video games are more important to them than film, than broadcast television, than journalism. This is their medium. Games are this generation’s rock and roll.”

SPEND TIME AT a middle school — even a hyperinnovative one like Quest to Learn — and one thing becomes immediately apparent: Being a sixth grader is a timeless art. Kids chew gum when they’re not supposed to. They ask for hugs from teachers when they need them. They get rowdy in gym class, dip Oreos in their chocolate-milk cartons at lunch, pick bits of food out of their braces and shout things like, “Hey, your epidermis is showing!” There is little they like to do quietly.

“I am *really sorry* it is taking you so long to sit in your chairs today,” an aggrieved Doyle was calling over the din one morning at the start of class. In the brief quiet that followed, he announced that, connected to work they were doing on ancient architecture, each student was to design a game that took place inside either a labyrinth, a pyramid or a cave. This would happen using an online game-making platform called Gamestar Mechanic, which was developed by Katie Salen and a team and is soon to be sold commercially. The platform allows users to learn game-making skills without being versed in programming language.

A hand shot up. It was Ellisa, a diminutive girl who wore her hair in a giant ponytailed puff on one side of her head. “Al, can I do a game with a cave, a pyramid and a labyrinth?”

“Sorry, you may not.”

Another hand. “What about a pyramid with a labyrinth inside of it?”
Doyle shook his head. “Just one,” he said.
Sitting in front of laptops, the students started in on their game-building, each one beginning with a blank screen. They created borders, paths and obstacles by dragging and dropping small cubes from a menu. They chose an animated sprite to serve as a game’s protagonist. They picked enemy sprites and set them marching in various patterns around the screen. They wrote the text that introduced the game and the text that flashed when a player reaches a new level. (“If the entrance to your cave is being guarded by a bear or a woolly mammoth,” said Doyle, sounding teacherly, “you have to tell us it’s a bear or a woolly mammoth.”) They added a variety of rewards and punishments. If the game seemed too easy, they made it harder. If the game seemed too hard, they made it easier. Earlier that day, I watched a girl named Maya make a game. She created a labyrinth, changed all the colors, swapped enemies in and out, changed the background, changed the music and finally set the game’s timer to 90 seconds. Then she played her game and finished it in 75. She adjusted the timer to 75 seconds and played again, this time losing. Finally, she set the timer at 80 and beat the game, but only just barely, at which point she declared the whole thing perfect.
The work appeared simple, but the challenge was evident. Twenty minutes in, the Sports for the Mind classroom was hushed but for the sound of keyboards being pounded and a faint arcadelike cacophony of poinging and bleeping over the syncopated pulse of game music. That night for homework, they would play one another’s games and write up constructive critiques.
The gold standard in class, I was told by nearly every student I spoke with, was to create a game that was hard to beat but harder still to quit. Kai was sitting in one corner working on a game he named What the Cave. It was teeming with robot enemies. “The whole point,” Kai said, “is you want your game to be hard, but you want it to be good.” He studied his screen for a moment. Then using his mouse, he deftly deleted a row of enemies. “What you want,” he said finally, “is good-hard.”
The language of gamers is, when you begin to decipher it, the language of strivers. People who play video games speak enthusiastically about “leveling up” and are always shooting for the epic win. Getting to the end of even a supposedly simple video game can take 15 or more hours of play time, and it almost always involves failure — lots and lots of failure.
This concept is something that Will Wright, who is best known for designing the Sims game franchise and the 2008 evolution-related game Spore, refers to as “failure-based learning,” in which failure is brief, surmountable, often exciting and therefore not scary. A well-built game is, in essence, a series of short-term feedback loops, delivering assessment in small, frequent doses. This in the end may be both more palatable and also more instructive to someone trying to learn. According to Ntiedo Etuk, the chief executive of Tabula Digita, which designs computer games that are now being used in roughly 1,200 schools around the country, children who persist in playing a game are demonstrating a valuable educational ideal. “They play for five minutes and they lose,” he says. “They play for 10 minutes and they lose. They’ll go back and do it a hundred times. They’ll fail until they win.” He adds: “Failure in an academic environment is depressing. Failure in a video game is pleasant. It’s completely aspirational.”
It is also, says James Paul Gee, antithetical to the governing reality of today’s public schools. “If you think about kids in school — especially in our testing regime — both the teacher and the student think that failure will lead to disaster,” he says. “That’s pretty much a guarantee that you’ll never get to truly deep learning.” Gee and others in the games-and-learning field have suggested that someday, if we choose to channel our resources into developing more and better games for use in classrooms, the games themselves could feasibly replace tests altogether. Students, by virtue of making it through the escalating levels of a game that teaches, say, the principles of quantum physics, will demonstrate their mastery simply by finishing the game. Or, as Gee says: “Think about it: if I make it through every level of Halo, do you really need to give me a test to see if I know everything it takes to get through every level of Halo?”
One day last spring, Jan Plass, a professor of educational communication and technology at New York University, and I were sitting in a classroom at the Urban Assembly Institute of Math and Science for Young Women, a girls-only public middle school in Brooklyn, where he and several graduate students were conducting research. Plass works at an organization called the Games for Learning Institute, directed by Ken

Perlin, an N.Y.U. computer-science professor, that is dedicated to exploring the granular details of what makes games so mesmerizing and effective for learning.

We were watching a small group of sixth-to-eighth-grade girls play a relatively low-tech math game on a series of laptops. The girls played in pairs, solving equations to score points. All the while, the laptops' built-in cameras recorded their voices and faces, while an imbedded piece of software tracked their movements inside the game. What Plass and his research team were hoping to find inside this data — which was being collected at 12 New York schools — were answers about whether children learn more when playing individually or collaboratively. (In order to measure progress, researchers gave the students tests before and after the game playing.)

Two of the girls were talking and pointing at the screen. "They're spending time discussing how to solve the problem," Plass said in a low voice. "They might not solve as many problems. But the question for us is whether the conversation adds to the learning, versus if they spent their time on more practice. Does discourse result in deeper processing?"

A question like this is, of course, as old as Socrates and not at all limited to game-oriented learning. But given that digital games like those designed by Plass and his colleagues allow researchers to capture and examine a student's second-by-second decision-making, they offer what seem to be uniquely refined opportunities to peer into the cognitive process. What they are studying, Plass said, is the science behind focused engagement — a psychological phenomenon known as "flow."

Much of this work is still in its infancy. Neuroscientists have connected game play to the production of dopamine, a powerful neurotransmitter central to the brain's reward-seeking system and thought to drive motivation and memory processing (and more negatively, addictive behaviors) — all of which could have implications for how, when and what type of games should be used to advance children's learning. But as it is with just about everything involving teaching and learning, there are no simple answers. Games, for example, appear to trigger greater dopamine releases in men than women, which could mean that game-based learning is more effective with boys than girls. Or, says Plass, it could be a matter of design: ideally, games can be built in such a way that they adapt to the individual learning styles of their players.

Paul Howard-Jones, a neuroscientist who teaches in the graduate school of education at the University of Bristol in Britain and coordinates the NeuroEducational Research Network, says that dopamine sends a "ready to learn" signal to the brain, essentially priming it to receive new information pleasurably. His research has shown that children's engagement levels are higher when they are anticipating a reward but cannot predict whether they will get it — or, as Howard-Jones put it to me, "when you move from a conventional educational atmosphere to something that more resembles sport." He is careful to add that games are not meant to supplant teachers nor undermine the value of more traditional learning. "Children need to learn how to read a book," he says. "They need to learn how to ask questions." But as our understanding of both cognitive science and game design continues to advance, he says that game play will find a central place inside schools. "I think in 30 years' time," he says, "we will marvel that we ever tried to deliver a curriculum without gaming."

One day last winter, I watched students at Quest to Learn playing with a different sort of technological tool — a newly introduced online social network for the school that had been built by Salen and her team of designers and was open to students, staff members and parents. The network, called Being Me, looked like a starter Facebook. In the coming weeks, mostly through the school's wellness class, students would work on learning things like how to tag photos, update their status, credit the work of others, comment meaningfully on blog posts and navigate the complex politics of "friending." It was another effort on the school's part to look at the things kids are already doing — social networking, playing video games, tinkering with digital media — and try to help them do it with more thought and purpose, to recognize both their role and their influence inside a larger system.

Being Me had been online for just one day, but it was already zinging with activity, as most of the students seemed to have logged on overnight. Isabel posted a video of herself riding a horse. Clyde put up a survey querying everyone on whether PlayStation 3 was better than Xbox 360. Charles blogged about a new restaurant he tried. ("I had the Caprese pizza. The tomato had a lot of flavor.") Kai posted a video — now being watched by practically everyone in the class — of himself dressed in a pink wig and a red raincoat,

pretending to be a girl he called “Heather.” Comments began to pile up. “Cool beans,” a girl sitting nearby wrote. Then another from a boy named Nuridin: “Dude, stop making me die over here. LOL.”
Seeing this as learning required a kind of leap — the same way it required a leap to watch students build digital mazes and load them with plinking cartoon sprites and imagine it might make them more successful as future adults — that it would possibly help them untangle and rebuild whatever broken systems we will have left for them. The electric pencil sharpener buzzed from a corner.
I watched a long-haired kid named Akahr pull up his profile on Being Me and spend a moment pondering what he would do for his first official status update. By design of the network, every status update began with the words “I am . . .” after which students could choose from an array of designated verbs and objects listed on drop-down menus. Most of the sixth graders were mixing and matching with a kind of frenzied abandon, playfully testing every last variation, posting their updates and waiting for a peal of laughter from somewhere in the classroom — a sign their status had been read. There was, “I am dancing Godzilla” and “I am hugging my bed.” Akhar clicked on his menu and pondered his options. Around the classroom, there were students respecting eggs and creating soy sauce and reading glitter and looking for Paris. Was this learning or a distraction from learning? Serious or not serious? Or was it possible, somehow, that it was both? Word by word, Akahr made his choices: “I am . . . imagining . . . the future.”
Sara Corbett is a contributing writer for the magazine. She wrote about the publication of Carl Jung’s “Red Book” last year.

http://www.nytimes.com/2010/09/19/magazine/19video-t.html?ref=magazine

The Pen That Never Forgets

By CLIVE THOMPSON

In the spring, Cincia Dervishaj was struggling with a take-home math quiz. It was testing her knowledge of exponential notation — translating numbers like "3.87 x 10^2" into a regular form. Dervishaj is a 13-year-old student at St. John's Lutheran School in Staten Island, and like many students grappling with exponents, she got confused about where to place the decimal point. "I didn't get them at all," Dervishaj told me in June when I visited her math class, which was crowded with four-year-old Dell computers, plastic posters of geometry formulas and a big bowl of Lego bricks.

To refresh her memory, Dervishaj pulled out her math notebook. But her class notes were not great: she had copied several sample problems but hadn't written a clear explanation of how exponents work.
She didn't need to. Dervishaj's entire grade 7 math class has been outfitted with "smart pens" made by Livescribe, a start-up based in Oakland, Calif. The pens perform an interesting trick: when Dervishaj and her classmates write in their notebooks, the pen records audio of whatever is going on around it and links the audio to the handwritten words. If her written notes are inadequate, she can tap the pen on a sentence or word, and the pen plays what the teacher was saying at that precise point.

Dervishaj showed me how it works, flipping to her page of notes on exponents and tapping a set of numbers in the middle of the page. Out of a tiny speaker in the thick, cigar-shaped pen, I could hear her teacher, Brian Licata, explaining that precise problem. "It's like having your own little personal teacher there, with you at all times," Dervishaj said.

Having a pen that listens, the students told me, has changed the class in curious ways. Some found the pens make class less stressful; because they don't need to worry about missing something, they feel freer to listen to what Licata says. When they do take notes, the pen alters their writing style: instead of verbatim snippets of Licata's instructions, they can write "key words" — essentially little handwritten tags that let them quickly locate a crucial moment in the audio stream. Licata himself uses a Livescribe pen to provide the students with extra lessons. Sitting at home, he'll draw out a complicated math problem while describing out loud how to solve it. Then he'll upload the result to a class Web site. There his students will see Licata's handwriting slowly fill the page while hearing his voice explaining what's going on. If students have trouble remembering how to tackle that type of problem, these little videos — "pencasts" — are online 24 hours a day. All the students I spoke to said they watch them.

LIKE MOST PIECES of classroom technology, the pens cause plenty of digital-age hassles. They can crash. The software for loading students' notes onto their computers or from there onto the Web can be finicky. And

the pens work only with special notepaper that enables the pen to track where it's writing; regular paper doesn't work. (Most students buy notepads from Livescribe, though it's possible to print the paper on a color printer.) There are also some unusual social side-effects. The presence of so many recording devices in the classroom creates a sort of panopticon — or panaudiocon, as it were. Dervishaj has found herself whispering to her seatmate, only to realize the pen was on, "so we're like, whoa!" — their gossip has been recorded alongside her notes. Although you can pause a recording, there's currently no way to selectively delete a few seconds of audio from the pen, so she's forced to make a decision: Delete all the audio for that lesson, or keep it in and hope nobody else ever hears her private chatter. She usually deletes.
Nonetheless, Licata is a convert. As the students started working quietly on review problems, their pens making tiny "boop" noises as the students began or paused their recording, Licata pulled me aside to say the pens had "transformed" his class. Compact and bristling with energy, Licata is a self-professed geek; in his 10 years of teaching, he has seen plenty of classroom gadgets come and go, from Web-based collaboration software to pricey whiteboards that let children play with geometric figures the way they'd manipulate an iPhone screen. Most of these gewgaws don't impress him. "Two or three times a year teachers whip out some new technology and use it, but it doesn't do anything better and it's never seen again," he said.

But this time, he said, was different. This is because the pen is based on an age-old classroom technique that requires no learning curve: pen-and-paper writing. Livescribe first released the pen in 2008; Licata encountered it when a colleague brought his own to work. Intrigued, he persuaded Livescribe to donate 20 pens to the school to outfit his entire class. (The pens sell for around $129.) "I've made more gains with this class this year than I've made with any class," he told me. In his evenings, Licata is pursuing a master's degree in education; separately, he intends to study how the smart pens might affect the way students learn, write and think. "Two years ago I would have told you that note-taking is a lost art, that handwriting was a lost art," he said. "But now I think handwriting is crucial."

TAKING NOTES HAS long posed a challenge in education. Decades of research has found a strong correlation between good notes and good grades: the more detailed and accurate your notes, the better you do in school. That's partly because the act of taking notes forces you to pay closer attention. But what's more important, according to some researchers, is that good notes provide a record: most of the benefits from notes come not from taking them but from reviewing them, because no matter how closely we pay attention, we forget things soon after we leave class. "We have feeble memories," says Ken Kiewra, a professor of educational psychology at the University of Nebraska and one of the world's leading researchers into note-taking.

Yet most students are very bad at taking notes. Kiewra's research has found that students record about a third of the critical information they hear in class. Why? Because note-taking is a surprisingly complex mental activity. It heavily taxes our "working memory" — the volume of information we can consciously hold in our heads and manipulate. Note-taking requires a student to listen to a teacher, pick out the most important points and summarize and record them, while trying not to lose the overall drift of the lecture. (The very best students do even more mental work: they blend what they're hearing with material they already know and reframe the concepts in their own words.) Given how jampacked this task is, "transcription fluency" matters: the less you have to think about the way you're recording notes, the better. When you're taking notes, you want to be as fast and as automatic as possible.

All note-taking methods have downsides. Handwriting is the most common and easiest, but a lecturer speaks at 150 to 200 words per minute, while even the speediest high-school students write no more than 40 words per minute. The more you struggle to keep up, the more you're focusing on the act of writing, not the act of paying attention.

Typing can be much faster. A skilled typist can manage 60 words a minute or more. And notes typed into a computer have other advantages: they can be quickly searched (unlike regular handwritten notes) and backed

up or shared online with other students. They're also neater and thus easier to review. But they come with other problems, not least of which is that typing can't capture the diagrammatic notes that classes in math, engineering or biology often require. What's more, while personal computers and laptops may be common in college, that isn't the case in cash-strapped high schools. Laptops in class also bring a host of distractions — from Facebook to Twitter — that teachers loathe. And students today are rarely taught touch typing; some note-taking studies have found that students can be even slower at typing than at handwriting.
One of the most complete ways to document what is said in class is to make an audio record: all 150-plus words a minute can be captured with no mental effort on the part of the student. Kiewra's research has found that audio can have a powerful effect on learning. In a 1991 experiment, he had four groups of students listen to a lecture. One group was allowed to listen once, another twice, the third three times and the fourth was free to scroll back and forth through the recording at will, listening to whatever snippets the students wanted to review. Those who relistened were increasingly likely to write down crucial "secondary" ideas — concepts in a lecture that add nuance to the main points but that we tend to miss when we're focused on writing down the core ideas. And the students who were able to move in and out of the audio stream performed as well as those who listened to the lecture three times in a row. (Students who recorded more secondary ideas also scored higher in a later quiz.) But as anyone who has tried to scroll back and forth through an audio file has discovered, reviewing audio is frustrating and clumsy. Audio may be richer in detail, but it is not, like writing and typescript, skimmable.

JIM MARGGRAFF, the 52-year-old inventor of the Livescribe pen, has a particular knack for blending audio and text. In the '90s, appalled by Americans' poor grasp of geography, he invented a globe that would speak the name of any city or country when you touched the location with a pen. In 1998, his firm was absorbed by Leapfrog, the educational-toy maker, where Marggraff invented toys that linked audio to paper. His first device, the LeapPad, was a book that would speak words and play other sounds whenever a child pointed a stylus at it. It quickly became Leapfrog's biggest hit.
In 2001, Marggraff was browsing a copy of Wired magazine when he read an article about Anoto, a Swedish firm that patented a clever pen technology: it imprinted sheets of paper with tiny dots that a camera-equipped pen could use to track precisely where it was on any page. Several firms were licensing the technology to create pens that would record pen strokes, allowing users to keep digital copies of whatever they wrote on the patterned paper. But Marggraff had a different idea. If the pen recorded audio while it wrote, he figured, it would borrow the best parts from almost every style of note-taking. The audio record would help note-takers find details missing from their written notes, and the handwritten notes would serve as a guide to the audio record, letting users quickly dart to the words they wanted to rehear. Marggraff quit Leapfrog in 2005 to work on his new idea, and three years later he released the first Livescribe pen. He has sold close to 500,000 pens in the last two years, mostly to teachers, students and businesspeople.

I met Marggraff in his San Francisco office this summer. He and Andrew Van Schaack, a professor in the Peabody College of Education at Vanderbilt University and Livescribe's science adviser, explained that the pen operated, in their view, as a supplement to your working memory. If you're not worried about catching every last word, you can allocate more of your attention to processing what you're hearing.

"I think people can be more confident in taking fewer notes, recognizing that they can go back if there's something important that they need," Van Schaack said. "As a teacher, I want to free up some cognitive ability. You know that little dial on there, your little brain tachometer? I want to drop off this one so I can use it on my thinking." Marggraff told me Livescribe has surveyed its customers on how they use the pen. "A lot of adults say that it helps them with A.D.H.D.," he said. "Students say: 'It helps me improve my grades in specific classes. I can think and listen, rather than writing.' They get more confident."

Livescribe pens often inspire proselytizing among users. I spoke to students at several colleges and schools who insisted that the pen had improved their performance significantly; one swore it helped boost his G.P.A. to 3.9 from 3.5. Others said they had evolved highly personalized short notations — even pictograms — to

make it easier to relocate important bits of audio. (Whenever his professor reeled off a long list of facts, one student would simply write "LIST" if he couldn't keep up, then go back later to fill in the details after class.) A few students pointed to the handwriting recognition in Livescribe's desktop software: once an individual user has transferred the contents of a pen to his or her computer, the software makes it possible to search that handwriting — so long as it's reasonably legible — by keyword. That, students said, markedly sped up studying for tests, because they could rapidly find notes on specific topics. The pen can also load "apps": for example, a user can draw an octave of a piano keyboard and play it (with the notes coming out of the pen's speaker), or write a word in English and have the pen translate it into Spanish on the pen's tiny L.E.D. display.

Still, it's hard to know whether Marggraff's rosiest ambitions are realistic. No one has yet published independent studies testing whether the Livescribe style of enhanced note-taking seriously improves educational performance. One of the only studies thus far is by Van Schaack himself. In the spring, he conducted an unpublished experiment in which he had 40 students watch a video of a 30-minute lecture on primatology. The students took notes with a Livescribe pen, and were also given an iPod with a recording of the lecture. Afterward, when asked to locate specific facts on both devices, the students were 2.5 times faster at retrieving the facts on the pen than on the iPod. It was, Van Schaack argues, evidence that the pen can make an audio stream genuinely accessible, potentially helping students tap into those important secondary ideas that we miss when we're scrambling to write solely by hand.

Marggraff suspects the deeper impact of the pen may not be in taking notes when you're listening to someone else, but when you're alone — and thinking through a problem by yourself. For example, he said, a book can overwhelm a reader with thoughts. "You're going to get ideas like crazy when you're reading," Marggraff says. "The issue is that it's too slow to sit down and write them" — but if you don't record them, you'll usually forget them. So when Marggraff is reading a book at home or even on a plane, he'll pull out his pen, hit record and start talking about what he's thinking, while jotting down some keywords. Later on, when he listens to the notes, "it's just astounding how relevant it is, and how much value it brings." No matter how good his written notes are, audio includes many more flashes of insight — the difference between the 30 words per minute of his writing and the 150 minutes per word of his speech, as it were.

Marggraff pulls out his laptop to show me notes he took while reading Malcolm Gladwell's book "Outliers." The notes are neat and legible, but the audio is even richer; when he taps on the middle of the note, I can hear his voice chattering away at high speed. When he listens to the notes, he'll often get new ideas, so he'll add notes, layering analysis on top of analysis.
"This is game-changing," he says. "This is a dialogue with yourself." He has used the technique to brainstorm patent ideas for hours at a time.

Similarly, in his class at St. John's, Licata has found the pen is useful in capturing the students' dialogues with themselves. For instance, he asks his students to talk to their pens while they do their take-home quizzes, recording their logic in audio. That way, if they go off the rails, Licata can click through the page to hear what, precisely, went wrong and why. "I'm actually able to follow their train of thought," he says.
Some experts have doubts about Livescribe as a silver bullet. As Kiewra points out, plenty of technologies in the past have been hailed as salvations of education. "There's been the radio, there's been the phonograph, moving pictures, the VCR" — and, of course, the computer. But the average student's note-taking ability remains as dismal as ever. Kiewra says he now believes the only way to seriously improve it is by painstakingly teaching students the core skills: how to listen for key concepts, how to review your notes and how to organize them to make meaning, teasing out interesting associations between bits of information. (As an example, he points out that students taking notes on the planets will learn lots of individual facts. But if they organize them into a chart, they'll make discoveries on their own: sort the planets by distance from the sun and speed of rotation, and you'll discover that the farther you go out, the more slowly they spin.) Kiewra also says that an effective way to get around the problem of incomplete and disorganized note-taking is for

teachers to give out “partial” notes — handouts that summarize key concepts in the lecture but leave blanks that the students must fill in, forcing them to pay attention. Some studies have found that students using partial notes capture a majority of the main concepts in a lecture, more than doubling their usual performance. Indeed, many modern educators say that students shouldn’t be taking notes in class at all. If it’s true that note-taking taxes their working memory, they argue, then teachers should simply hand out complete sets of notes that reflect everything in the lecture — leaving students free to listen and reflect. After all, if the Internet has done anything, it has made it trivially easy for instructors to distribute materials.

“I don’t think anyone should be writing down what the teacher’s saying in class,” is the blunt assessment of Lisa Nielsen, author of a blog, “The Innovative Educator,” who also heads up a division of the New York City Department of Education devoted to finding uses for new digital tools in classrooms. “Teachers should be pulling in YouTube videos or lectures from experts around the world, piping in great people into their classrooms, and all those things can be captured online — on Facebook, on a blog, on a wiki or Web site — for students to be looking at later,” she says. “Now, should students be making meaning of what they’re hearing or coming up with questions? Yes. But they don’t need to write down everything the teacher’s said.” There is some social-science support for the no-note-taking view. In one experiment, Kiewra took several groups of students and subjected them to different note-taking situations: some attended a lecture and reviewed their own notes; others didn’t attend but were given a set of notes from the instructor. Those who heard the lecture and took notes scored 51 percent on a subsequent test, while those who only read the instructor’s notes scored 69 percent.

Of course, if Marggraff has his way, smart pens could become so common — and so much cheaper — that bad notes, or at least incomplete ones, will become a thing of the past. Indeed, if most pen-and-paper writing could be easily copied and swapped online, the impacts on education could be intriguing and widespread. Marggraff intends to release software that lets teachers print their students’ work on dot-patterned paper; students could do their assignment, e-mail it in, then receive a graded paper e-mailed back with handwritten and spoken feedback from the teacher. Students would most likely swap notes more often; perhaps an entire class could designate one really good note-taker and let him write while everyone else listens, sharing the notes online later.

Marggraff even foresees textbooks in which students could make notes in the margins and have a permanent digital record of their written and spoken thoughts beside the text. “Now we really have bridged the paper and the digital worlds,” he adds. Perhaps the future of the pen is on the screen.
Clive Thompson, a contributing writer for the magazine, writes frequently about technology and science.

http://www.nytimes.com/2010/09/19/magazine/19Livescribe-t.html?ref=magazine

Tutors Made to Measure
By MAGGIE JONES

On a summer afternoon, Isabel, a math tutor with long chestnut-colored hair and hoop earrings, sat in the lower-right corner of my computer screen as I wrestled with geometry problems. When I answered correctly, Isabel gave me a quick congratulatory smile. When I rushed, randomly guessing at perimeters of triangles and rectangles (geometry was never my favorite), Isabel, inferring from the speed of my keystrokes, wanted to know if I was bored. Was it because of the last problem? Did I want to choose the level of the next problem? “I think that more important than getting the answer right,” she said in words reminiscent of many a high-school teacher, “is putting in the effort and that we can all be good in math if we try.”

For years automated computer tutors have used algorithms to assess students’ cognitive skills and tailor the lessons. But according to Rosalind Picard, an M.I.T. professor who founded what’s known as affective computing, online tutors should also read and respond to students’ emotional cues. When is the student bored? When has her frustration escalated to the point that she is about to give up? And what can a computer program do to keep her in the game?

This is where Isabel comes in. She and her digital counterparts of different sexes and races are tutors in the online program Wayang Outpost. Designed by two University of Massachusetts, Amherst, researchers, Beverly Park Woolf and Ivon M. Arroyo, the program was originally developed to encourage middle- and high-school girls — who early on perform as well in math as boys do but express greater discouragement and are less likely to pursue careers in math and science — with friendly, supportive tutors like Isabel, who often mirrors students’ emotions, offers hints when needed and debunks gender stereotypes about math.

And indeed, in studies of Wayang Outpost, though all students benefited from the program, those who reported being most disengaged in math showed the greatest improvements — girls more than boys, lower-achieving students more than high-achieving.

This fall, hundreds of middle- and high-school students will pull up a chair to work with Isabel and other “affective pedagogical agents.” Some will be assigned to tutors who match their sexes and races. Others will be given tutors who do not match. Students will be hooked up to sensors monitoring sweat (which can indicate excitement or anxiety), the pressure they place on their mice (frustration) and how much they fidget on their seat cushions. A tiny camera atop the computer will register the slight furrow of the brow, the smile, the tilt of the head and the eye movements that indicate attention, nervousness, satisfaction. The resulting information will be used to tailor the tutors’ encouragements to achieve the maximum education outcome.

“Computer tutors are never going to completely replace human teachers or be 100 percent accurate,” Picard warns. But if Isabel keeps students engaged in math with her emotion-friendly style, she will have done plenty.

http://www.nytimes.com/2010/09/19/magazine/19Essays-tutors-t.html?ref=magazine

Anytime, Anywhere
By CARLO ROTELLA

Karen Cator, director of the office of education technology at the U.S. Department of Education, says she thinks of online learning this way: “If students have their own computer, it can travel with them from home to school. There can be software programs that help the student, or there can be an online teacher, but the technology can also augment a teacher in a face-to-face classroom.”
Such shape-changing mobility is becoming the norm. According to a study by the Sloan Consortium, at the K-12 level, there were 50,000 students enrolled in wholly or partly online courses in 2000. By 2008, there were more than a million. Most of the students are in high school (many taking courses in subjects their local districts find it inconvenient to offer in classrooms) or in credit-recovery courses intended to lower the dropout rate by allowing students to pass a previously failed or incomplete subject. About 200,000 students are in full-time virtual schools, getting all of their schooling online.
Caprice Young, the former chief executive of KC Distance Learning, says, “In 2008, our primary clients were alternative schools and charters, but in the last year our client base flipped to predominantly traditional schools.” Online courses have typically catered to some of the most motivated students — those seeking Advanced Placement credit, for instance — and also to some of the least motivated, especially those at risk of dropping out. But now, as it becomes a standard part of normal public education (70 percent of school districts had students enrolled in an online course), online learning is increasingly reaching all types of students.
President Obama’s Department of Education supports online learning, notably in its National Education Technology Plan, to be released this month. Other countries are digitizing their curricula on a national scale. Proponents of online learning warn that we’re falling behind, but skeptics should be asking: Is the instruction good enough? Will some teachers lose their jobs? Is online learning just another concession to the electronic shrinkage of public life? Is it a fancy way for government to abdicate some of its responsibility to educate?
For better or for worse, imagine a near future in which your avatar can attend high school in a Second Life-like environment, your body no longer required to sit quietly in a row and your mind no longer obliged to settle for what the local district can offer. You won’t need a locker, and if you realize with swooping horror that there’s a big test today and you’re not ready, you can stop time and study until you are. And your avatar’s skin is clear. And you can fly.

http://www.nytimes.com/2010/09/19/magazine/19Essays-online-t.html?ref=magazine

Hacks Into Hackers

By NICHOLAS CARLSON

Tom Rowe

Last spring, Nick Bilton, an adjunct professor at New York University (and a New York Times blogger), and his technology class stashed sensors all over their floor at the Tisch School of the Arts: on elevators, in hallways, outside bathrooms, in the lounge and in classrooms. They let the sensors collect data for about 36 hours and then rounded them back up.

Bilton says the students discovered a lot about the work habits of their classmates: “People used the left elevator more than the right one, and people barely take the stairs. People show up around 9 p.m. and leave around 4 a.m. In the morning, there’s not much activity.” Bilton admits that foot-traffic patterns in one of N.Y.U.’s buildings are not “a big news story,” but the story was important to a particular audience — his students. The exercise was his way of demonstrating a belief that is central to the way he, a former programmer at The Times, conducts his journalism: reporters need to know how to manipulate computers in order to tell the stories that matter most to their audiences.

As a reporter, Bilton uses code to track hires at companies like Apple and Amazon. He has written programs to test Facebook’s privacy policies. He says hacks should be hackers, and he isn’t alone. In San Francisco, the Forbes reporter Taylor Buley, despite saying he is “not a great programmer,” writes code scripts to help him “do the same work, just quicker.”

And now, the Columbia University Graduate School of Journalism is starting a dual-degree master’s program in journalism and computer science. Many j-schools teach how to edit videos and write HTML, the Internet’s simplest code. One goal of the Columbia program, according to Bill Grueskin, the dean of academic affairs, is to produce journalists who will “take it several steps beyond — to where they’re creating a lot of their own new tools.” That means learning enough computer science and software engineering to be able to design tools for information gathering, synthesis, analysis and circulation — or enough, at least, to see what technology can do for journalism. Henning Schulzrinne, a computer-science professor at Columbia, says he hopes students will also leave the program with “tools to assist in gathering, processing and presenting news.”

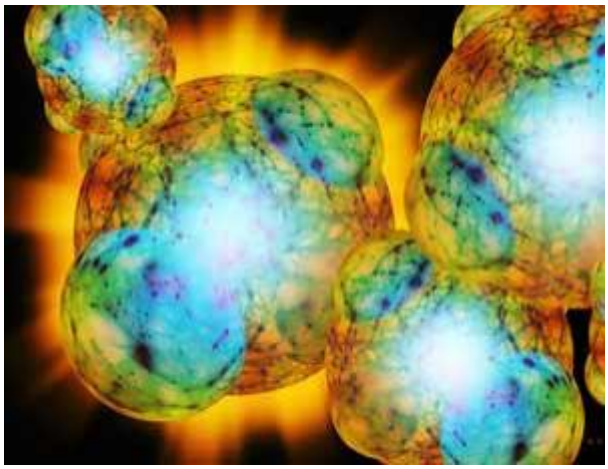
But what’s in it for the engineers, who might have more lucrative things to do than save journalism? Grueskin argues that “one of the things engineers want to do is find practical, intractable problems society is facing and help come up with ways to solve those problems.” The unhealthy state of journalism, he says, is definitely one of those intractable problems.

Julia Hirschberg, a professor of computer science who has helped plan the new program, told me in an e-mail, “We don’t expect everyone who graduates to work for traditional news companies.” She said, however, that the skills students will walk away with will leave them “in a great position” to contribute to all kinds of companies — and she mentioned technology firms like Yahoo and Google.

http://www.nytimes.com/2010/09/19/magazine/19Essays-HigherEd-t.html?ref=magazine

Cosmic accidents: How we avoided the void

- 22 September 2010 by **Stephen Battersby**
- Magazine issue 2779.



It's good to expand your horizons (Image: Detlev Van Ravenswaay/SPL)

We wouldn't exist if our cosmic neighbourhood had been just a bit less dense than average during the tumultuous moments after the big bang

It began with a bang. What cosmic coincidences preceded our universe's birth are in the realms of speculation. Suffice it to say that some 13.75 billion years ago - give or take a yoctosecond - the cosmos was deciding what to be when it grew up.

"Much bigger", if the most popular model of the universe's beginnings is to be believed. According to the theory of inflation, the newly born universe was suffused with something called the inflaton field, which drove an exponential expansion of the cosmos for a period of about 10^{-32} seconds, stretching it flat and uniform in the process.

That usefully accounts for some otherwise tricky-to-explain characteristics of our universe, but the real point of interest is that the inflaton field, although essentially uniform, was not quite identical in each bit of space. Chance quantum fluctuations made it slightly more dense here, and just a little less dense there. It is lucky for us that this was so, and that here and there were that way around. If here had been a bit less dense than the average, then we would not exist. For a hundred million light years in all directions around where we would not be, there would be a dark and lifeless void.

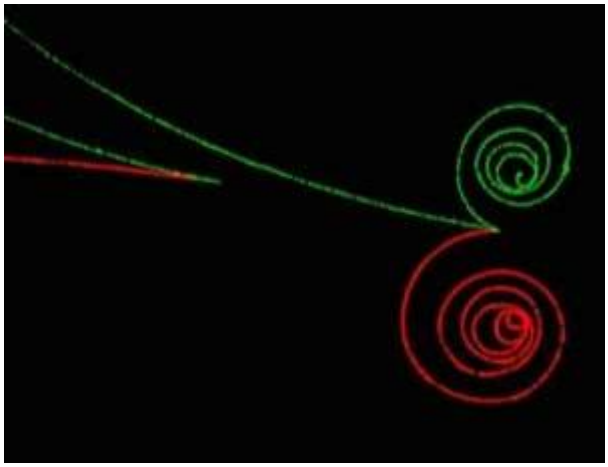
This one microscopic quantum of noise, amplified by gravity, eventually grew into a huge agglomeration of galaxies and clusters of galaxies known as the Virgo supercluster. Among its many clumps is one straggly and undistinguished thicket we call the local group. Within that is the Milky Way, our home.

Looking far out into the cosmos, astronomers can see the mottled pattern of the cosmic microwave background radiation, a snapshot of the growth and consolidation process in action when the first stable atoms formed some 380,000 years after the big bang. Variations in the pattern seem entirely random, and most physicists regard the quantum fluctuations that created it as having no cause at all. Of all happy accidents, this one might be the most accidental.

http://www.newscientist.com/article/mg20727795.400-cosmic-accidents-how-we-avoided-the-void.html

Cosmic accidents: Tipping the antimatter balance

- 22 September 2010 by **Stephen Battersby**
- Magazine issue 2779.



These things really do matter (Image: Lawrence Berkeley/SPL)

Why isn't the cosmos a sea of bland radiation? The triumph of matter suggests that the laws of physics are biased

Still unimaginably hot and dense, the post-inflationary universe was a melange of particles - electrons, positrons, quarks, antiquarks and the like - buzzing around to no particular end. Stable unions between particles that might create stars, planets and life were still far away. One obstacle was the near-equal numbers of matter and antimatter particles. For us to be here, one of them had to give.

You can't make a planet or a person out of light. You need matter - heavy, stable particles such as protons and neutrons. And yet it seems an extraordinary accident that matter exists at all. Standard theories say that matter and antimatter were created in equal amounts after the big bang. Since the two annihilate each other on contact, generating pairs of high-energy photons, all there should be in today's cosmos is a sea of restless and rather bland radiation.

This is not the case. Something seems to have favoured the creation of matter at a crucial moment within the first instants after the big bang.

A surplus of just one extra matter particle per billion would have been enough to lead eventually to today's convenient mattery residue. But how would such an imbalance arise? While there is a pro-matter bias in some particle reactions, it is far too slight to create an advantage even this small. So physicists assume that a stronger bias, the consequence of unknown processes beyond the standard model of particle physics, must appear at the sort of high energies prevalent in the early universe.

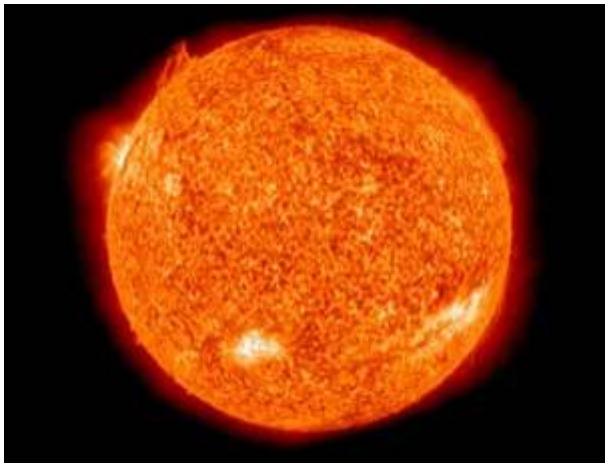
An increasing suspicion is that such über-physics could be variable, changing across a multitude of universes. If so, then our little observable universe was fortunate to acquire a stock of matter, while many other realms will be radiation wastelands.

Matter is not the only potential victim of such shifty physics. It could also lead to some ultra-dense universes that collapse into black holes, and others laced with dark energy that rapidly rips all structures apart. In this picture, the emergence of a universe that would eventually become hospitable to humans is a rare event indeed.

http://www.newscientist.com/article/mg20727795.500-cosmic-accidents-tipping-the-antimatter-balance.html

Cosmic accidents: Sparking up our star

- 22 September 2010 by **Stephen Battersby**
- Magazine issue 2779.



Here comes the sun (Image: SDO/NASA)

Hydrogen, helium, interstellar dust – the ingredients of a solar system. Just stir together and set on fire

Matter prevailed, and it didn't look back. As the universe cooled, stable atoms and molecules soon formed. One hundred million years on, the first stars, giants of hydrogen and helium, appeared. They lived fast and died young in huge explosions that seeded the cosmos with heavier elements, the ingredients of later stars and galaxies. Among those galaxies was the Milky Way. Little of note happened in one of its corners until some 9 billion years after the big bang.

What does it take to make a solar system?

Hydrogen, helium and a sprinkling of the dust that fills the space between stars. All these were hanging around our corner of the cosmos in abundance well before 4.6 billion years ago. But more was needed: a spark to set that inert gas cloud on fire.

Clues to the nature of that spark lie preserved in meteorites. Unlike the often-melted and mixed-up rocks native to our planet, meteorites have remained virtually unchanged since they condensed while the solar system was forming, preserving the chemistry of those early millennia.

One particular meteorite discovered in 2003 in Bishunpur, India, contained large quantities of iron-60, a radioactive isotope that decays over a few million years into stable nickel-60 (*The Astrophysical Journal*, vol 588, p L44). Because iron-60 is so short-lived, interstellar gas generally holds just a trace of it. The large amounts in the Bishunpur meteorite imply that our solar system formed from a much richer brew.

The likelihood is that this brew was spiced up by a nearby supernova. These massive stellar explosions are one of the few cosmic processes known to create large quantities of heavy radioactive isotopes such as iron-60. Shock waves from such a supernova could have triggered the formation of the sun and planets by compressing the primordial gas cloud.

Or the conception of the solar system might have been a gentler affair. According to new calculations, a red giant star of sufficient size could rival a supernova in iron-60 production and produce other radioactive elements in the right proportions to fit meteorite records. These elements would be forged in a deep layer of the star, carried to the surface by convection, and ejected as part of a powerful stellar wind that could also stir up any gas clouds nearby.

Whether it was explosion or ejection, the sun is only the most obvious star we have to thank for our existence.

http://www.newscientist.com/article/mg20727795.600-cosmic-accidents-sparking-up-our-star.html?full=true&print=true

Cosmic accidents: Mars attacks

- 22 September 2010 by **David Shiga**
- Magazine issue 2779.

Finding moonshine (Image: KeystoneUSA-ZUMA/Rex Features)

A colossal interplanetary collision doesn't sound like a good thing – but without it, things might have turned out very differently

One hundred million years into the life of the sun, the dust left over from its formation has gradually coagulated into orbiting bodies in the nascent solar system. There are small rocky lumps close to the sun and larger, icier bodies in the cold outer recesses. As yet, though, there is little to distinguish the third rock from the sun from any other.

The solar system in which the infant Earth found itself was an unsettled environment, filled with lumps of rock whizzing around on irregular orbits. Some 4.5 billion years ago one of these, a Mars-sized body, clobbered our planet. The result was a comprehensive rearrangement. Some of the impacting material stuck, while the rest was blasted into orbit along with bits of Earth excavated by the collision, where it formed the moon.

It does not sound a particularly propitious event. But luckily, it resulted in a satellite that is anomalously big in comparison to its parent planet. There is nothing else like it in the solar system, where satellites are relatively small bodies that either accreted slowly from orbiting debris or were captured in passing. Elsewhere it seems a similar story. Giant collisions in other solar systems would produce abundant dust visible to the infrared Spitzer Space Telescope, but although a few such dusty systems have been found, collisions big enough to produce something like the moon seem to happen in only 5 to 10 per cent of solar systems - with the number of instances where this has actually happened considerably smaller even than that (*The Astrophysical Journal*, vol 670, p 516).

Why does this matter? Because the moon's size provides a steadying gravitational hand that helps to stabilise the tilt, or "obliquity", of Earth's axis. That prevents wild changes in the pattern of solar heating on the planet's surface that could lead to extreme climate swings, including frequent periods where the whole planet freezes over. That's a big deal for us. "Conditions might be bad for complex land-based life if there were no moon and obliquity varied significantly," says David Spiegel, a planetary scientist at Princeton University.

Earth might still have spawned life without its outsize moon - even with a frozen surface, the water beneath could offer a decent habitat for sea creatures, Spiegel says. It's just unlikely that we would be around to appreciate it.

http://www.newscientist.com/article/mg20727795.700-cosmic-accidents-mars-attacks.html

Cosmic accidents: Blasting the Earth into life

- 22 September 2010 by **David Shiga**
- Magazine issue 2779.

That bombardment is heavy (Image: NASA/Corbis)

The solar system's "late heavy bombardment" blasted our planet – but might also have delivered our water, and created nurseries for life

The adolescent Earth's travails were not over with the impact that created the moon. Trouble was brewing further out among the giants of the solar system. Those rumblings eventually precipitated a calamity that once again provided life with an opportunity.

The craggy features of the "man in the moon" are familiar from childhood stories. Prosaically, though, they are impact craters scarring the moon's surface.

Rock samples brought back by Apollo astronauts reveal an odd fact: the big impact craters all seem to date to the same time, around 3.9 billion years ago. This is concrete evidence of a violent period in the solar system's history known as the late heavy bombardment. The moon was unlikely to have been the only target. Being bigger, Earth was probably pummelled even more intensely, though its more active geology has since erased most of the evidence.

The cause of this impromptu game of planetary bagatelle is still not entirely clear. In 2005, however, came the suggestion that it was triggered by a tussle between the solar system's four giant planets, Jupiter, Saturn, Uranus and Neptune (*Nature*, vol 435, p 459). Slight drifts in Saturn and Jupiter's orbits eventually led to Saturn's orbital period becoming exactly twice that of Jupiter. This gravitational "resonance" shook up the orbits of all four giant planets and sent nearby comets and asteroids shooting off towards the inner solar system.

Lucky for us? Where Earth formed close in to the sun it would have been too hot for water to condense and be incorporated into our planet. Comets and asteroids formed further out where water ice would have been plentiful. It seems plausible, then, that Earth's first water was delivered by bombardment.

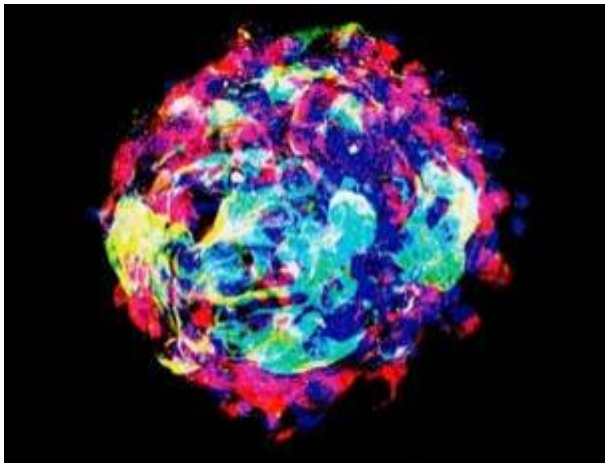
The late heavy bombardment could have had a more direct impact on life's origins, too. Initially, it created extremely harsh conditions on Earth. "Imagine pools of molten rock at the surface the size of the continent of Africa," says Stephen Mojzsis, a geologist at the University of Colorado in Boulder. But once they had cooled, the impact craters would have been ideal sites in which to start life, says Charles Cockell of the Open University in Milton Keynes, UK, with residual heat driving chemical reactions in warm water circulating through the rock (*Philosophical Transactions of the Royal Society B*, vol 361, p 1845).

Alternatively, if life had already begun, the event would have altered the course of evolution, eliminating all but the most heat-tolerant microbes, says Mojzsis. "This is the story of life - mass extinction leading to new styles of life," he says. It was a story that still had a few chapters to run.

http://www.newscientist.com/article/mg20727795.800-cosmic-accidents-blasting-the-earth-into-life.html

Cosmic accidents: One giant leap for a single cell

- 22 September 2010 by **Michael Le Page**
- Magazine issue 2779. **Subscribe and save**



What made us more than bacteria? (Image: Dr Gopal Murti/SPL)

A freak event created the ancestor of all multicellular life on Earth. Without this unconventional genesis, we might never have become more than bacteria

Life is what you make of it. For the first organisms on the newly watery Earth, that was little. For a billion years or more, single-celled entities simply morphed, multiplied and colonised the oceans. Photosynthesis was one innovation: from about 2.5 billion years ago, blooms of sea bacteria supplied Earth's atmosphere with its first whiff of oxygen. But when the next turning point came, it was in a rather unexpected direction.

Life on Earth stands either side of a chasm. On one side are the prokaryotes - bacteria and archaea - whose single cells are not much more than tiny bags of chemicals. On the other are the eukaryotes, whose complex cells have internal membranes, skeletons and transport systems.

The world's largest bacterium is less than a millimetre long, but a single eukaryotic cell can stretch for well over a metre. And while bacteria never form anything more complex than strings of identical cells, eukaryotic cells cooperate to make everything from brains and leaves to bones and wood.

The countless simple cells living in each of the many environments on Earth have had over 3 billion years to evolve complexity. It could have happened repeatedly - and yet it appears to have happened just once, perhaps 2 billion years ago. All complex life is descended from a single common ancestor.

Why is that so? Because, says Nick Lane of University College London, natural selection normally favours fast replication, keeping simple cells simple. Then a freak event occurred: an archeaon engulfed a bacterium and the two cells formed a symbiotic relationship. That transformed the dynamics of evolution, leading to a period of rapid change that produced innovations such as sex. The incorporated bacterium eventually evolved into mitochondria, the energy generators of complex cells.

Such "endosymbioses" are now common in complex cells.The chloroplasts that carry out photosynthesis in plant cells, for example, were originally a photosynthesising bacterium. But we only know of a couple of other examples of a simple cell playing host to another. So it seems there was nothing inevitable about the rise of the sophisticated organisms from which we evolved. "The unavoidable conclusion is that the universe should be full of bacteria, but more complex life will be rare," says Lane.

http://www.newscientist.com/article/mg20727795.900-cosmic-accidents-one-giant-leap-for-a-single-cell.html

Cosmic accidents: The age of heroic lichen

- 22 September 2010 by **Richard Webb**
- Magazine issue 2779.

What's to like about lichen? (Image:Yva Momatiuk & John Eastcott/FLPA)

Early life had to ride an oxygen rollercoaster – until humble symbioses of algae and fungus put an end to boom and bust

The world of the first complex cells was very different to today's. The early efforts of photosynthesising bacteria had raised atmospheric oxygen levels to 2 per cent, barely one-tenth of current levels. Suffocating air and stagnant seas were the leitmotifs of the next period of our planet's history, an environmental stasis dubbed the "boring billion". An extraordinary coincidence of geology and biology shook Earth from its slumber.

If eukaryotes were ever going to get where they are today, they needed oxygen's chemical muscle. It powers the process of aerobic respiration that keeps not just us going, but almost all animal and plant life.

Around 800 million years ago, things began to look up for oxygen. Rifting and volcanism associated with the break-up of the supercontinent Rodinia increased weathering and flooded the oceans with nutrients, causing photosynthesising cyanobacteria blooms to undergo something of a boom.

Happy ending, with abundant oxygen for all? Not in the first instance: increased photosynthesis sucked up carbon dioxide, and as the blooms died and sank to the ocean floor, this important greenhouse gas leached out of the atmosphere. By 720 million years ago, the planet had been plunged into a glaciation that reached to the equator - a "snowball Earth".

As so often before, seeming catastrophe was a chance for life. "When CO_2 levels decrease, it drives biological innovation," says geochemist Graham Shields of University College London. In this instance, it bounced new types of complex cell into leaving the marine ghetto and colonising the land.

Faced with a largely icebound planet, these pioneering terrestrial life forms - green algae and lichen - initially did little. But CO_2 levels gradually recovered and, some 635 million years ago, the glaciers receded to the poles, revealing land that was primed to go green as never before.

Lichen, symbioses of algae and fungus, have roots known as hyphae that anchor them to the rocks beneath. These created new avenues for physical and chemical rock weathering, and the oceans were flooded with nutrients once more.

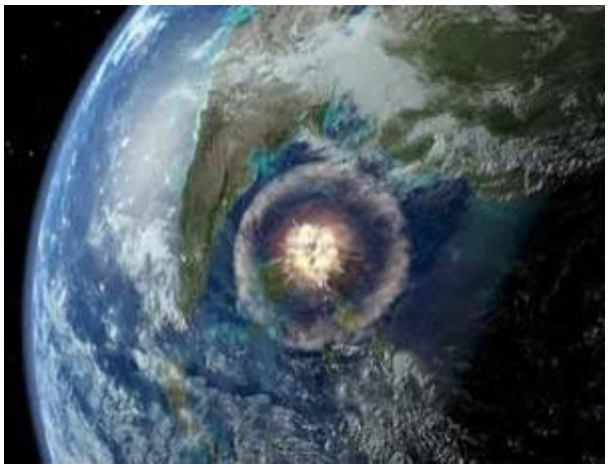
This time, though, the result wasn't just bloom and bust. The lichen kept eating away at the rocks, and a constant stream of nutrients kept photosynthesising bacteria in the seas on the perpetual up. Slowly, atmospheric oxygen levels rose to the heights of today.

Soon afterwards, about 580 million years ago, the first of our animal ancestors nosed their way into the fossil record, followed by the leafy plants - lucky beneficiaries of some unlikely biological heroes.

http://www.newscientist.com/article/mg20727796.000-cosmic-accidents-the-age-of-heroic-lichen.html

Cosmic accidents: Killer asteroid with a silver lining

- 22 September 2010 by **Graham Lawton**
- Magazine issue 2779.



The rock that did for dinosaurs (Image: Joe Tucciarone/SPL)

A 10-kilometre-wide rock did for the dinosaurs, but smashed open a window of opportunity for unimpressive little animals called mammals

The upping of atmospheric oxygen was followed by a frenzy of evolutionary innovation, during which most of the animal groups known today popped up. By 350 million years ago, the coal beds laid down in the carboniferous period speak of a world covered in lush greenery, too. Soon this verdant Earth became home to animals of a size never seen before: the dinosaurs. The age of the reptiles lasted for more than 160 million years. It took an extraterrestrial intervention to clear the way for a new world order.

Nothing like the late heavy bombardment has hit Earth in recent geological time, but every 100 million years or so something big wallops the planet. If it happened now we would be wiped out. Yet curiously, we probably owe our existence to the last such impact.

Around 65.5 million years ago an asteroid some 10 kilometres across slammed into the Yucatan peninsula in present-day Mexico. The release of carbon and sulphur-rich gases from the blasted rock layers precipitated a global catastrophe in which fires raged, the sky darkened, Earth cooled and acid rain showered down. Within months the dinosaurs were dead. So too were almost all other reptiles of sea and air, along with ammonites and most birds and land plants (*Science*, vol 327, p 1241).

For mammals, it was a different story. They didn't exactly sail through - around half of the species went extinct - but those that survived were small, fast-breeding and versatile, and could scavenge the abundant detritus created by the impact. They were able to burrow or hide to escape the fires and acid rain. They often lived in or around freshwater ecosystems, which are fed largely by dead organic matter and so were more resilient in the face of catastrophe than oceans and dry land.

These survivors went on to inherit the Earth. As the biosphere gradually recovered, mammals filled the niches left vacant by the dinosaurs, and eventually those of the marine reptiles too. The fossil record suggests this happened in a burst of evolutionary creativity between 65 and 55 million years ago. Some "molecular clock" studies, which compare the genomes of related living species to reconstruct their evolutionary tree, paint a slightly different picture, implying that mammalian evolution didn't gear up until more than 10 million years after the impact.

Either way, one lineage that makes its debut is ours, the primates. Reason enough to say that if that asteroid had not been there and then, we would not be here and now.

http://www.newscientist.com/article/mg20727796.100-cosmic-accidents-killer-asteroid-with-a-silver-lining.html

Cosmic accidents: Brains or brawn – which was best?

- 22 September 2010 by **Anil Ananthaswamy**
- Magazine issue 2779.

Would you rather think or eat? (Image: Paul Souders/Corbis)

When the going got tough in prehistoric East Africa, some of humanity's closest relatives went for bigger jaws, rather than bigger brains. Big mistake

By some 30 million years ago, the primate upstarts had come to dominate the canopies of the once more lush tropical rainforests. For one particular group, this was a mere staging post.

Before about 20 million years ago, east Africa boasted Amazon-like jungles that were a stable and plentiful home to our forebears, still swinging from the trees. Then the Earth moved, quite literally. A plume of magma started pushing up from beneath what is now northern Ethiopia.

During the following 15 million years, two massive mountain ranges running north to south, each about 2 kilometres high, rose up out of the east African plateau. Saddled in the middle was the Great Rift Valley, a depression a kilometre above sea level.

The mountains to the east deflected moisture-laden winds arriving from the Indian Ocean, and those in the west stopped similar winds from the Congo. Deprived of rain, the valley gradually began to change from lush rainforest to sparser savannah. For our African ancestors, living in the trees was no longer such a viable survival strategy.

The newly mountainous terrain also became host to ephemeral deep-water lakes that formed and disappeared within hundreds of years (*Quaternary Science Reviews*, in press). This environmental variability was a source of tremendous evolutionary pressure. "You needed an ability to migrate and move from food source to food source," says Mark Maslin of University College London. One way or another, that led to a seminal moment in primate development around 6 million years ago: one species learned to stand and walk on two feet.

The rapidly changing environment meant primate evolution couldn't stop there. "Either you had to think your way out, or eat your way out," says Maslin. About 2.5 million years ago, evolution took two turns: one towards bigger brains to figure out better ways to adapt, the other towards bigger jaws to eat tough tubers and nuts. The first strategy had the greatest staying power. The lantern-jawed hominins eventually died out, while the brainier *Homo habilis* is feted as the direct ancestor of the humans who would eventually walk out of Africa.

http://www.newscientist.com/article/mg20727796.200-cosmic-accidents-brains-or-brawn--which-was-best.html

Cosmic accidents: Inventing language, the easy way

- 22 September 2010 by **David Robson**
- Magazine issue 2779.

It's good to talk (Janek Skarzynski/AFP/Getty))

Fresh pastures meant a cosier life for early humans – if they hadn't, we would never have loosened up enough to learn to speak

And walk out of Africa we did - eventually. Anatomically modern humans, with their slender frames and large brains, had evolved in what is now Ethiopia by some 200,000 years ago, but it was less than 100,000 years ago that a small group stepped across the Red Sea onto the Arabian peninsula. We don't know why: possibly it was an act of whim or wanderlust rather than one of pressing need. Either way, it was one giant leap.

In the pastures new of the Middle East and Asia, early humans found fresh and bountiful environments, easing the competition for resources both among themselves and with other primates. Add in tools that allowed them to harvest new kinds of food, and our forebears had never had it so good.

Released from many of the selective pressures that had shackled their evolution, they began to change subtly. Their calls, for example, had once needed to be very specific - one to signal aggression, one to announce feeding time and so on - and were hard-wired in the brain. Any variation from a small inherited "vocabulary" risked a potentially fatal misunderstanding, so mutations that promoted greater flexibility were quickly weeded out.

In the new havens, however, mutations emerged that allowed more complex vocalisations, controlled by wider regions of the brain. Ultimately, these morphed into huge learned vocabularies and flexible grammars that exploded the tight constraints on interpersonal communication. A change of scene had accidentally created that most human of features: language.

How can we be sure? It's impossible to go back in time and test the idea, but convincing evidence comes from studies of birdsong, which is often used as an analogue of human language. Terrence Deacon of the University of California, Berkeley, for example, has found that Bengalese finches quickly evolve a more complicated patois when they were removed from the wild to the cushier environment of the domestic aviary.

And there's no doubting how significant a development this was. Words play such a central role in human cognition that the evolution of language set the scene for more advanced technology, society and culture - most of the things, in fact, that make us what we are today.

http://www.newscientist.com/article/mg20727796.300-cosmic-accidents-inventing-language-the-easy-way.html

Cosmic accidents: The certainty of chance

- 22 September 2010 by **Stephen Battersby**
- Magazine issue 2779.

Our lives are chaos (Image: Prakash Singh/AFP/Getty)

Tiny changes at the beginning make big differences in the end. That's why our existence is perilously perched on a great pyramid of trivia

And so here we are. Exploding stars, giant collisions, revolutions in evolution: there is no denying that there have been some momentous twists on the road to us. But not all turning points in history are so special, so ostentatious. As we leave the trail of accident and coincidence that marks our past, we might consider an alternative take: that absolutely everything was the luck of the draw.

Even before chaos theory was developed in the 20th century, it was clear to historians and physicists that small causes could lead to large effects. The alluring length of Cleopatra's nose or Richard III's lack of a horseshoe nail might bring down empires and dynasties; the slightest gravitational nudge to an orbiting moon could be amplified over time into celestial disarray.

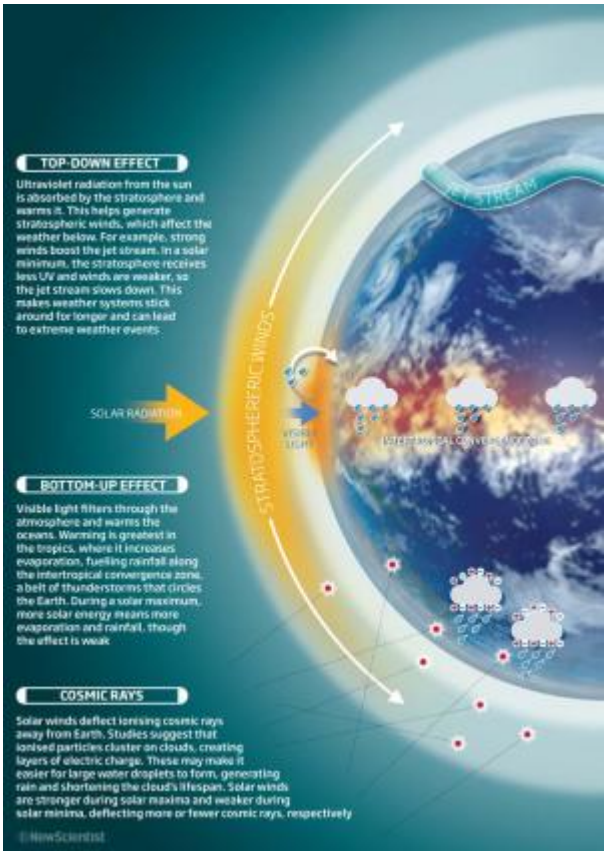
Arguably, even the tiniest events can be crucial. As an example, imagine being in a position to look down on the planet after the rather obvious and messy demise of the dinosaurs 65 million years ago (page 41). You ping a single extra photon down towards Earth's surface, and on the way it hits a water molecule in the atmosphere, boosting its energy slightly and changing its future collisions with other molecules. The weather is a chaotic system in which small differences in initial conditions can cause exponentially diverging outcomes, a property known as the butterfly effect. Before long, our errant molecule is moving storms. Around the planet, the shifted weather means that animals will find rich pasture in different places, or take shelter on different days. They will meet and mate with different animals. Species will evolve in different directions.

Starting with the same genetic stock and the same set of environmental niches, life on our alternative Earth would as a whole almost certainly look similar to today's. Early primates could well have produced ape-like descendants, for example. But they wouldn't be actual chimps or actual gorillas or actual humans. Our existence is perilously perched on a great pyramid of trivia.

http://www.newscientist.com/article/mg20727796.400-cosmic-accidents-the-certainty-of-chance.html

The sun joins the climate club

- Updated 12:40 23 September 2010 by **Michael Marshall**
- Magazine issue 2779.



Enlarge image

Editorial: *The sun's activity has a place in climate science*

THE idea that changes in the sun's activity can influence the climate is making a comeback, after years of scientific vilification, thanks to major advances in our understanding of the atmosphere.

The findings do not suggest - as climate sceptics frequently do - that we can blame the rise of global temperatures since the early 20th century on the sun. "There are extravagant claims for the effects of the sun on global climate," says Giles Harrison, an atmospheric physicist at the University of Reading, UK. "They are not supported."

Where solar effects may play a role is in influencing regional weather patterns over the coming decades. Predictions on these scales of time and space are crucial for nations seeking to prepare for the future.

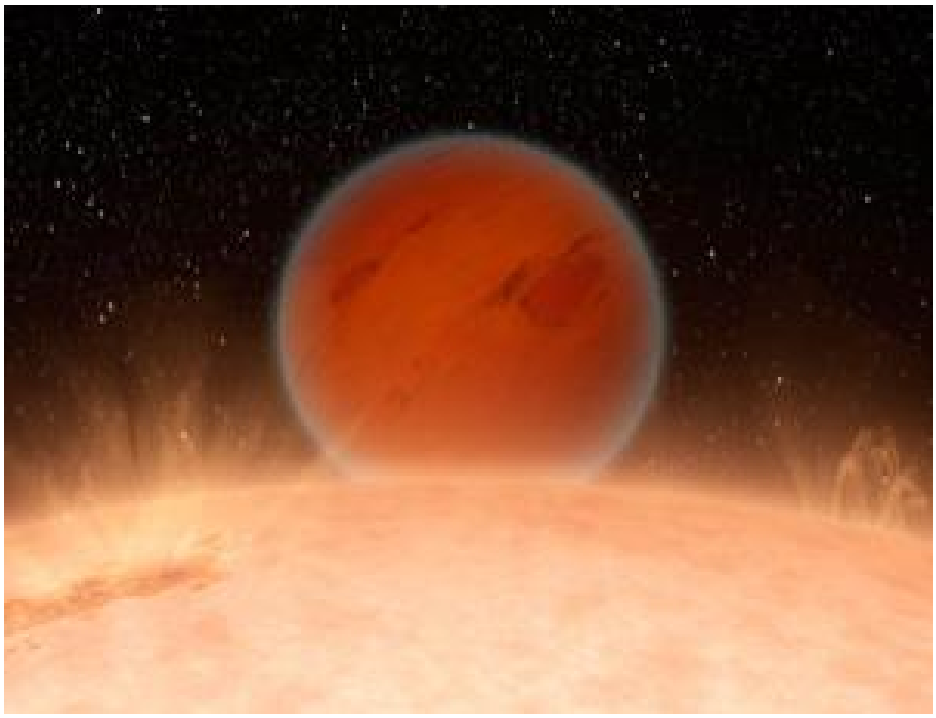
Over the famous 11-year solar cycle, the sun's brightness varies by just 0.1 per cent. This was seen as too small a change to impinge on the global climate system, so solar effects have generally been left out of climate models. However, the latest research has changed this view, and the next report by the Intergovernmental Panel on Climate Change (IPCC), due in 2013, will include solar effects in its models.

So far, three mechanisms have come to light (see diagram). The best understood is what is known as the top-down effect, described by Mike Lockwood, also at the University of Reading, and Joanna Haigh of Imperial College London. Although the sun's brightness does not change much during solar maxima and minima, the type of radiation it emits does. During maxima the sun emits more ultraviolet radiation, which is absorbed by the stratosphere.This warms up, generating high-altitude winds. Although the exact mechanism is unclear, this appears to have knock-on effects on regional weather: strong stratospheric winds lead to a strong jet stream.
The sun's brightness does not change much during solar maxima, but the type of radiation it emits does
The reverse is true in solar minima, and the effect is particularly evident in Europe, where minima increase the chances of extreme weather. Indeed, this year's cold winter and the Russian heatwave in July have been linked to the sun's current lull, which froze weather systems in place for longer than normal.
The second effect is bottom-up, in which additional visible radiation during a solar maximum warms the tropical oceans, causing more evaporation and therefore more rain, especially close to the equator.
On its own, the effect may not be sufficient to cause noticeable differences. "It's too weak a forcing," says Tim Woollings of the University of Reading. But a study by Katja Matthes at the GFZ German Research Centre for Geosciences in Potsdam and colleagues suggests the two effects could work together to greater effect. For example, observations show that monsoon rains in south-east Asia tend to be stronger during peak solar years. The researchers found that they were only able to reproduce this in models if they included both effects (*Science*, vol 325, p 1114).
The third solar influence on climate is extraterrestrial. Earth is bombarded by cosmic rays from exploding stars, which are largely deflected by the solar wind during solar maxima and to a slightly lesser degree in minima.
One theory held that cosmic rays cool the planet by helping to form airborne particles that water vapour condenses onto, increasing cloud cover. However, models suggest the effect is tiny (*Nature*, vol 460, p 332). Just to be sure, though, the idea is being tested by the CLOUD experiment at CERN in Geneva, Switzerland. Initial results are expected in the next six months.
A theory that has more traction with climate scientists says the rays may change cloud behaviour rather than formation. Using weather balloon measurements, Harrison has shown that clouds have charged layers at their top and bottom, and he suggests that ions produced by cosmic rays might be responsible (*Geophysical Research Letters*, DOI: 10.1029/2010GL043605). "The charge might make it easier for larger water droplets to form," he says, causing rain to fall sooner during solar minima. "But that's just one of many possibilities."
Cosmic rays might be responsible for the charged layers at the top and bottom of clouds
So how large are these effects? In its 2007 report, the IPCC stated that changes in solar irradiance accounted for less than 5 per cent of planet warming since 1750. The scale of the effect is unlikely to change. But having established that global average temperatures are rising and will continue to rise over the 21st century, the key task for the next IPCC report will be to refine regional and medium-term forecasts. For this, including the upper atmosphere in climate models will be key. "We have known for a while that this makes a difference," says Gavin Schmidt of NASA's Goddard Institute for Space Studies in New York, "especially for solar effects."

http://www.newscientist.com/article/mg20727793.100-the-sun-joins-the-climate-club.html

Is there a Moore's law for science?

- 01:36 21 September 2010 by **Rachel Courtland**



The first Earth-like exoplanet discovery could be made in less than a year (Image: NASA/JPL/Caltech/R. Hurt)

Can the rate of past discoveries be used to predict future ones? We may soon find out. Two researchers have used the pace of past exoplanet finds to predict that the first habitable Earth-like planet could turn up in May 2011.

In 1965, Intel co-founder Gordon Moore observed that the number of transistors that fit on a chip doubles about once every two years – a trend now known as Moore's law. Samuel Arbesman of Harvard Medical School in Boston wants to see if scientometrics – the statistical study of science itself – can similarly be used to not only study past progress but also to make predictions.

He and Greg Laughlin of the University of California, Santa Cruz, are testing the idea with exoplanets. Over the past 15 years or so, the pace of planet discoveries has been accelerating, with some 490 planets now known. "It is actually somewhat similar to Moore's law of exponential growth," Arbesman says.

Habitability metric

To predict when astronomers might find the first planet similar in size to Earth that also orbits far enough from its star to boast liquid water, the team scoured the discovery records of 370 exoplanets.

They focused on two basic properties needed for habitability: a planet's mass and its surface temperature. They used these two factors to assign each planet a 'habitability metric' ranging from 0 to 1, where 0 was uninhabitable and 1 is close to Earth's twin.

A rough estimate of each planet's habitability was then plotted against the date of its discovery. Using different subsets of the 370 planets, the researchers made curves from the individual points and extrapolated the curves to find when a planet would be found with a habitability of 1. They then analysed the range of discovery dates to determine which would be most probable.

Their calculations suggest there is a 50 per cent chance that the first habitable exo-Earth will be found by May 2011, a 75 per cent chance it will be found by 2020, and a 95 per cent chance it will be found by 2264.

Change of pace

In fact, exoplanet researchers have made forecasts of the future informally, plotting the mass of planets against the date of discovery to see how the field is progressing. "We've done that for many years at conferences," says Eric Ford of the University of Florida in Gainesville. "The new aspect of this paper is putting an uncertainty on those predictions and unfortunately the uncertainty is quite large."

One source of uncertainty is how factors like changes in funding and the development of new techniques and technology can alter the pace of discovery. "Like the stock market, past returns are no guarantee of future performance," Ford says.

"There are always these complex factors of how science is actually done," Arbesman agrees. But he says the forecasting technique could still prove useful, even if these factors are not accounted for directly. In part, that is because new technologies tend to take a while to ramp up, so they may not lead to sharp jumps in the number of discoveries made.

Previously, Arbesman has quantified how the ease of discovering new mammalian species, chemical elements, and asteroids affects the rate of their discovery. New species and asteroids are more difficult to find the smaller they are, and indeed larger ones are found first. For chemical elements, the opposite is true, since the bigger they are, the rarer and more unstable they tend to be.

http://www.newscientist.com/article/dn19474-is-there-a-moores-law-for-science.html

What's the right path for indoor satnav?

- 15:47 21 September 2010 by **Paul Marks**

Nokia's indoor tracking system on a Nokia N8 smartphone (Image: Nokia Research Centre)

Tracking down one of the last few parking spots in the cramped confines of a dimly lit multi-storey car park is not among life's pleasures. German car maker BMW thinks it has the answer: an indoor positioning system (IPS) that guides drivers to that precious parking spot and later helps them find their car again – through smart use of the car's anti-roll inertial sensors and a mapping app on a cellphone.

BMW's was one of many ideas unveiled at last week's Indoor Positioning and Indoor Navigation (IPIN) conference in Zurich, Switzerland, a gathering of engineers hoping to mimic the runaway success of satnav technology – but this time indoors.

IPS proponents want to pepper public buildings with wireless transmitters to help people locate their departure gate at an airport, say, or a particular store in a vast mall, or an exhibit in a labyrinthine museum. IPS will also be able to track moving targets, letting us locate friends in a multi-storey building regardless of what floor they are on.

But the technology could be a while coming to a public building near you because there is no broad agreement on which technology is best for pinpointing people and objects deep within buildings. The different radio-reflecting and absorbing materials in the built environment mean that radio waves, commonly used in outdoor positioning systems like GPS and the European Union's upcoming Galileo network, cannot reliably negotiate complex architectural geometries.

Time and strength

Consequently, engineers are trialling a variety of different methods to find the most reliable. Two leading contenders are called received signal strength (RSS) and time of arrival (ToA).

RSS relies on knowing the strength of a radio signal at its source and monitoring the drop-off with distance. Given a number of static transmitters, the receiver can work out where it is by triangulation. RSS techniques can use Wi-Fi, Bluetooth and ZigBee – an ultra-low-power version of Bluetooth – radio networks.

ToA, on the other hand, involves reading time stamps beamed from transmitters in known positions and calculating a position by comparing the times when signals from different transmitters arrive. It is the method at work in GPS.

Rivals play tag

At the Nokia World trade show in London last week, Fabio Belloni of the Nokia Research Lab in Tampere, Finland, and his colleagues wore slim, credit-card-sized radio tags to track their movements to within 30 centimetres using an RSS approach. An upgrade of Nokia's technology, presented by Belloni's colleagues

at IPIN, also included an inertial sensor, allowing dead reckoning of the user's motion in between accurate IPS fixes.
A rival system is being offered by Omnisense, a geolocation firm based near Cambridge, UK, which presented the technology to investors at the Meerkats and Avatars invention show in Cambridge this month. Omnisense uses ZigBee radio, inertial sensors and a GPS receiver in its RSS tags – allowing them to switch seamlessly between indoors and outdoor locations, says the firm's Andy Thurman.
The technology could help track miners both above ground and underground, people suffering from dementia – and cattle. Working out when a cow is ovulating is important to farmers – and they "present" in a different direction to bulls in the herd when this happens. "The inertial sensors will tell us this," Thurman says.

GPS emulator

One of the most interesting ideas at IPIN was a ToA approach that mimics the format of the GPS signal – and which is locked to the GPS atomic clock to boot – allowing the satnav receiver technology to be used indoors as well as out. Developed by Locata Corporation of Canberra, Australia, the system places radio nodes that beam out GPS timing data around an area or building of interest. It's designed to aid the military if GPS is being jammed – indeed, the US air force bought one of the systems this week. Chief executive Nunzio Gambale is investigating a range of consumer applications as well.
But these varied systems leave the standardisation problem unsolved. The Open Mobile Alliance, a global cellphone industry body, is looking into how the next generation of 3G technology – currently called LTE, for Long Term Evolution – might be harnessed to provide a standard positioning protocol. But Kanwar Chopra, an engineer with CSR in Cambridge, UK, is sceptical.
"I don't think there is ever going to be one particular technology for indoor location sensing," he told the UK National Microelectronics Institute's Future World Symposium in London last week. "As we go deeper and deeper indoors, accelerometers and gyros have to do the work. Radio signals are just not designed for location sensing in all environments. It's always going to be a fusion of multiple signal types."

http://www.newscientist.com/article/dn19476-innovation-whats-the-right-path-for-indoor-satnav.html

Titanium foam builds Wolverine bones

- 18:07 23 September 2010 by **Jamie Condliffe**

Rebuilt bones will get tougher (Image: c.20thC.Fox/Everett/Rex Features)

Eat your heart out, Wolverine. The X-Men superhero won't be the only one with with metal fused into his skeleton if a new titanium foam proves suitable for replacing and strengthening damaged bones.
Bone implants are typically made of solid metal – usually titanium. Though well tolerated by the body, such implants are significantly stiffer than bone.
This means that an implant may end up carrying a far higher load than the bone it is placed next to, according to Peter Quadbeck of the Fraunhofer Institute for Manufacturing Technology and Advanced Materials Research in Dresden, Germany. In a worst-case scenario, the decrease in stress placed on the bone means it will deteriorate, while the implant loosens and needs to be replaced.

Spongy inspiration

Now Quadbeck and colleagues have created a titanium implant with a foam-like structure, inspired by the spongy nature of bone. The titanium foam does a better job than solid metal when it comes to matching the mechanical properties of bone, such as flexibility, and this encourages more effective bone regrowth.
What's more, the foam is porous, so the bone can grow around and within it, truly integrating the implant with the skeleton.
The titanium foam is made by saturating polyurethane foam with a solution of titanium powder and binding agents. The titanium clings to the polyurethane matrix, which is then vaporised away along with the binding agents. This results in a titanium lattice which is finally heat-treated to harden it.
Though the foam has yet to be approved for use in humans, Quadbeck and colleagues are now working with physicians to explore its suitability for treating certain injuries.
Peter Lee of the Department of Materials at Imperial College London is impressed. He says there are applications where inserting one of these titanium foams "looks like the most promising solution", such as bridging long gaps between broken bones.
Yuyuan Zhao, a materials engineer at the University of Liverpool, UK, adds that "if human bone isn't good enough, an implant could give your body better performance" than leaving bone to heal naturally or using other types of implant.

http://www.newscientist.com/article/dn19493-titanium-foam-builds-wolverine-bones.html

Volcano breath test promises eruption early warning

- 17:33 20 September 2010 by **Kate Ravilious**

Advance warning needed (Image: Tony Gentile/Rex Features)

More than 500 million people live in the shadow of a volcano, but predicting an eruption can be tricky. Forecasts based on periodic gas sampling could be improved with the volcanic equivalent of a breath tester that picks up changes in the composition of gases spewing from its vent.

Most instruments would melt if placed inside the mouth of a volcano, but Alton Horsfall and Nick Wright at the Centre for Extreme Environment Technology at Newcastle University, UK, have been using silicon carbide to create electronic components that can venture where no instruments have ever gone before. "Silicon's a wonderful material to about 175 °C and then it goes horribly wrong, whereas silicon carbide runs to around 600 °C on a practical level," explains Horsfall.

Silicon carbide's ability to withstand high-temperature and high-radiation environments comes from the exceedingly strong bonds between the silicon and carbon atoms, but these tough properties also make it difficult to work with and expensive to manufacture.

Dangerous location

Now Horsfall and Wright have managed to manipulate silicon carbide into viable electronic components. "The sensors are sensitive to oxygen, hydrogen, hydrogen sulphide and sulphur dioxide, that we've tested so far, and can achieve a sensitivity of the order of 10 parts per million," says Horsfall. Although there are still issues with cross-sensitivity, Horsfall hopes to have sensor arrays that can identify unique gases in a mixture within a year.

The next challenge is to integrate them into a device about the size of a smartphone. "Ultimately we hope the devices will be self-powered, using energy-harvesting technologies such as solar cells," says Horsfall.

Such devices could be used in a multitude of dangerous locations; monitoring radioactivity in nuclear waste storage sites, for example, or tracking the pollution inside a jet engine or car exhaust.

In the case of volcanoes, Horsfall and Wright envisage leaving an instrument at the lip of a gas vent to continuously monitor the emerging gases. A radio-frequency transmitter will send the results back to volcanologists in a lab.

Changes in the composition of volcano breath can be a clear sign of imminent eruption; for example, emissions of sulphur increased by an order of magnitude prior to the eruption of mount Pinatubo in the Philippines in 1991. And although we can't stop volcanoes from erupting, a forewarning can provide vital time to prepare.

Horsfall presented the research at the Extreme III Technology Showcase Event at Newcastle University last week.

http://www.newscientist.com/article/dn19472-volcano-breath-test-promises-eruption-early-warning.html

Wind farms make like a fish

- 17:21 23 September 2010 by **Paul Marks**
-

A shoal of turbines (Wind Spire Energy)

Can the flicking tails of schooling fish help squeeze more power out of a wind farm? A group of aeronautical engineers seem to think so.

Inspired by the turbulence created by fish schools, they are now testing whether it's possible to position wind turbines so that they help each other – and so boost a farm's energy output.

Wind farm turbines tend to fall into two types. Three-bladed, horizontal-axis wind turbines are more common – the world's biggest HAWT farm opened off the coast of Kent, UK this week. However, a new breed of vertical axis wind turbines (VAWT) are on the up and up.

VAWTs feature a vertical shaft around which airstream-intercepting wings swirl (see Picture). The "lift" of the wind tangentially yanks the turbine around.

Their advantage? They can harvest airflow from all directions, plus are cheaper to maintain than standard turbines because their generators and gearboxes are on or near the ground.

One downside is that an individual VAWT is less efficient than a typical three-rotor turbine, says aeronautical engineer John Dabiri at Caltech in Pasadena.

However, HAWTs are not perfect. They have to be spaced wide apart - up to 10 times their rotor diameter – to avoid the blades of a neighbouring turbine slowing down the wind too much. That means building them offshore or where there is plenty of land.

VAWTs churn up less of the surrounding air. So Dabiri and colleagues wanted to find out if packing them as tight as possible could rival the overall efficiency of a typical wind farm.

Thought of school

As they did so, inspiration struck Dabiri: "It occurred to me that the equations I was writing were the same as I had previously seen in models of the vortices in a school of fish. From there it was just connecting the dots, conceptually speaking," he says.

One reason fish swim en masse is that it allows them to travel two to six times further than when swimming solo. In 1973, Daniel Weihs of the University of Cambridge (*Nature*, DOI:10.1038/241290a0) suggested that the vortices shed by the tail of a fish in a school sets the surrounding water moving faster so that neighbouring fish get a speed boost.

Could turbines in air help each other too? By modifying the hydrodynamic fish equations for aerodynamics and then feeding them into a fluid dynamics model, they were able to work out optimum turbine placements. A VAWT farm positioned in this way could generate 10 times the power of a HAWT farm of the same area. "We're proposing that VAWTs can be a more effective solution even for large-scale utility power generation," he says.

Class test

Now the team are putting their idea to the test. This summer, the Caltech team operated six vertical turbines north of Los Angeles. The turbines are around 10 metres tall and were mounted on mobile platforms.

The platforms allowed the team to move the turbines to test the most efficient wind farm layouts. They compared their results to those from a HAWT farm on a similar plot of land.

For now, Dabiri is keeping the results close to his chest – saying only that they are "promising" – but he has been encouraged enough to press ahead with patent applications and to seek further tests. "The next step will hopefully be a larger-scale field demonstration," he says.

Robert Blake of the University of British Columbia, Canada and guest editor of the edition of the journal that the work appeared in says the study is "innovative" and "illustrates that biological systems can provide good models for engineering."

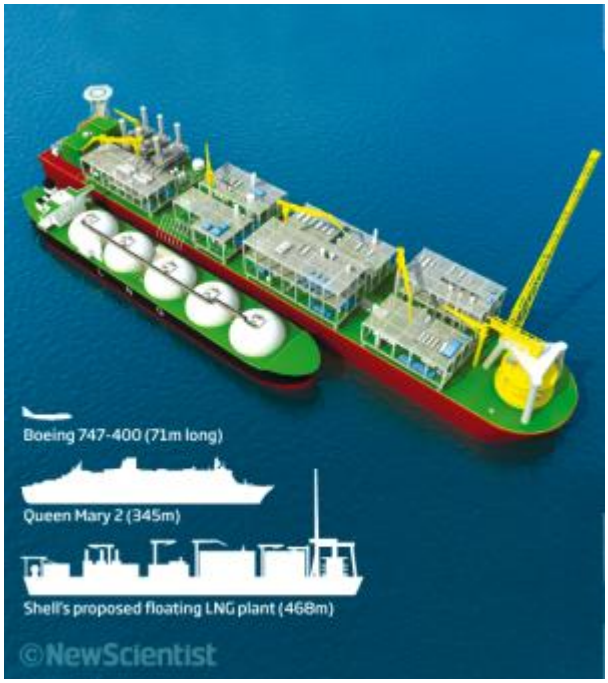
Thorsteinn Sigfusson, director-general of the Innovation Center Iceland in Reykjavik, adds: "In countries like my own where the wind is unsteady and changes direction quickly [VAWTs] could be a major contribution. I look forward to hearing how their larger scale tests go."

Journal Reference: *Biomimetics and Bioinspiration*, DOI:10.1088/1748-3182/5/3/035005

http://www.newscientist.com/article/dn19492-green-machine-wind-farms-make-like-a-fish.html

Oil company to build longest floating vessel ever

- 23 September 2010
- Magazine issue 2779



Building it will be a challenge (Image: Shell)

IT WILL be the longest floating vessel ever to ease its way out of a shipyard - 468 metres long, to be precise. Oil giant Shell wants to exploit the Prelude gas field 475 kilometres north-east of Broome, Western Australia, by building a Floating Liquefied Natural Gas (FLNG) plant. This "stranded field" is too far from land for a pipeline to connect an extraction rig to a gas liquefaction plant on shore, so Shell plans to combine the two at sea. "In simple terms, the facility can be compared to an island with a liquid natural gas plant on it," says Shell's Neil Gilmour.

In simple terms, the facility can be compared to an island with a natural gas plant on it

If built, the vessel will be 10 metres longer than the biggest supertanker ever, the Knock Nevis, scrapped in late 2009. Afloat, it will displace 600,000 tonnes of water - six times that displaced by the US Navy's Nimitz-class nuclear-powered aircraft carriers. No floating oil or gas rig come close to this.

Building such a vast vessel will be an engineering challenge, says Mark Lambert of the Royal Institution of Naval Architects in London. "It's feasible," he says, "but they will have to be very careful about how it flexes along its length if fatigue cracking is to be avoided."

If the Australian government gives the project the go-ahead after an environmental impact assessment, the vessel will be built in a Korean shipyard and then towed to the Prelude field, where Shell says it could be installed in 2015.

http://www.newscientist.com/article/mg20727794.500-oil-company-to-build-longest-floating-vessel-ever.html

Robots on TV: Rescue bot knows, um, what you mean

- 13:14 23 September 2010 by **Catherine de Lange**

Communicating the human way (Image: Feng Li/Getty)

A robot that can understand plain English and manage a complicated to-do list could soon be the hero of search and rescue missions.

Most robots that can recognise speech only respond to pre-determined instructions. For example, some powered wheelchairs respond to spoken directions, but only when certain words are spoken clearly. In the real world, that's not how humans communicate. Our speech is peppered with "disfluencies" – the "umms", "ahs" and stutters of everyday language. If we want to successfully speak to robots in real-life situations – such as search and rescue missions, where noise and stress might get in the way of clarity – robots need to understand these complications.

Now, Matthias Scheutz, a computer scientist from Indiana University in Bloomington, and colleagues have developed a robot that can cope with these ungrammatical speech patterns. Their design filters out disfluencies and helps the robot translate natural speech into clear instructions. The robot can also give feedback, saying "OK" to show that it understands an instruction.

The robot, which has been tested in a mock search and rescue scenario (see video above), also picks up key words such as "try": when told, "Try to do x", for example, the robot interprets this as a "soft" instruction to do x as long as it doesn't clash with more important goals. This means the robot can interpret the subtleties of human speech to prioritise tasks.

Better interactions between robots and humans should make robots more reliable team members in situations where misunderstandings can be fatal, Scheutz says.

http://www.newscientist.com/article/dn19469-robots-on-tv-rescue-bot-knows-um-what-you-mean.html

Just chillin' – molecules that steady quantum computers

- 15:01 22 September 2010 by **Kate McAlpine**
-

Laser cooling – a technique for chilling atoms down to ultracold temperatures – has been extended to molecules for the first time. The advance could help make molecular quantum computers possible.
Cooling with lasers exploits a particular aspect of atomic behaviour. An atom will absorb a photon of a given frequency, transferring the energy to one of its electrons which is briefly kicked up to an excited state. When it drops back down, the atom emits a photon in a random direction and can then absorb another photon.
If the initial photons all arrive from a specific direction – along a laser beam – but the emitted photons leave the atom in random directions, the net result is that the atom travels more slowly towards the laser. Atoms or molecules travel more sluggishly at low temperatures, and so because the atom moves more slowly towards the laser, it is lower in temperature in this direction.
To approach absolute zero requires several thousand cycles of photon absorption and emission. There's a risk that during one cycle the atom might fall into a "dark state" that does not absorb the photons in the narrow frequency range emitted by the laser. It is for this reason that molecular laser cooling is difficult, says David DeMille of Yale University. Atoms have relatively simple sets of energy states making it easy to avoid a dark state. But molecules have more subtle energy states – the bonds between their atoms can stretch and squash into a range of vibrational and rotational states, some of which will be dark.

Few vibrations

In the past decade, it has emerged that some molecules readily occupy relatively few vibrational states, and that there are ways to keep the molecule from spiralling into multiple rotational states. "The combination of these ideas is what led to this breakthrough," says Edward Shuman of DeMille's group.
He and his colleagues chose their molecule carefully so that it would fall into only three vibrational states even after more than 100,000 cycles. The best candidate was a polar molecule, more positively charged on one side and more negatively charged on the other, called strontium fluoride.
The team first cooled their molecules to about 4 kelvin using cold helium gas. They then used a filter to remove particularly energetic – or hot – molecules before introducing them to a 15-centimetre-long hall of mirrors which reflected the three cooling laser beams.
The main laser cooled the molecules, and the other two kicked molecules out of unwanted vibrational states so that they were always available to absorb the main laser's photons.

Hall of mirrors

By the time they reached the end of the hall, each molecule had crossed the laser beams roughly 75 times, absorbing and emitting 500 to 1000 photons. Consequently, in one direction the laser had all but frozen the atom's motion, chilling them down to a thousandth of a degree above absolute zero. Viewed from a different direction, however, the atoms retain the motion characteristic of 4 kelvin.
"This is a really complex problem experimentally and the DeMille group is very courageous to have kept hammering away at it till it was solved," says Lincoln Carr, a cold molecule researcher at the Colorado School of Mines in Golden. "It will be great to see this technique extended to other molecules besides strontium fluoride."
The team believes that molecular laser cooling could work in three dimensions with a larger array of lasers to cool the molecules in different directions. If so, the resulting slow-moving molecules could be loaded into an array to form the information register of a quantum computer.
Entanglement allows quantum bits, or qubits, to use quantum superposition to do multiple computations simultaneously. Polar molecules can become entangled through their electric dipoles, but their overall neutral charge allows them to withstand disturbances from outside electromagnetic fields, so a molecular quantum computer would be less prone to electrical interference than one with charged ions for qubits.

http://www.newscientist.com/article/dn19488-just-chillin--molecules-that-steady-quantum-computers.html

Why our walls really should have ears

- 15:43 14 September 2010 by **Helen Knight**

Nature's AC (Image: Ray Tang/Rex Features)

Read more: Green buildings in pictures in *The growing beauty of green architecture*

Would you decorate your roof with lamb's or elephant ears?

It's not an unusual form of taxidermy – these are plants, and some of the best suited to coat our roofs and walls and so make cooler, greener cities.

Green roofs help to reduce the heat island effect in towns and cities because plants absorb less heat than concrete and can also cool the air via the process of evapotranspiration. This can save energy by cutting the need for air conditioning on hot days. What's more, they reduce the risk of flooding by absorbing water and, of course, they absorb carbon dioxide.

Most existing green roofs use various species of *Sedum*, because the plants can survive without rain for long periods, meaning they require little maintenance.

But Tijana Blanusa, a Royal Horticultural Society researcher based at the University of Reading in the UK, wanted to know if *Sedum* really is the best plant for the job.

The ears have it

She compared a variety of plants, including a *Sedum* mix, lamb's ear and elephant ear, to see if differences in leaf shape and structure would make a difference to the temperature of the air above them.

She found that lamb's ear, a silvery, hairy-leafed plant, had the consistently coolest leaves over a two-year period. "Even when it is really stressed, and the leaves of other plants get a few degrees warmer than when they are watered, the lamb's ear manages to keep its leaves cooler than those that don't have hairs," she says.

What's more, when she measured the air temperature 20 centimetres above each plant, she found that on the hottest summer afternoons the air above lamb's ear was also cooler than above the other plants.

She will present her findings at the World Green Roof Congress in London tomorrow.

Flood failure

In cities like Austin, Texas, that are hot and prone to flash floods, *Sedum* is a poor performer, says Mark Simmons, an ecologist at the University of Texas at Austin.

When Simmons compared six green roofs in Austin planted with a range of species, he found that the city's mix of long periods of heavy rain followed by stretches of drought was too much for the *Sedum*, causing it to rot away.

All the plants he tested tended to cool the air around them, but grasses such as big bluestem and maize performed best at absorbing rainwater, he says.

http://www.newscientist.com/article/dn19444-green-machine-why-our-walls-really-should-have-ears.html

'Off-grid' cellphone towers could save lives

- 22 September 2010 by **Harvey Rubin** and **Alice Conant**
- Magazine issue 2778.

Off grid, but power happy (Image: Shutterstock)

*Electricity from rural cellphone towers in poor countries could chill vaccines, saving 5 million lives every year, say **Harvey Rubin** and **Alice Conant***

EVERY year, at least 2 million people die from vaccine-preventable diseases such as polio, measles and hepatitis. A further 3 million die from diseases spread by unclean water. Both of these big problems ultimately come down to the same thing: a lack of energy infrastructure in the developing world. We propose a solution that could be implemented immediately.

The 2 million vaccine-preventable deaths do not occur for lack of vaccines, but because of inadequate distribution. To work properly, most vaccines must be kept cold. That means constant refrigeration from the point of manufacture to the point of delivery, often a rural location. The series of storage and mobile refrigeration units required to achieve this is called the "cold chain".

Refrigeration requires energy, and in countries with a limited energy infrastructure, maintaining the cold chain can be an overwhelming challenge (*Vaccine*, vol 12, p 1423). A 2007 study in rural India found that 90 per cent of local health centres suffered frequent power failures, and that only 45 per cent of these had a back-up generator (*Public Health Reports*, vol 122, p 112).

Several other studies come to similar conclusions. In Nigeria, for example, inadequate energy infrastructure causes significant loss of vaccine potency between the National Cold Store in Lagos and rural vaccination centres (*Public Health*, vol 110, p 325).

Although the cold chain is not the only impediment to immunisation, it is a major one. A technology that allows the cold chain to better penetrate rural regions would have a big impact.

Many of the 3 million people killed by water-borne diseases are children. Their deaths are a direct result of the fact that more than a billion people have inadequate access to clean water and 2.6 billion lack adequate sanitation. Access to clean water requires water treatment, an energy-intensive process that is often impossible because there is no reliable local energy source.

Both problems demonstrate the urgent need for a rural energy infrastructure in the developing world. Our Energy for Health project, based at the University of Pennsylvania in Philadelphia, proposes to tackle this problem by hitching it to a juggernaut of global technological development - cellphones.

Cellphones are the fastest spreading technology in the world. According to the United Nations' International Telecommunication Union, approximately 75 per cent of the world's rural inhabitants are now covered by a cellular signal and close to 100 per cent will have coverage by 2015.
Cellphone networks rely on cell towers, and towers need power. This is usually supplied from the electricity grid. In recent years, however, cellphone networks have increasingly spread into areas with no grid connectivity. These use stand-alone cell towers powered by diesel generators and, increasingly, solar and wind.
The off-grid network is growing fast. The industry trade association, GSMA, estimates that by 2012 there will be 639,000 off-grid cell towers in the developing world. These represent a potential new energy infrastructure in locations with no access to the electrical grid.
Our proposal is simple: use surplus energy from off-grid cell towers to power cold chains and water purification systems. If we succeed, by 2015 everybody in the world could have access to vaccines and clean water and we could save 5 million lives a year.
If we succeed, by 2015 everybody in the world could have access to vaccines and clean water
Although supplying power is not part of the network operators' business plan, GSMA recognises its potential. It promotes the idea through an initiative called "Community Power" and its most recent report states "a significant opportunity exists to provide... energy to people in the developing world who live beyond the electricity grid".
With the support of Community Power, network operators are already exploring ways of using their surplus tower power to charge mobile handsets, household batteries and rechargeable lanterns. They also recognise the potential for powering entire villages.
Our first aim is to solve the cold chain problem due to its minimal energy requirements. Cold-chain refrigerators require a minimum of 8 hours of electricity a day, and even the most energy-hungry models require no more than 2 kilowatts of power. Off-grid cell towers produce about 5 kilowatts of excess power on average, so this should be achievable with no negative impact on the cellphone network.
Other cold-chain solutions are being explored, including heat-stable vaccines, solar powered refrigeration units and immunisation teams with refrigeration units in their cars. However, these methods are expensive and some require many more years of research.
Water purification is more complicated. There are numerous purification methods, so the energy requirements are not as easy to calculate. In addition, infrastructure for transporting water is often lacking. But if cell towers can provide the energy for water purification and are then integrated with transportation projects, clean water could be made available to all rural locations in developing countries.
Our idea has received enthusiastic support and we are starting to put the wheels in motion. The next step is quite straightforward. We want to implement a pilot project in collaboration with the cellphone and pharmaceutical industries and a local healthcare system. We are ready to start immediately - we must start immediately - and we are available to provide further information or to receive suggestions.
Harvey Rubin directs the Institute for Strategic Threat Analysis and Response at the University of Pennsylvania, Philadelphia (email rubinh@upenn.edu).
Alice Conant is a student at Harvey Mudd College in Claremont, California

http://www.newscientist.com/article/mg20727786.200-offgrid-cellphone-towers-could-save-lives.html

Untagged: Software recognises animals it's seen before

- Updated 12:03 20 September 2010 by **Helen Knight**
- Magazine issue 2778.

Check out my pink spot (Image: Michael Patrick O'Neil/NHPA)

LEOPARDS can't change their spots - and tigers, zebras and whale sharks can't change their stripes. This just as well since they can be used to identify individual animals from pictures or video instead of conventional identity bands and radio tags.

It is more effective to track animals by such "fingerprints" since they don't have to be caught and sedated, which is stressful.

To monitor the population and movement of leatherback sea turtles, marine biologists normally use plastic "cattle tags", which contain a unique identity number. These often fall off, says Scott Eckert, a director of the Caribbean sea turtle conservation network Widecast. "We get a large number of leatherbacks coming into Trinidad with tag scars. So we know they've been tagged, but we have no idea when," he says. "We lose a tremendous amount of valuable information."

Widecast approached Eric Pauwels and colleagues at the Dutch centre for mathematics and computing (CWI) in Amsterdam to develop an algorithm that would identify individual leatherback sea turtles from digital images of their pink spot, a patch without pigment on the top of their heads. These spots are unique to each turtle, and don't change throughout their lives, says Pauwels. The algorithm looks for specific identifiers on the spots - in particular areas of contrast, such as white patches on dark areas. It then encodes these details into a unique biometric sign for the turtle.

The team has tested the system on digital photographs of leatherbacks, and they now plan to add it to Obis-Seamap, a global marine animal database. Biologists will then be able to upload images of sea turtles alongside details of where they have been spotted, and get an instant ID if its details are there.

It's not just researchers who could use the system, says Pauwels. "Ideally, anyone who comes across a turtle on a beach could take a photograph, upload it to the website and find out whether the animal has been seen before, where it is from, and how old it is," he says.

Anyone who sees a turtle on a beach could take a photograph and find out where the animal is from

Tilo Burghardt at the University of Bristol, UK, is hoping to do the same for African penguins. His team has developed a system to automatically identify individual penguins from video of a colony on Robben Island, off the coast of Cape Town, South Africa.

Usually, studying penguin populations means attaching numbered bands to their flippers, says Burghardt, but these can cause severe injuries. And practically speaking there's a limit to how many uncooperative birds one researcher can band.

Burghardt maps the placement and shape of spots on each penguin's chest as they pass the camera, and compares this with a database of known birds. Soon visitors to the island will be able to upload their own pictures to help with identification.

At a computer vision conference in Istanbul, Turkey, last month, Burghardt revealed that the penguin-spotting technique can be used to fingerprint any animal with spots or stripes. Next, he hopes to use it to spot great white sharks by the jagged pattern on the rear of their first dorsal fin.

It is not just an animal's surface features that can be used as identifiers: footprints are also unique, says Zoe Jewell of Belize based conservation organisation WildTrack.

While monitoring black rhino using radio collars in Zimbabwe in the 1990s, Jewell and her husband Sky Alibhai discovered that repeatedly sedating females to attach and then maintain collars reduced their fertility rates (*Journal of Zoology*, vol 253, p 333).

So they began to investigate whether technology could emulate the way bush trackers identify animals by their prints. The footprint identification software they developed measures the distances and angles between various landmarks on the print, to create a unique biometric signature. So far it works for white and black rhino, cheetahs and polar bears.

The software doesn't cope too well with smudged footprints, which have to be picked out by hand, but the pair are working with software firm SAS, based in Cary, North Carolina, to solve this.

WildTrack is working with a conservation group in India to help them track Bengal tigers. And they recently received a request for help in identifying a rogue elephant in a herd in Botswana that has been trampling crops. This is likely to be tough, says Alibhai, because there are likely to be few features to look out for with an elephant print.

"You can spin the thing around and you don't know where the top and bottom are," he says. But he is still optimistic that the new technique will help spot their elephant in the crowd.

When this article was first posted, WildTrack was misspelled

Birds-eye viewer

HOW would you like to perch for hours on a cold and windy cliff top, monitoring the comings and goings of hundreds of identical birds? That's often the unenviable task of those studying nesting guillemots. But help is at hand.

Patrick Dickinson of the University of Lincoln, UK, says a researcher may wish to monitor a pair of birds every day to see if their chick is still there. "But they can't stare at one pair of birds for the whole day."

So Dickinson and colleagues are developing software that can pick out birds from a background of moving foliage. Not only will this automate the process of counting the birds, but it should also give biologists valuable insights into their behaviour, says Dickinson. "One of the things they are interested in is chick survival rates, and how that correlates with the amount of time birds spend at their nests," he says. "To get data like that manually is virtually impossible."

The system will be tested on video footage of nesting guillemots on Skomer off the coast of Wales, UK. The first step is to train the software on images of the nesting area, to develop a model of the moving background. It then compares this to each new video frame, breaking the image down into different regions and looking for new objects with the right shape and position to be nesting birds.

http://www.newscientist.com/article/mg20727785.700-untagged-software-recognises-animals-its-seen-before.html?full=true&print=true

Think or swim: Can we hold back the oceans?

- 22 September 2010 by **Stephen Battersby**
- Magazine issue 2778.

Is there a way of defending low-lying coastal areas? (Image: Stephen Frink/Getty)

Not even massive geoengineering projects will stop the seas' relentless rise. Maybe it's time we found somewhere to put all that excess water

FOR some, the end may come slowly, as the seas creep a little higher each year. That was the fate of the ancient cities of Herakleion and Eastern Canopus, which took centuries to be swallowed up. Elsewhere, the land may be eroded by waves and swept away by currents, as happened to the medieval English port of Dunwich. Or disaster could strike almost overnight, when a storm joins forces with the tides to create a surge that overwhelms flood defences, leaving the survivors wondering if there is any point in rebuilding.

As the world gets warmer, sea levels are rising. It has been happening at a snail's pace so far, but as it speeds up more and more low-lying coastal land will be lost. At risk are many of the world's cities and huge areas of fertile farmland. The sea is set to rise a metre or more by the end of this century, swamping much vital intrastructure and displacing hundreds of millions of people (*New Scientist*, 1 July 2009, p 28). And that's just the start. "Unless there is a rapid and dramatic about-face in emissions - which no one expects - the next century will be far worse than this century," says glaciologist Bob Bindshadler of NASA's Goddard Space Flight Center in Greenbelt, Maryland.

Throwing trillions of dollars at the problem could probably save big cities such as New York, London and Shanghai, but the task of defending all low-lying coastal areas and islands seems hopeless. Or is it? What if, instead of fighting a rearguard action against the encroaching oceans, we stopped sea levels rising at all? Could we find a way to slow the accelerating glaciers, drain seas into deserts or add more ice to the great ice caps of Greenland and Antarctica?

These ideas might sound Bond-villain crazy but we have got ourselves into such a bad situation that maybe we should start to consider them. If we carry on as we are, sea levels will rise for millennia, probably by well over 10 metres. Slashing greenhouse gas emissions would slow the rise and ensure it peaks sooner and at a lower level, but the longer we prevaricate, the bigger the rise we will be committed to. Even if "conventional" geoengineering schemes for cooling the planet were put in place and worked as planned, they would have little effect on sea level over the next century unless combined with drastic emissions cuts.

In short, if coastal dwellers don't want their children and grandchildren to have to abandon land to the sea, now is the time to start coming up with Plan C. So *New Scientist* set out in search of the handful of researchers who have begun to think about specific ways to hold back the waters, or are at least prepared to talk about the feasibility of such ideas.

One of the reasons why the great ice sheets of Greenland and Antartica are already shrinking is that the ice is draining off the land faster. Ice floating on the surrounding seas usually acts as a brake, holding back glaciers on land, so as this ice is lost the glaciers flow faster. The acceleration of the Jakobshavn glacier in Greenland is thought to be the result of warm currents melting the floating tongue of the glacier. Other outlet glaciers are being attacked in a similar way.

Mike MacCracken of the Climate Institute in Washington DC is one of those starting to think that we shouldn't just sit back and let warm currents melt ice shelves. "Is there some way of doing something to stop that flow, or cool the water?" he asks.

Last year, physicist Russel Seitz at Harvard University suggested that the planet could be cooled by using fleets of customised boats to generate swarms of tiny bubbles. This would whiten the surface of the oceans and so reflect more sunlight. MacCracken says the bubbles might be better deployed in a more focused way, to cool the currents that are undermining the Jakobshavn glacier and others like it. A couple of degrees of chill would take this water down to freezing point, rendering it harmless. "At least that would slow the pace of change," MacCracken says.

What about a more direct approach: building a physical barrier to halt a glacier's flow into the sea by brute force? Bindshadler thinks that is a non-starter. "The ice discharge has many sources, mostly remote and in environments where barriers are not likely to work," he says. "Taking just the one example I know best, the Pine Island glacier in Antarctica drains into an ice shelf that at its front is 25 kilometres across and 500 metres thick, and moves at over 10 metres per day. The seabed there is 1000 metres down and is made of sediment hundreds of metres thick and the consistency of toothpaste." Not your ideal building site.

A slightly more subtle scheme to rein in the glaciers was proposed more than 20 years ago by Douglas MacAyeal of the University of Chicago. His idea is to fight ice with ice. The big outlet glaciers feed into giant floating shelves of ice, which break off into icebergs at their outer edges. MacAyeal suggested pumping water up from beneath the ice and depositing it on the upper surface, where it would freeze to form a thick ridge, weighing down the floating ice shelf. Add enough ice in this way, and the bottom of the ice shelf would eventually be forced down onto the seabed. Friction with the seabed would slow down the shelf's movement, which in turn would hold back the glaciers feeding into it. It would be like tightening a colossal valve.

"I think it's quite an inspired idea," says Bindshadler. But nobody has followed it up to work out how practical the scheme would be. "On the back of an envelope it has promise - but these ice shelves are big. You would need a lot of drilling rigs all over the ice shelf, and my intuition is that if you look at the energetics of it, it won't work," Bindshadler says.

Even if we could apply brakes to glaciers, this would only slow down sea level rise. Could we do better than that and reverse it - actually make the sea retreat? If you think of the sea as a giant bathtub, then the most obvious way to lower its level is to take out the plug.

"One of the oldest notions is filling depressions on the land," says MacCracken. Among the largest of these is the Qattara depression in northern Egypt, which at its lowest point is more than 130 metres below sea level. Various schemes have been proposed to channel water from the Mediterranean into the depression to generate hydroelectric power, and as a by-product a few thousand cubic kilometres of the sea would be drained away. Unfortunately, that's only enough to shave about 3 millimetres off sea level: a drop in the ocean. And there would be grave consequences for the local environment. "The seepage of salt water through fracture systems would salinate aquifers for good," says Farouk El-Baz, a geologist at Boston University who has studied the region.

Refilling the Dead Sea is no better. Because of surrounding hills, this depression could be filled to 60 metres above sea level, but even that would only offset the rise by 5 millimetres - and drown several towns into the bargain.

How about digging new holes on land to drain away a little more of the ocean? Or better still, dredging the seabed and piling the mud on nearby land to raise its level? The world's oceans cover 360 million square kilometres, so to reverse a 1-metre rise in level, 360 trillion cubic metres of soil or sediment would have to be dug or dredged, and piled up somewhere. That's a lot of digging - and in fact the scale of the task is so colossal that even nuclear explosions wouldn't be up to it. In the Sedan nuclear test of 1962, designed to investigate the possibility of using nuclear explosions for excavating canals, mines and so on, a 100-kilotonne

bomb blew a neat hole in the Nevada desert. It is one of the largest artificial craters on Earth, but even so it would hold only a few million cubic metres of water. Not even the most crazed white-cat stroker would suggest setting off hundreds of millions of such charges around the world's coasts.
Not even the most crazed white-cat stroker would suggest setting off hundreds of millions of nuclear charges

Totally unrealistic

A slightly less improbable notion is to pump seawater up onto the frigid highlands of Antarctica and let it freeze. The East Antarctic ice sheet is thought to be much more stable than its shaky West Antarctic counterpart, and might hang onto its new load for thousands of years. But the scale of the operation that would be required is, to say the least, daunting. The water would have to be pumped 1000 kilometres or more, and raised to an altitude of at least a couple of thousand metres. The energy cost would be staggering. According to *New Scientist*'s calculations, to shift a metre's worth of sea level would need several terawatts of power - in the same ballpark as the power consumption of the whole world today - sustained for a century.
"You would also have to make sure your pipes don't freeze up, which wouldn't be easy," says MacCracken.
He doesn't quite rule out the idea, pointing to the success of geothermal hot-water pipes that stretch across the chilly landscape of Iceland. However, Chris Binnie, a UK-based consultant hydrological engineer sees no chance of the idea being put into practice. "It is totally unrealistic," he says.
Even if this brute force approach were feasible, trying to build up the ice caps might well prove futile if the world continues to warm. There may, however, be a subtler approach that will both add ice to the ice caps and ensure it stays there for millennia.
An old idea for fighting climate change is to spray fine sulphate droplets into the stratosphere, where they would reflect some incoming sunlight and so cool the globe. Rather than spreading the stuff around the planet as is currently being considered, sulphates might be deployed more selectively at high latitudes, acting as parasols for the polar regions. This has been suggested as a way to preserve the vanishing sea ice in the Arctic Ocean, but it could also have a fortunate side effect. "We did some climate simulations with reduced solar radiation over the Arctic and Antarctic," says Ken Caldeira of Stanford University in California. "Greenhouse gases will still be warming equatorial regions, so water is evaporating and the atmosphere is moister. The deflection of sunlight cools high-latitude air masses, so that moisture comes down as snowfall."
Snow that lands high on an ice cap will stick there, gradually turn to ice, and not return to the seas for many thousands of years. The numbers are promising. Greenland alone might take up as much as a centimetre of sea level per year. If the polar cooling also slows down the flow of outlet glaciers, that might more than make up for the rise in sea level.
Or will it? The notion of engineering lower sea levels remains a highly speculative topic and, as with geoengineering measures intended to cool the planet, the very idea of deliberately messing about with the delicate mechanisms of our planet understandably horrifies many people. Even the enthusiasts say that it could only be part of the answer.
"If the world doesn't control emissions, I'm pretty sure that no geoengineering solution will work - and it would potentially create other side effects and false promises," says MacCracken. "But if we do get on a path to curbing emissions dramatically - down 50 per cent by 2050, say - then the question becomes, can geoengineering help with the hump we're going to go through over the next few centuries?"

How to raise entire cities

When the town of Galveston in Texas was largely destroyed by a hurricane-driven flood in 1900, its citizens decided on a no-nonsense strategy to stop it happening again. They jacked up surviving buildings and shoved sediment in underneath, raising the town by 5 metres. This approach is unlikely to be copied any time soon, though. Lifting buildings is horribly expensive, and would seriously disrupt the workings of an intricately wired-up modern city.
One alternative is using seawater to solve the problem. Andrea Comerlati of the University of Padua in Italy has proposed raising Venice by pumping water into the bedrock 700 metres beneath the city. According to his calculations it would take only 12 wells and 10 years to lift the city by 10 to 40 centimetres.
That could help in the short run but it is not even halfway towards compensating for a metre or more of future sea-level rise. It has another downside, too: if the pumps stop, the land will deflate and the city will sink - a

slow-motion farce of a disaster. "To create permanent uplift, you need a layer of solid matter," says Lawrence Murdoch of Clemson University in South Carolina.

His suggestion is to pump some sort of slurry down a network of boreholes. He reckons that if the geology is right, the high-pressure fluid will create horizontal fractures in the rock that spread out from each borehole, eventually joining up into one continuous layer. When the water gets squeezed out again, the solid particles left behind will form a permanent new layer.

Murdoch has done some small-scale experiments to show that the fracturing does work, and is hoping to get funding for larger field tests. This method has the potential to lift up land areas by several metres, he says. "And disturbance to life at the surface would be relatively slight."

As a side benefit, you could get rid of waste materials this way. Murdoch suggests using ash from coal-fired power stations, which should set like concrete.

The method might even be used for larger coastal regions, rather than just cities. "I think that it would scale up fairly well," says Murdoch. Inevitably, money will be the key. To raise a square kilometre of land by a metre would cost roughly $8 million, he calculates. While that might be a bargain for an island airport or a city in the developed world, it is unlikely to help farmers in Bangladesh. Lifting up the land may be strictly for the rich.

Stephen Battersby is a consultant for New Scientist

http://www.newscientist.com/article/mg20727781.600-think-or-swim-can-we-hold-back-the-oceans.html

Whooping cough epidemic suggests bacteria are adapting

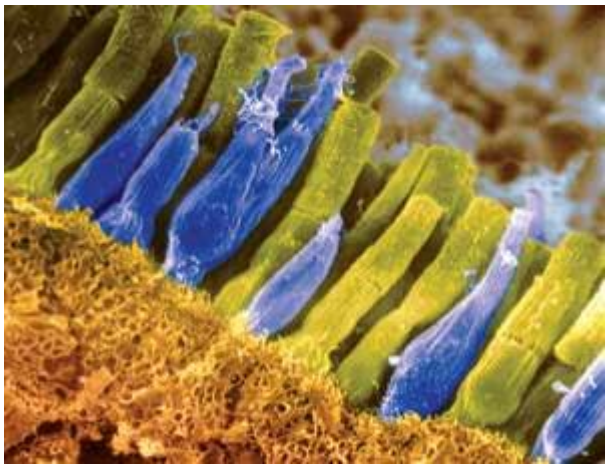
- 23 September 2010
- Magazine issue 2779.

NINE babies have died in California, and four in Australia, so far, in the worst epidemic of whooping cough in rich countries since vaccination became widespread in the 1950s. The main cause is a lack of re-vaccination, but the bacterium may also be adapting to beat vaccines.
Vaccination protects babies - these recent deaths have been in babies not yet vaccinated - but immunity wanes with age, so older children and adults can be unwittingly infected with whooping cough and infect unvaccinated babies. California is one of 21 states that don't require re-vaccination of children entering secondary school. It is now offering vaccine to anyone over 7.
Yet waning immunity doesn't explain why whooping cough, or pertussis, has climbed steadily in Europe and North America since the 1990s, says Frits Mooi of the Dutch National Institute for Public Health and the Environment in Bilthoven.
Vaccines are still made with strains isolated before the 1950s, he says. Mooi has evidence that circulating pertussis bacteria are mutating to evade vaccines, and producing more of a toxin that fights immunity.
Whooping cough bacteria currently in circulation appear to be mutating to evade vaccines
"If confirmed, it will be the first known case of a human disease germ adapting to vaccination," says William Schaffner, head of preventive medicine at Vanderbilt University in Nashville, Tennessee.

http://www.newscientist.com/article/mg20727792.300-whooping-cough-epidemic-suggests-bacteria-are-adapting.html

Retinal cone cells transplanted into blind mice

- 00:01 22 September 2010 by **Andy Coghlan**



In this colour-enhanced image, the rods are shown in green and the cones in blue (Image: Omikron/SPL)
Retinal cone cells vital for colour vision have been successfully transplanted into blind mice. The same team transplanted rod cells, used in night vision, four years ago. The hope for restoring vision in the blind is that transplantable cells which mature into rods or cones can be derived from human embryonic stem cells (hESCs), which can grow into any of the body's tissues.
"Ultimately, all blindness results from loss of cones," says Jane Sowden of University College London. Sowden's team extracted cells for transplant from the eyes of fetal or newborn mice. They selected cells with activity in a gene called *cone rod homeobox* which commits cells to becoming rods or cones.
Treatment was given to mice engineered to mimic a form of childhood blindness called Leber's congenital amaurosis. The team injected 200,000 isolated cells into each eye, in a space between the layer of light-sensitive cells – engineered to be damaged in the recipient mice – at the rear of the retina and a supporting epithelial cell layer above. Within 21 days, the new cells settled into the photoreceptor layer and grew into rods and cones.
"This is very exciting work and it would be a huge medical breakthrough to be able to restore lost photoreceptors in patients who are blind," says Robert Lanza, chief scientific officer at Advanced Cell Technology, a company in Worcester, Massachusetts, which in 2004 successfully turned hESCs into retinal cells. "But it's important to point out that this is very early-stage work, and incorporation of the cells into the retina doesn't mean that they're functional, which is of course the ultimate goal."
Journal reference: *Human Molecular Genetics*, DOI: 10.1093/hmg/ddq378

http://www.newscientist.com/article/dn19478-retinal-cone-cells-transplanted-into-blind-mice.html

City-dwelling helped us evolve resistance to disease

- 12:20 20 September 2010 by **John Cannon**

Living in a crowded city doesn't sound like a recipe for good health, but it may have helped our ancestors protect their descendants from disease.

Some people carry a genetic sequence, or allele, that provides immunity to leprosy and tuberculosis. Mark Thomas, an evolutionary biologist from University College London, and Ian Barnes, a molecular palaeobiologist from Royal Holloway, University of London, wondered whether this genetic immunity could have been gained when people began living in close proximity. Poor sanitation would have meant that disease was rife in ancient cities, but exposure to the pathogens would have led to resistance developing, which the inhabitants would have passed onto their descendants.

To test this idea, Thomas and colleagues analysed the DNA of people living in 12 regions in Europe, Asia and Africa. For each area, they combed the historical and anthropological records to work out when people first started living in close-knit groups. They found that the longer cities in the region had been established, the more likely it was that the current inhabitants carried the immunity allele.

Thank the cows

It had been thought that the allele became prevalent when cattle were first domesticated, as cows carry a strain of TB that humans can catch. But the team found a stronger correlation between the allele and urbanisation than with the onset of cattle farming.

It is likely that cattle domestication would have played a role in developing the immunity, because cattle farming would have been important in early city life, Barnes points out.

Thomas describes population dynamics as "an awesome, underplayed feature of our history" and thinks resistance to other diseases could also have evolved in this way.

John Odling-Smee, an evolutionary biologist at the University of Oxford who wasn't involved in the study, agrees. "This study could be regarded as the tip of the iceberg" in terms of the effects of urbanisation on disease immunity, he says.

Journal reference: *Evolution*, DOI: 10.1111/j.1558-5646.2010.01132.x

http://www.newscientist.com/article/dn19466-citydwelling-helped-us-evolve-resistance-to-disease.html

For clean hands, don't rub, scrub with a paper towel

- 18 September 2010
- Magazine issue 2778.

DOCTORS and nurses take note - rubbing your hands together in a hand dryer leaves them coated with more bacteria than just after you washed them. Even normal skin bacteria may be bad news for sick people.
"When you rub your hands, you bring a lot of bacteria to the surface from the pores of your skin," says Anna Snelling of the University of Bradford, UK. She asked 14 volunteers to dry their hands for 15 seconds using three different types of air dryer, sometimes rubbing their hands together and sometimes not.
When volunteers kept their hands still, the dryers reduced skin bacteria numbers by around 37 per cent compared to just after washing. But the count rose by 18 per cent when volunteers rubbed their hands under one of the machines. Paper towels proved the most efficient, halving the bacterial count even though volunteers rubbed their hands. That's because the towels actually scrape off the bacteria (*Journal of Applied Microbiology*, DOI: 10.1111/j.1365-2672.2010.04838.x).
The work was funded by Dyson, the hand-dryer manufacturer based in Malmesbury, UK.

http://www.newscientist.com/article/mg20727785.200-for-clean-hands-dont-rub-scrub-with-a-paper-towel.html

Standing on a stepladder makes you age faster

- 20:37 23 September 2010 by **David Shiga**
- For similar stories, visit the **Quantum World** Topic Guide

We think of relativity's effects on time as occurring at near light speeds or in the presence of crushing gravitational fields. But new atomic clock experiments show the pace of time changes at everyday speeds and heights – when you ride a bicycle or climb a stepladder.

Einstein's theory of relativity shattered the notion that time runs at the same rate for everyone, everywhere in the universe. Instead it predicts that time slows down in a gravitational field, making clocks run a little slower on Earth's surface than in deep space.

It also predicts time is skewed by velocity differences between observers, giving rise to the so-called twin paradox. A twin who returns from a journey in a fast-moving spacecraft will have aged much less then the twin who stayed home.

These effects have been demonstrated in numerous experiments, including one that sent atomic clocks flying on airplanes and showed they fell behind clocks that stayed put on the ground, due to the difference in velocity. Another showed that an atomic clock slowed down when launched on a rocket 10,000 kilometres above Earth's surface, where the planet's gravitational field is weaker.

James Chin-Wen Chou of the National Institute of Standards and Technology in Boulder, Colorado, led a team that used atomic clocks to show the effects of relativity at more familiar scales.

Tick rate

The experiment kept time using a laser that emitted light only at a specific frequency. Tuning the laser to this frequency involved measuring when an aluminium ion held in place by an electric field absorbed the laser light, since the ion only absorbs light that oscillates 1.12×10^{15} times per second. The oscillations of the laser light could then be used like the ticks of a regular clock to measure the passage of time.

The experimenters measured the change in tick rate of one such clock when raised 33 centimetres in their lab, keeping a second identical clock fixed as a reference. The increased height made the clock run ever so slightly faster – by about 4 parts in 100 million billion (10^{17}). The effect is so small that it would add up to a difference of just 90 billionths of a second over a human lifetime of around 80 years.

In another experiment, an oscillating electric field was used to set the ion in one clock jiggling back and forth at a speed of about 10 metres per second, or 36 kilometres per hour. The ion in the other clock was kept fixed. Because of the difference in motion between the two clocks, the one with the jiggling ion ran slightly more slowly, by 6 parts in 10^{16}.

Thought experiments

The time-slowing effects of gravity have been measured on even smaller distances than 33 centimetres. In February, a team that included US Energy Secretary and Nobel prizewinning physicist Steven Chu reported seeing these effects when the difference in height between two objects was just 0.1 millimetre. The experiment exploited the fact that, thanks to quantum mechanics, atoms can behave like waves. It showed that waves at different heights oscillate at different frequencies due to gravitational time stretching.

But the new results by Chou's team represent the first time that atomic clocks have been used to show the gravitational effect over such small distances and the velocity effect at such small speeds. "When we learn relativity in school, clocks in different reference frames are usually introduced to illustrate the results of relativity," Chou says. "In that sense, this paper resembles more closely the thought experiments that teachers use to teach relativity."

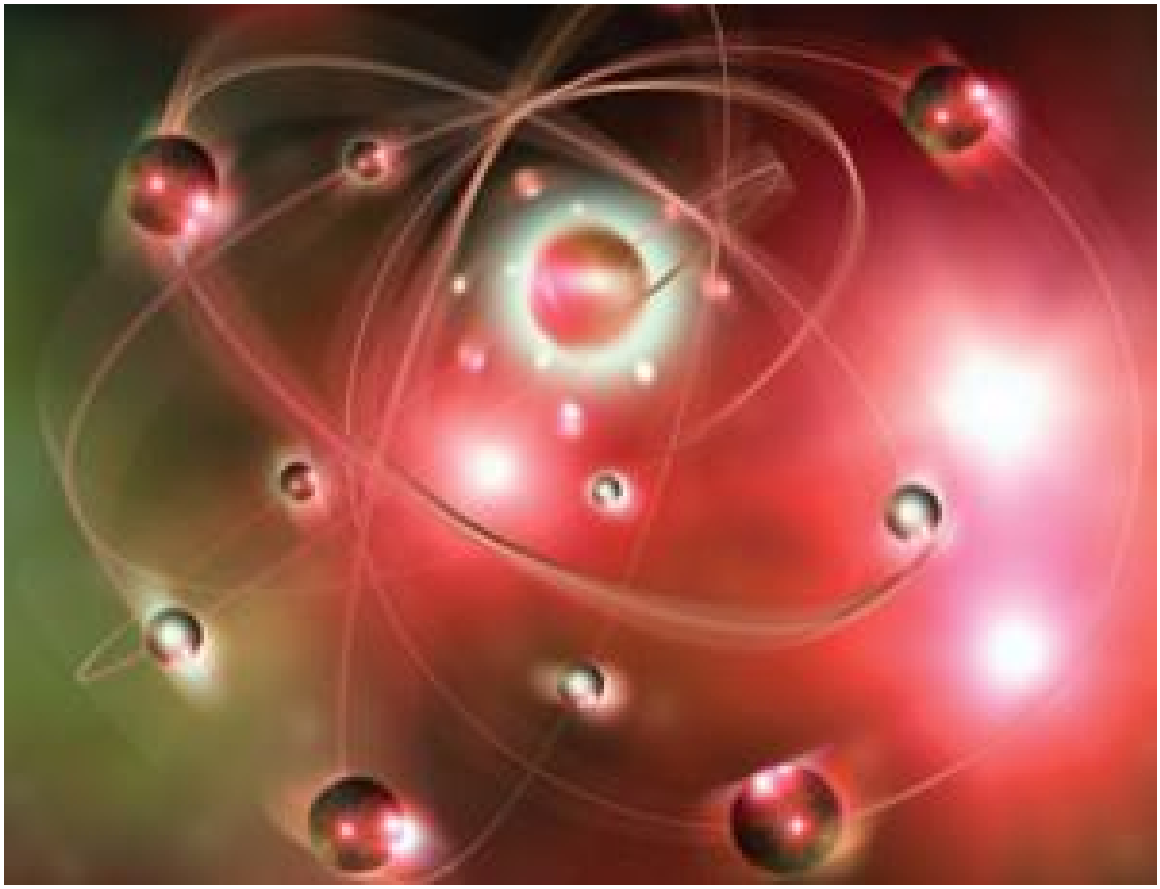
"It is truly wonderful that Chou and his partners have been able to measure time dilation associated with a height change of less than a metre," says Michael Bevis of Ohio State University in Columbus, who was not involved in the new experiments.

Journal reference: *Science* (DOI: 10.1126/science.1192720)

http://www.newscientist.com/article/dn19494-standing-on-a-stepladder-makes-you-age-faster.html

Large proton halo sparks devilish row

- 23 September 2010 by **Kate McAlpine**
- Magazine issue 2779.



Now with extra shine (Image: Mehau Kulyk/SPL)

IN CHRISTIAN art, a halo symbolises holiness. In particle physics, a ring of positive charge around the proton has become the focus of a devilish row.

The dispute concerns an attempt to square a recent suggestion that the radius of the proton is smaller than we thought with the theory of quantum electrodynamics (QED), which has successfully explained quantum phenomena since the 1940s.

A proton's radius cannot be measured directly, but has to be deduced by measuring the energies of different electron "shells" in a hydrogen atom. Through QED, these energies combine with a model of how the proton's charge is distributed to give the proton's radius.

The smaller value for the proton radius came from measurements of an exotic form of hydrogen that contains a heavy type of electron known as a muon. This was expected merely to add precision to previous measurements based on ordinary hydrogen. Instead, the muonic measurements suggested a radius that was a whopping 4 per cent smaller (*New Scientist*, 10 July, p 10). That could signify a problem either with the muonic measurement or with QED, neither of which seems particularly likely.

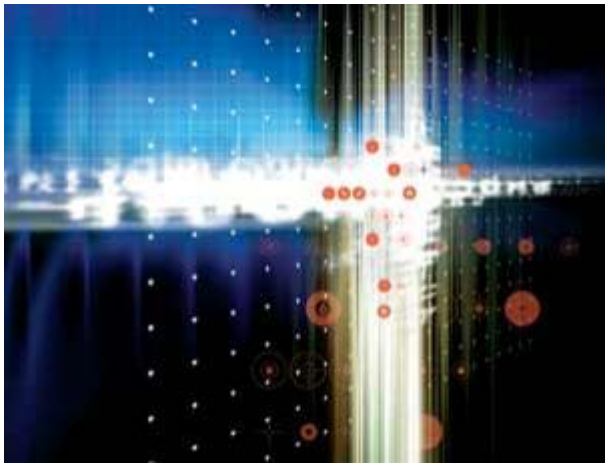
Now Alvaro De Rújula of the Autonomous University of Madrid, Spain, has another solution: changing our model of how the proton's positive charge is distributed.

About 75 per cent of this charge is concentrated in a central core, the edge of which is considered the edge of the proton proper. Although the other quarter of the proton's charge lies outside this (see diagram), the charge distribution in the "halo" is still key to finding the proton radius. So De Rújula decided to explore whether varying the charge distribution in the halo could bring the old and new calculations for the proton's radius into agreement - and remove the conflict with QED.
He found that it can, if the halo band extends 4.7 times as far as previously thought. He concludes that this is the proton's true structure (*Physics Letters B*, DOI: 10.1016/j.physletb.2010.08.074).
The proposal has been contentious since De Rújula first posted it to the arxiv preprint server on 23 August. Chief among the sceptics are Gerald A. Miller and Ian Cloët of the University of Washington in Seattle, who posted a rebuttal just two days later. "De Rújula's explanation is simply off the wall," says Miller. "It is as if the amount of water in a thimble were spread out into the volume of a swimming pool".
This is an exaggeration, counters De Rújula, "unless the thimble covers a whale's face".
Miller concedes that a thimble and a pint glass is a fairer analogy. Even so, he and Cloët have calculated that a proton with a charge that extends as far as De Rújula suggests is not compatible with experiments looking at the extent to which electrons are deflected towards protons at different distances (arxiv.org/abs/1008.4345v3).
De Rújula says the matter could be resolved with new electron-proton collision experiments or fresh analysis of existing data. He is convinced that, somehow, "QED will be vindicated".

http://www.newscientist.com/article/mg20727793.500-large-proton-halo-sparks-devilish-row.html

Dimensions vanish in quantum gravity

- 22 September 2010 by **Rachel Courtland**
- Magazine issue 2779.



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FORGET Flatland, the two-dimensional world imagined in the 1884 novella by Edwin Abbott. On tiny scales, 3D space may give way to mere lines.

So say researchers working on theories of quantum gravity, which aim to unite quantum mechanics with general relativity. They have recently noticed that several different quantum gravity theories all predict the same strange behaviour at small scales: fields and particles start to behave as if space is one-dimensional.

The observation could help unite these disparate ideas. "There are some strange coincidences here that might be pointing toward something important," says Steven Carlip at the University of California, Davis.

He has noted that the theories yield similar results and has come up with an explanation for how dimensions might vanish (arxiv.org/abs/1009.1136v1). "The hope is that we could use that to figure out what quantum gravity really is," he says.

Disappearing dimensions first came to light in 2005 in computer simulations by Renate Loll of Utrecht University in the Netherlands, and colleagues. They have been pursuing a quantum gravity idea known as causal dynamical triangulation.

In their simulations, they focus on a parameter called the spectral dimension, which describes how particles or fields gradually move away from a given point - a process similar to diffusion. To their surprise, Loll found this process happens much faster at scales of 10^{-35} metres, equivalent to the "Planck length", the distance at which quantum gravity effects become significant.

This can be explained if the particles are effectively moving in just one spatial dimension. That's because the fewer dimensions that are available, the fewer directions in which a particle can move, and so the less time it will take to wander away from its original position.

It was hard to make sense of such a strange result at first. Now, as Carlip notes, it seems that a reduction in dimensions pops up in many theories of quantum gravity (see "Different theories, same ingredient"). A technique called renormalisation group analysis suggests the same sort of reduction in spectral dimension might occur at tiny scales, says Carlip, as does a theory that radically alters the rules of general relativity, published last year by Petr Horava of the University of California, Berkeley.

Finding that very different approaches have something in common is exciting, as it suggests we may have stumbled upon an underlying property of quantum gravity, says Leonardo Modesto of the Perimeter Institute for Theoretical Physics in Waterloo, Canada. "People have emerged from quite different corners of the community and started saying, 'let's understand this result'," adds Loll.

People have emerged from quite different corners of the community, saying 'let's understand this'
But how can dimensions simply vanish? Carlip suggests we could explain this by turning to the idea of "quantum foam", proposed by John Wheeler in the 1950s. Wheeler suggested that quantum fluctuations alter the geometry of space-time, rendering it choppy and inhomogeneous at small scales. "But that was a qualitative picture," Loll says. "No one had any sense of what it actually looks like."
Carlip suggests that this foam behaves similarly to the space-time close to a singularity, the object at the centre of a black hole. According to general relativity, gravity is so strong near a singularity that space-time becomes distorted. Under these conditions, light is so strongly bent that it can take an infinitely long time to travel between nearby points. This means neighbouring patches of space-time become effectively disconnected from one another, allowing them to expand and contract independently.
Carlip suggests that at the tiny length scales of quantum gravity, the same sort of disconnection happens between different regions of space. This in turn allows space at different points to expand or contract faster in one dimension than in the others.
The dimensions of space may become disconnected at the tiny length scales of quantum gravity
As a result, over very short distances and timescales, the motion of a particle is dominated by one dimension, though this favoured dimension keeps changing randomly. This means that if you wait long enough or look at larger distance scales, space becomes effectively three-dimensional.
"It's a potentially fruitful idea," Loll says. "But there are still some hard questions you can ask." Carlip agrees: "We have a very long way to go before we can claim that it describes the real world."
One big question is how quantum foam can focus light so strongly that nearby regions become effectively disconnected from one another. Modesto says a possible explanation is that the foam can be treated as being made up of minuscule black holes.
For experimental evidence of space-time's fundamental structure, light from distant galaxies might hold clues. Last year, NASA's orbiting Fermi gamma-ray telescope found no evidence that the speed of light might vary with its frequency, an effect that would be evidence for a quantum foam. However, more precise measurements are needed to exclude the possibility. These might even allow different models for the foam, including some with fewer dimensions, to be tested, Carlip says.
In the meantime, some physicists continue to be delighted that multiple teams are homing in on the same idea. "I think it is one of the most interesting things to happen in quantum gravity for quite some time," says Loll.

Different theories, same ingredient

Several theories of quantum gravity suggest, or are consistent with, the idea that two dimensions fall away at small length scales.

Causal dynamical triangulation

Created by Renate Loll of Utrecht University, and colleagues, this treats space-time as a superposition of structures, some smooth, others curved. Then particles behave as if there are two dimensions, which could be one of space and one of time.

Renormalisation group analysis

Infinities abound when quantum mechanics is applied to fields such as electromagnetism. Renormalisation gets rid of the problem by ignoring the effects of the field at short range. The distance at which this fudge works can be made even smaller using ideas consistent with losing two dimensions.

Horava gravity

Put forward by Petr Horava of the University of California, Berkeley, it removes a key symmetry from general relativity, and results in particles moving as if in two dimensions.

String theory

Notorious for adding dimensions to space, at high temperatures string theory behaves thermodynamically as if space-time has two dimensions.

Loop quantum gravity

This view of the fabric of the universe suggests a mess of links between disparate patches of space-time.

http://www.newscientist.com/article/mg20727793.400-dimensions-vanish-in-quantum-gravity.html

Brain-hacking art: Two pictures for the price of one

- 23 September 2010 by **Jessica Griggs**
- Magazine issue 2778.

Slave Market with the Disappearing Bust of Voltaire. 1940 (Oil on Canvas)/Salvador Dali (1904-89)/Salvador Dali Museum/St. Petersburg, Florida, USA/(C)DACS/The Bridgeman Art Library)

Paintings containing carefully constructed illusions can make your brain flip as it tries to make sense of what it sees

WHAT do you see when you look at the painting above? A semi-naked woman in the foreground? Check. A crumbling building in the background? Check. Nothing too unusual there. But what about the turbaned figures under the archway? Look now, and you might see them talking to two other characters in black and white. But look again, and they may instead be admiring a bust of the philosopher Voltaire.

This is Salvador Dali's *Slave Market with the Disappearing Bust of Voltaire*, which includes an illusion that lets observers perceive two possible images. Just in case you can't see it, the rear arch of the building becomes the forehead of Voltaire. The heads of the black-and-white figures are his eyes, and their clothes his cheeks and chin.

Susana Martinez-Conde, a visual neuroscientist at the Barrow Neurological Institute in Phoenix, Arizona, explains that the ambiguity arises because our brain's perception of the world is a rough approximation of reality. "Our brain has to fit within our cranium so it cannot process everything that is out there," she says. So the brain takes short cuts, sampling only the most significant parts of the scene, such as the contours, the

edges and the corners of objects. The rest is typically built around our memories of past experience and our expectations of what should be there.

This is particularly noticeable when the images are vague, says Martinez-Conde. Compare the level of detail in the non-ambiguous figure of the woman on the left, who is richly depicted from the creases of her turban to the tendrils of her hair, with that of Voltaire, whose ears are missing and whose mouth cannot be made out. Similarly, the hands and necks are missing from the black-and-white characters. "There is a lot of information which needs to be filled in, and the brain can fill it in in a number of different ways," she explains.

The brain's expectations often feed into the visual system, determining how these brain regions fill in the missing details and group different parts of the image. It's the same reason that trompe l'oeil works (page 36), and it means your previous experiences might determine whether you see the figures or Voltaire's face first.

But why does the painting seem to flip between the two interpretations at random? Previous fMRI brain scans have suggested that two separate pools of neurons code each of the possible interpretations (*Proceedings of the Royal Society B*, vol 265, p 2427). This led Andrew Parker and Kristine Krug at the University of Oxford to hypothesise that we see one interpretation when the corresponding set of neurons fires more strongly than the set representing the other image. Neural responses fluctuate, however, so eventually the other pool of neurons will gain the upper hand. "The flip occurs when one of these two almost warring populations of neurons, for reasons probably quite random, becomes more active," says Parker. He has tested this theory in monkeys using a similar illusion (*Philosophical Transactions of the Royal Society B*, vol 357, p 1053).

Why would the human mind have developed this strange trait? "We evolved to make sense of partial visual details and to make out a coherent picture even in poor lighting," says Martinez-Conde. "Illusions are a by-product of this. They represent the dissociation between objective reality and subjective perception."

Jessica Griggs is the careers editor of New Scientist

http://www.newscientist.com/article/mg20727781.400-brainhacking-art-two-pictures-for-the-price-of-one.html

Brain scans may help fix criminal responsibility

- 22 September 2010 by **Jessica Hamzelou**
- Magazine issue 2779.

Not yet responsible (Image: Andreas Schlegel/fstop/Corbis)

A FEW years ago, 17-year-old Christopher Simmons was convicted of breaking into Shirley Crook's house in St Louis, Missouri, tying her up and throwing her off a bridge. The evidence was overwhelming and Simmons confessed to the murder. When the jury recommended a death sentence, Simmons's defence referred to scientific papers that suggested a the brain of a typical 17-year-old was not yet fully mature. Not only did Simmons escape the death penalty, the US Supreme Court changed the law so that only those over 18 can face death row.

Now neuroscientists claim we are closer to being able to estimate brain maturity using brain scans, which might prompt lawyers to offer a defence of immaturity based on an accused individual's own brain scan.

Nico Dosenbach's team at Washington University School of Medicine in St Louis reckon they can predict how old a person is using a 5-minute brain scan.

The idea is based on the fact that brain structure changes as we age. For example, the brain's grey matter peaks in childhood and is then pruned throughout adolescence. White matter, which forms the connections between brain regions, steadily increases, eventually levelling off (see diagram).

As we age, parts of the brain that are further apart are better connected and better able to communicate. "The short connections get weaker and the longer ones get stronger," says Dosenbach.

His team used functional MRI to measure brain activity in 195 people aged between 7 and 30. "If you see the same regions of the brain are active in sync, it's evidence that they're connected."

The group tracked those changes, which levelled off at around age 20. After feeding the information into a computer, they were able to predict the chronological age of other individuals based on a 5-minute session in the scanner.

"The machine can predict with 92 per cent accuracy whether a brain belongs to an adult (over 25) or a child," says Dosenbach (*Science*, DOI: 10.1126/science.1194144).

"The findings are going to make a big splash," says Jay Giedd at the National Institute of Mental Health in Bethesda, Maryland. He points out that as well as helping to diagnose developmental disorders, such a scan could, in theory, be used to get a defendant off the hook based on the immaturity of their brain. Other aspects of brain development, such as understanding how brain connectivity typically changes with age, would also need to be taken into account to determine whether the maturity of an individual's brain matches their actual age.

The age of criminal responsibility is already a contentious issue. In the US alone the age at which a person can legally be tried as an adult ranges from 7 to 18, depending on the state. In Scotland the age is being raised from 8 to 12, and in England a group of neuroscientists, psychiatrists and legal professionals are campaigning for a rise in age of responsibility, saying 10 is too low.

"We know the brain of a 10-year-old is extremely immature compared to an adult, both structurally and functionally," says Sarah-Jayne Blakemore at University College London, a signatory on a letter being

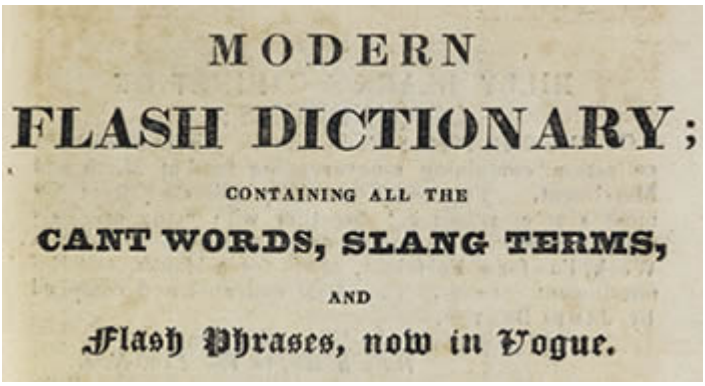
prepared for the Law Commission of England. "Our argument is that when people make a legal ruling [for children of this age], they should take into account that the brain is very immature."
Others argue that by the age of 10 a child understands the difference between right and wrong. "A child at the age of 2 knows not to bite someone," says Arthur Toga at the University of California, Los Angeles.
"It's not to do with knowing the difference between right and wrong," counters Blakemore. The group argue that because the prefrontal cortex (PFC) is the last part of the brain to mature, a child is unable to understand the long-term consequences of their actions. A child may be unable to suppress potentially dangerous behaviour, and make bad decisions. "It's the PFC that stops you doing 200 miles an hour down the motorway," says Blakemore.
"The ability to do these things changes a lot during adolescence, and courts need to take this into account when deciding punishments," agrees Giedd, who is not part of the campaign. A brain scan could aid this decision.
So how do you decide what the age of criminal responsibility should be? Although Blakemore's co-signatories make the case for raising the age from 10 they say further research will be needed to determine what it should be.
"The idea that the brain suddenly becomes adult is misleading because the brain is plastic and continues to change throughout adulthood," says Blakemore. Dosenbach's study suggests the major changes to the brain's structure don't start to level off until around age 20. But is this a realistic age of criminal responsibility?
"If the standard is 'as good as it's going to get' then the age of criminal responsibility should be set around 20," Giedd says. "But it's a matter of whether we need the brain to be at its completely mature state."
If brain maturity is set at 'as good as it's going to get' then the age of criminal responsibility should be 20
Another option is to have a sliding scale of responsibility for adolescents, decided on a case by case basis. In England and Wales, 10 to 14-year-olds used to be assessed this way, says barrister Paul Mendelle of 25 Bedford Row Chambers in London. The law changed after two 10-year-old boys were convicted of the torture and murder of 2-year-old James Bulger.
"Based only on my professional experience the sliding scale seemed to work best," says Mendelle. "Some are able to appreciate the consequences of what they've done, but children are often just ignorant of the consequences of their actions." In these assessments, a brain scan could come in handy, he adds.
Even if someone's brain could be deemed physically "immature", it's not yet clear how age-related changes in volume of grey and white matter tally with a person's behaviour. "We know that the brain is maturing physiologically," says Owen Jones, director of the Law and Neuroscience Project at Vanderbilt University in Nashville, Tennessee. "But that doesn't necessarily come hand in hand with functional maturity, which is what the legal system is concerned with."
Toga agrees: "There is no hard and fast rule of development, and there will always be some degree of variation depending on genetics, environment, experience, diet and stimulation."
Despite difficulties linking brain maturity to behaviour, it is likely lawyers will attempt to use brain maturity scans in the courtroom. Nita Farahany at Vanderbilt University assessed 700 US legal cases between 2004 and 2009, including 45 juvenile cases. Of the adult defendants 16 per cent introduced brain scans which pointed towards mental illness and tumours, in an attempt to diminish responsibility for a crime.
In the US a neuroscientist can already be called to testify on behalf of a child and present peer-reviewed research to make the case that adolescent brains are immature.
"It isn't always a winning claim, but in several cases it was successful in decreasing the sentence," says Farahany.
For better or worse, it is likely that individual brain scans for assessing brain maturity will be used in the courts in the next few years, says Farahany.
Individual brain scans for brain maturity will likely enter the courts in the next few years

http://www.newscientist.com/article/mg20727793.000-brain-scans-may-help-fix-criminal-responsibility.html

Evolving English: One Language, Many Voices

A major exhibition and events programme at the British Library

12 November 2010 – 3 April 2011



This is the first exhibition to explore the English language in all its national and international diversity. Iconic books and manuscripts will be set alongside engaging everyday texts to show the many social, cultural and historical strands from which the language is woven.

Treasures such as the only surviving manuscript of Beowulf, Shakespeare 'quartos', the King James Bible, Dr Johnson's dictionary and recorded speech by Pankhurst, Churchill, Gandhi and Mandela will be on show— together with posters, lists of slang, early newspapers from around the world, trading records, comics, adverts, children's books, dialect recordings, text messages and web pages.

Drawing on our sound collections the exhibition will explore how English is spoken in the UK, from rural dialects to urban youth speak, and celebrate English as it is spoken by 1.8 billion people around the world. An interactive and media-rich exhibition, it will emphasise how, from the very beginning, English has been shaped by the different cultures and languages with which it came into contact.

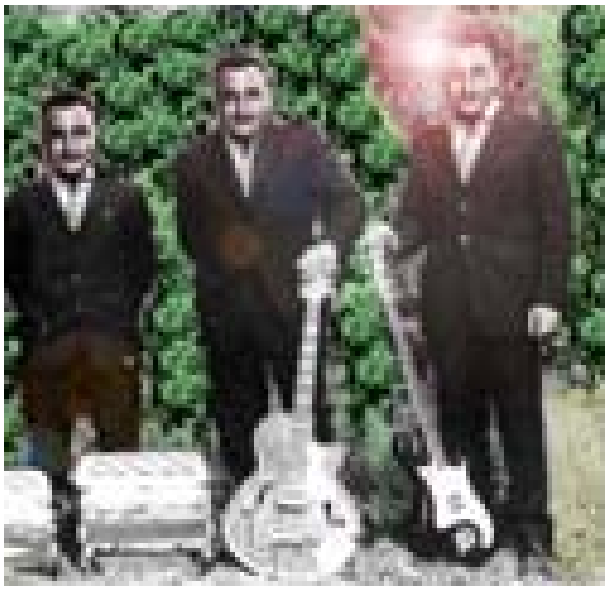
For schools

Free workshops exploring 'Evolving English: One Language, Many Voices' will be available for Secondary and Further Education students. Workshops support and enrich the English Language and Literature curriculum, helping participants to develop skills in language analysis and interpretation.

Workshops will provide students with the unique opportunity to see and hear texts, artefacts and recordings that exemplify language change and variation. Through creative activities, interactive games and source-based learning, students will develop an understanding of the diversity of the English language, its various global influences and the way in which this has impacted on our cultural identity.

http://www.bl.uk/evolvingenglish/

Growing Knowledge: Wu Ming Present Manituana



Wed 13 Oct 2010, 18.30 - 20.00

Conference Centre, British Library

A rare show by **Wu Ming,** the post-modernist prankster collective from Bologna that formerly went under the name **Luther Blissett** and are the collaborative creators of spy fictions *Q*. and *'54*. Their latest conception, *Manituana*, comes in the form of vivid and richly detailed historical fiction about the Mohawk nation in the American War of Independence and its perilous alliances with the British – but the narrative has been jointly authored through countless online exchanges.

The "communitarian" use of the Internet is central to the work of **Wu Ming**, who have long been masters of the creative potential of the Internet. The interactive website for *Manituana* features music, animations, maps, alternative plots and side stories and enables the world of the novel to be expanded and enriched. People are invited to contribute fiction, music and artwork to the world of the story via the website. All of **Wu Ming's** work is available under '*copyleft*', which allows reproduction in electronic form for non-commercial purposes.

"Manituana unspools mesmerisingly like an old Hollywood movie" Todd McEwen, Guardian

"Manituana shuns anachronism as it sets about delivering a fast-flowing, densely peopled, richly decorated story of a precious way of life, and thought, on the brink of the modern abyss. As for Wu Ming and their bewitching fictional fellowship, let's hope that many moons will pass before we see the last of these mysterious Mohicans." ***Boyd Tonkin,*** *Independent.*

http://www.bl.uk/whatson/events/event113912.html

Monogamy, Polygyny and the Well-Tended Garden

The advent of agriculture created a new kind of seed-scattering strategy.

By Michael Haederle

One researcher shows that the advent of agriculture created the beginnings of monogamy in a world that had seen polygyny as the norm. (istockphoto.com)

We have all seen the bumper stickers insisting that marriage "is between one man and one woman," but throughout most of human history, that hasn't really been the case.

Anthropologists say 83 percent of societies they have studied traditionally permitted polygyny — marriage with multiple wives. (The more common term "polygamy" has the broader definition of having multiple spouses.) Just 17 percent insisted on monogamous marriage.

So how did social monogamy, which has spread in the past few centuries thanks to the influence of Euro-American culture, come to be?

Most evolutionary biologists think monogamy originated as a form of social leveling that reduced male competition for mates, fostered cooperation and led to the rise of successful nation-states.

But Italian anthropologist Laura Fortunato sees a deeper logic. She believes monogamy arose from differing reproductive strategies among men and women in the face of changing modes of subsistence.

"In anthropology people hardly ever felt the need to explain monogamous marriage," observes Fortunato, an Omidyar Fellow at the Santa Fe Institute in New Mexico. Monogamy was simply taken as a given by early European and American researchers who went off to study societies different from their own.

The usual evolutionary explanation is suspect, because social monogamy actually "long predates the establishment of large nation states," Fortunato wrote in a 2009 paper she co-authored with biologist Marco Archetti and published in the *Journal of Evolutionary Biology*.

Evolutionary accounts of marriage tend to focus simply on male reproductive success (success being measured by whether an organism passes on its genes to its offspring).

In mammals — including humans — the ease with which males produce sperm cells suggests they will put their effort into frequent mating as a reproductive strategy, while females, with a finite number of eggs and the need for a long period of internal gestation (followed by lactation), tend to put more effort into parenting.

According to this simple math, it makes sense for a man to take multiple wives, and it probably explains why polygyny was so widespread throughout human prehistory, Fortunato says. But only prosperous men take multiple wives in such societies, while their less wealthy brethren content themselves with just one mate — creating de facto monogamy, she says.

Polygyny is common among people who practice horticulture, clearing small plots of land to raise a variety of food crops, Fortunato says. Even today it is widespread in Africa, where horticulture is common.

But fathering many children (hoping some of them will survive to adulthood) is not the only possible male reproductive strategy, Fortunato writes. Transmitting wealth to the next generation is a way of improving the odds of a child's survival — and of one's reproductive success. Here, monogamy makes sense because it "channels a man's property to the offspring of a single wife," rather than having it dissipated among the children of multiple wives.

Fortunato argues from the historical record that monogamy first arose in Eurasian societies just as true agriculture was taking hold — about 12,000 years ago. Agriculture involves intensive cultivation of large tracts of land, often requiring ploughing, irrigation, fertilization and other soil improvements.

As agriculture spread, arable land became scarcer — and valuable. Land ownership became critical to reproductive success, driving a new form of marriage in which males were assured of investing resources in their heirs, thus improving the odds that their genes would be successfully passed on.

But in Fortunato's telling, that isn't the end of the story. She challenges the notion that women are just along for the ride in these varying versions of male reproductive strategy. "Women are not these passive players," Fortunato says. "They have some kind of say in what their husbands are doing."

"We've basically extended this model to say that if males allocate resources strategically, then females might allocate paternity strategically," Fortunato says. "This wasn't included in the previous model."

A couple arrives at a shared (if unspoken) understanding: If the man commits to passing on his resources to her children, the woman will commit to mating monogamously — meaning the children are likely his offspring. Fortunato sees in this contract the roots of elaborate social norms regarding female sexual behavior.

Fortunato cites historical examples in support of her argument. In ancient Rome, where monogamous marriage was the norm, men regularly had children with women other than their wives, she says.

“Why did these societies have a norm promoting monogamy when they in fact condoned polygamous mating? The explanation which we give is that marriage strategies have more to do with how property is transferred across generations than they have to do with mating and the production of children.”

It all sounds depressingly unromantic. Fortunato points out that in the history of marriage, “[t]his association between love and marriage in Western societies is a very recent thing.” Early marriage contracts “really did sound like a contract,” focusing on an exchange of goods and obligations.

Some of Fortunato’s other research focuses on which societies include doweries and bridewealth as part of the marriage ritual.

She has, for example, created phylogenetic trees comparing societies speaking Indo-European languages to show how cultural practices have been conserved as social groups branched off from one another in their descent from a common ancestor.

Assuming that cultural traits usually descend vertically — through time — instead of being borrowed from neighboring groups, Fortunato examines which practices these cultural cousins share in common and how they differ.

Dowry, in which wealth is transferred to a bride or the newlywed couple, was found exclusively in European and Asian societies, Fortunato notes. “You see that dowries tend to occur in societies that are monogamous,” she says. “One of the explanations is that dowry is a way that allows women to compete for access to men where polygyny is not allowed.”

It sounds a little like the plot of a Jane Austen novel: Men are, in effect, the scarcer resource, says Fortunato. “It makes wealthy men very attractive.”

She acknowledges that much of this work is speculative, and the answers often depend on the categories used to frame the questions. “I see this as a first step. This tries to explain what we see. It is a more crude look at what is going on. We’re trying to paint a broader picture.”

http://www.miller-mccune.com/culture/monogamy-polygyny-and-the-well-tended-garden-18752?utm_source=Newsletter128&utm_medium=email&utm_content=0928&utm_campaign=newsletters

Long Nights and Thin Ice: A Penguin's Tale

A conversation with penguin expert Grant Ballard on the short-term wins and long-term losses facing one of the world's most charismatic animals.

By Michael Todd

The Adèlie penguins that ecologist Grant Ballard studies will be dire.

It is the best of times, it is the worst of times — for penguins.

But like the French populace careening to apocalypse in Dickens' "Tale of Two Cities," the final outcome for the Adèlie penguins that ecologist Grant Ballard studies will be dire.

Ballard, the director of the Informatics Program at PRBO Conservation Science in Point Reyes, Calif., has been studying the Adélies on Antarctica's Ross Island since 1996. (A nonprofit, PRBO started in 1965 as Point Reyes Bird Observatory and now studies biodiversity conservation on land and sea.)

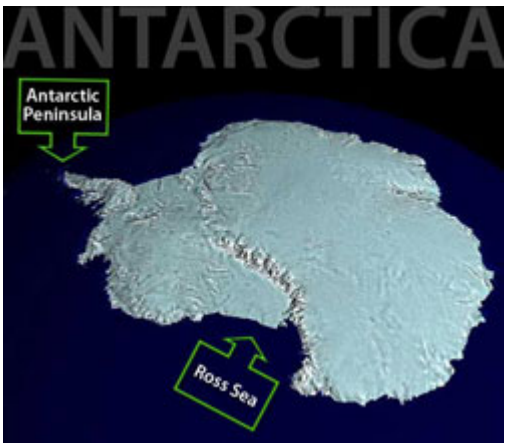
His research has determined that some colonies of Adèlies, those living near Ross Island, are going to be near-term winners of how climate change affects the world's seventh continent. This will occur even as their peers on the Antarctic Peninsula 2,000 miles away face a punishing slog toward probable localized extinction.

"The colonies I study are doing very well right now," Ballard explains, "and that's nice, because they're not doing so well in other parts of Antarctica, so it's good that they're doing well somewhere. We expect them to do so for a little time to come, but again, that depends on what climate model you choose. It could be as short as 20 years before they start facing some real challenges."

Those challenges affect how they feed and breed, and in a land that really has no constituency among policymakers despite the charisma of its (few) denizens. But Adèlies are tough old birds, and they've survived past advances and retreats of the Antarctic ice sheet in the last 40 millennia or so.

"They've been able to adapt to large scale change previously," Ballard notes. "If we could just give them a break, they may be able to do it again." But the accelerated pace of anthropogenic climate change, and a newfound interest in Antarctic fisheries by humankind, may be a double whammy the Adèlies can't avoid.

Grant Ballard's mentor at PRBO, the renowned penguin expert David G. Ainley, has dubbed Adèlies the "bellwether of climate change," in part because they are completely dependent on the continued existence of sea ice and in part because they have been well studied and so provide a good baseline for observing change. (Ainley even used the "Tale of Two Cities" analogy in discussing differing fates of colonies just on Ross Island.)



And while they too troop across ice fields, Adélies are not the marquee bird in the popular documentary *The March of the Penguins*; that role went to their tuxedoed cousin, the Emperor penguin.

"Well studied" isn't an easy proposition in the Antarctic, Ballard says, and no one had ever looked the Adelies' entire migratory cycle before. "The fact that they're out at sea, in the middle of pack ice, and it's really dark, dangerous and expensive to study them at that time means that it hasn't been done."

The research he was part of — conducted between 2003 and 2005 by PRBO along with H.T. Harvey and Associates, Stanford University, NASA and the British Antarctic Survey— involved fitting the birds with geolocator tags on their legs so the researchers could determine what the birds were up to, based on light levels and time, year-round, and not just in seasons congenial to human scientists. The results appear in the journal *Ecology*.

Modern technology helps, but is no panacea. You can rig the birds with satellite transmitters, as the researchers also did, but they're big, bothersome to the bird, difficult to attach, often don't work after a while and often pecked off or molted away. The much smaller geolocator tags are easier on the birds, and as long as they're black and white they don't automatically get pecked off, but they also require finding the same birds a year or two down the line to retrieve the tag and download its data. (The researchers are heading back this year for a closer look at individual bird behavior based on age and experience.)

Beyond the existential concerns, the research has uncovered some interesting information about the birds. Using ocean currents, Adèlies may make annual roundtrips of more than 8,000 miles, behavior the scientists think evolved as recently as the last ice age. And like many travelers, the birds hustle home on the return leg of the trip, moving about twice as fast as they go from their wintering location to their breeding spots.

"There's a real urgency in what they did — they never waste any time," says Ballard. "They're at limits of what they can do — really in a hurry to get started, "to look for last year's mate, to seek premium nest site. "Yeah," he concludes, "I think they're in a hurry to get home."

That migration is the focus of concerns about the penguins' long-term prospects in a warmer world.

The birds' entire ecosystem revolves around ice, where it is and where it ain't. When they're foraging at sea, they need the ice as a place to rest and as a jumping-off and -in point for the buffet. These areas of open sea water surrounded by ice might, in summertime, see 15 to 20 percent ice cover; in the wintertime, as much as 80 percent.

But Adèlies raise their families on land, building nests of small stones on rocky outcrops and plains.

"It's kind of a paradox for them," Ballard acknowledges. "They reside in Antarctica, where there's hardly any ice-free terrain, and yet they require that to nest."

While that all suggests a rather fiddly species, Adèlies have shown themselves pretty robust.

Some boom-and-bust in their colonies has always occurred, and the birds' natural curiosity, their tendency to explore, has served them well. "There's a certain percentage of the population that's always out there looking for a new opportunity, and they will settle in a place that looks like a good idea even if there are no penguins there," Ballard says, adding, "and there's usually a reason there's no penguins there."

However, those "test" colonies may be well placed for changing times.

While such flexibility may sound sensible to people, it surprised scientists. In another recent paper looking at Adèlies at Ross, researchers — including Ballard and Ainley — from PRBO, H.T. Harvey, Oregon State University and Landacre Research New Zealand documented penguins abandoning their traditional nesting sites when times there grew too hard.

"Witnessing large numbers of adult birds who have already successfully nested in one location switching to a new site in the face of environmental change has rarely been documented and is indeed surprising," Oregon State's Kate Dugger is quoted in a release.

While that sounds reassuring for penguins and their partisans, there's a caveat. "Like animals living near the tops of mountains," Dugger cautions, "polar animals have limited options if the planet warms beyond a certain point."

In that vein, researchers are watching these adventuresome penguins wend their way south, toward the South Pole.

With warming, he said, those that are moving farther south will be the ones that find a new place that's got the newest open water and the least competition for food and they'll probably thrive. … "At some point — and it might be very close to where they are now, but we don't know — they won't be able to overcome that difference that they have to cover to get back to the wintering ground."

Ballard says he thinks the birds could waddle the distance, but the associated risks and effort of jumping in and out of sea ice will create a limit. "They won't adapt endlessly — I believe they've never ever been more

than 20 or 30 kilometers south of where they are now," he says, using mummified remains dating back 35,000 to 40,000 years as his boundary line.

The distance south also creates another problem for the birds — wintertime darkness in a place where the night is half a year long. The penguins on the Antarctic Peninsula are moving south to find sea ice in the winter, which puts them in longer and longer periods of darkness.

"But they also require light," Ballard says. "They require light for navigating, and we think they require it for some aspects of foraging, although we don't know for sure exactly why they need light because they forage very deep where it's very dark. It seems they need to initiate dives when there's at least some light.

"We know from other studies that they don't move around at all when it's dark or seriously overcast, so it seems they require some amount of sun or some concept of where the sun is to make long-distance migrations."

"Ultimately penguins around Antarctica will face darkness or lack of ice — they'll just reach that boundary from different directions," he has said.

But in the Ross Sea, these are actually pretty good times for Adèlies since the hole in the ozone layer — remember that? — creates upper atmosphere cooling, which increases winds, which increases sea ice. Ballard calls it a "giant ice generator," and as long as temperatures remain above freezing, it will likely remain one.

"People expect the ice to be going away, and fast, but in the Ross Sea it isn't — yet. However, we do expect to in 20 years, or it could be 40 years, depending on which models you look at, we expect we'll start seeing a decline in sea ice again, in the Ross Sea."

The Antarctic, a continent, is not the Arctic, an oceanic system, despite their shared frigidity. Antarctica is holding a huge amount of landlocked ice, which is mostly reflecting sunlight back, which slows the rate of loss. The peninsula, however, is already seeing loss of sea ice.

"It's a situation much more similar to the Arctic, and in those areas Adèlie penguins are disappearing already." Flooding caused by warmer temperatures has been especially harmful for penguin chicks, which can't yet "thermo-regulate" when they're wet. In one case, a 2001 snowfall — although cold as heck, Antarctica is usually pretty dry and therefore not particularly snowy — was so big it buried thousands of adults on their nests. A similar freakish blizzard came in 2006, but it was later in the season and less devastating.

Although freakish, the historical record — based on mummified penguins — shows that weird weather like giant blizzards and giant icebergs and even localized appearances and disappearances of Adèlies has occurred before. Disappearances on the Antarctic Peninsula, at least of small colonies struggling in less optimal places, are occurring now, as ecologist Bill Fraser has documented (and *The New Yorker*'s Fen Montaigne reported on in December.)

But climate change isn't the only human-caused woe for the birds.

"They have other challenges with fisheries coming in more and more now, too," Ballard says. "There's sort of the double whammy of climate change and increased human extraction, especially with fisheries. The penguins [which eat krill, small fish and squid] don't necessarily compete directly with the fishermen, but the

ecosystem as a whole does. We're concerned about what happens to the system when you start removing — as we have everywhere — the top predators, the big fish."

Ballard and the other researchers are providing information to member of the Convention on the Conservation of Antarctic Marine Living Resources, the one organization with the statutory authority to create non-fishing areas off Antarctica. The convention is planning examine that possibility in the spring. The researchers have also provided information to the nongovernmental organization the Antarctica and South Ocean Coalition, which while it hasn't taken a stand on a marine protected area for the Ross Sea it is clearly pro-conservation, as this film demonstrates.

While Ballard isn't taking a public position on the what the convention should do, because the Antarctic is pretty much the last accessible place on Earth that hasn't been completely altered by humanity, he is concerned about a potential loss that echoes beyond Adèlie colonies.

"From a scientific perspective, it's a tragedy to lose this place, last reference point." Ballard laments. "From a cultural perspective, a human value perspective, I think people can understand it's probably not a good idea to destroy every ecosystem on the planet."

http://www.miller-mccune.com/environment/long-nights-and-thin-ice-a-penguins-tale-23045/

Rocky Mountain Dust-up: Runoff's Dirty Secret

The dust on high peaks, blown in from Southwestern pastures, farms, mining roads and off-road vehicle parks, is hastening snowmelt and reducing the runoff into the Colorado River, scientists say.

By Melinda Burns

Snow pits like this one, dug in the mountains of the Upper Colorado River basin, were used to study the layering of dust in snowfields and its impact on the absorption of sunlight. (Center for Snow and Avalanche Studies)

Every time the winds blow east from the deserts of the Southwest, it means less water for 27 million people who depend on the Colorado River.

Layers of dust form every year on snowfields in the Rocky Mountains, blown in from pastures, farms, dirt roads and off-road vehicle parks. For decades, according to a study released this week by the National Academy of Sciences, this dust on snow both accelerates the annual runoff by weeks and reduces what reaches the Colorado River by 5 percent.

Clean snow reflects about 80 percent of the sunlight that hits it. But in the high Rockies, dust on snow absorbs heat from the sun, dropping reflectivity to just 33 percent, said Thomas Painter, the lead researcher for the study and a snow hydrologist at the University of California, Los Angeles, and NASA's Jet Propulsion Laboratory.

"The dust is doubling the load of sun going into the snow pack," Painter said. "It's so effective at melting down the clean snow underneath it and on top of it."

The dust, which looks like dirt, can fool the eye, too.

"It can look like a desert," Painter said. "It really looks like you're skiing on sand dunes. It's stunning. At times, we would get a little confused."

In all, the scientists found, 35 billion cubic feet of Colorado River runoff — Los Angeles's water use every 18 months — is lost each year because of dust on snow. They estimate that the loss goes back 80 years. While this is bad for humans, 75-year-old rules on using the open range have helped; today, there is five times as much dust on snow in the Rockies as in the mid-1800s, down from six times as much at the turn of the 20th century.

Previously, Painter co-authored a study of mud cores from mountain lakes showing that dust in the Rockies increased six-fold between the mid-1800s and the early 20th century, as settlers trooped into the Southwest with their livestock and plows. The cattle and the farmers disturbed the delicate desert crust and left it vulnerable to blowing in the wind.

Tom Painter is pictured tracking radiation in June 2007. In melting snow, dust comes to light. (Center for Snow and Avalanche Studies)

The new study is the first to quantify the effects of dust on snow on the scale of an entire river basin. It shows, too, that dust is far more damaging to runoff than the soot that blows into the Rockies from coal-fired power plants in the region.

Steven Fassnacht, a Colorado State University snow hydrologist who has studied dust on snow in Spain and Antarctica as well as the American West, called the findings of Painter's team "ground-breaking and important." Although the study did not look at how dust changes the surface of snow (it makes it smoother), these effects would not likely change the overall conclusions, Fassnacht said. The team's methodology "should be applicable anywhere in the world," he said.

Experiments on the rate of snowmelt date back to Ben Franklin, the American statesman better known for kites and keys. He placed pieces of colored fabric on snow, and he found that the snow melted fastest under the darkest cloths.

Because it is dark, dust on snow causes more snow to evaporate, and faster. (A similar concern about soot from oceangoing vessels concerns those watching Arctic ice decline.)

Specifically, the snow pack in the Rockies melts three weeks earlier than it did decades ago, Painter and his colleagues found. The earlier melt exposes the underlying plants, which then draw up water and exhale it into the atmosphere. Three more weeks of that plant activity accounts for most of the runoff loss.

Jeff Dozier, a snow hydrologist at the University of California, Santa Barbara, who reviewed the NASA-led paper for publication, said the highlight of the report was that three-week calculation for earlier snow melt.

"This is a real advance," he said. "That's probably occurring in other places of the world."

For the study, a team of six scientists from NASA, the U.S. Geological Survey, the National Snow and Ice Data Center of Boulder, Colo., the Center for Snow and Avalanche Studies of Silverton, Colo., and the University of Washington collected snow samples at various levels. They measured the reflectivity of the snow and the balance of energy coming in and going out. They used advanced hydrology models, and they compared the present to the past.

The Colorado River supplies water to seven states — Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming — and the supply is already overcommitted. Compounding the problems for water managers, the snow is melting more often in the spring, not in the summer, when farms and cities need it the most.

Twelve dust layers shown in a study plot in Colorado's Senator Beck Basin Study Area. (Center for Snow and Avalanche Studies)

Over the years, drought, wildfire, off-road vehicle parks and dirt roads for oil and gas exploration, in addition to grazing and farming, have contributed to the layers of dust on Rocky Mountain snowfields, the scientists said. Unless steps are taken to curb the dust and help prolong snow cover, they said, more runoff could be lost as the region gets drier. Up to 20 percent of Colorado River flow could be lost by 2050 because of climate change, scientists say.

Compared to the challenge of high-level international negotiations over greenhouse gas emissions, the study said, dealing with man-made disturbances in the Southwest high desert would be a relatively easy way to cushion water shortages from the Colorado River.

It's been shown before that regulation (as well as progressive grazing practices) can help keep the dust down. The Taylor Grazing Act of 1934, which required permits for grazing on public lands, effectively reduced the amount of dust falling in the Rockies by 25 percent.

http://www.miller-mccune.com/environment/rocky-mountain-dust-up-runoffs-dirty-secret-23223/

Real Men Do Apologize

Newly published research finds men are as willing as women to apologize. But they're less likely to believe a particular incident warrants contrition.

By Tom Jacobs

In the continuing battle of the sexes, score one for men. New research finds men are as willing as women to apologize, contrary to popular belief. However, researchers also report men are less likely to believe a particular incident warrants contrition. (Gremlin / istockphoto.com)

Men, according to conventional wisdom, are stubbornly unwilling to apologize. Countless pop psychology books have referenced this reluctance, explaining that our egos are too fragile to admit we're wrong, or we're oblivious to important nuances of social interaction.

Sorry to disrupt that lovely feeling of superiority, ladies, but newly published research suggests such smug explanations miss the mark. Writing in the journal *Psychological Science*, University of Waterloo psychologists Karina Schumann and Michael Ross report that men are, indeed, less likely to say "I'm sorry." But they're also less likely to take offense and expect an apology from someone else.

Their conclusion is that "men apologize less frequently than women because they have a higher threshold for what constitutes offensive behavior." Whether on the giving or receiving end, males are less likely to feel an unpleasant incident is serious enough to warrant a statement of remorse.

This thesis was confirmed by two studies. In the first, 33 male and 33 female college students filled out an online questionnaire each evening for 12 nights. They described up to three instances that day in which "you apologized to someone or did something to someone else that might have deserved an apology." They also

described up to three incidents in which “someone else apologized to you, or did something to you that might have deserved an apology.”

As expected, the women reported offering more apologies than the men. However, they also reported committing more offenses. After taking this different threshold of perceived offensive behavior into account, “we found that the gender difference in frequency of apologies disappeared,” Schumann and Ross write. “Female and male transgressors apologized for an equal proportion of their offenses (approximately 81 percent).”

“It appears that once men and women categorized a behavior as offensive, they were equally likely to apologize for it, and their apologies were similarly effusive,” they conclude. “Contrary to popular speculations, men’s apologies were as detailed as those offered by women.”

In a second, confirming study, “women perceived three imagined offenses and their own recalled offenses as more severe than men did,” and thus more deserving of an apology, the researchers report.

So men are less likely to perceive a situation as reaching the level of significance necessary to warrant an apology, whether they are the offending or offended party. This may reflect the fact that women “are more focused on the experiences of other people and on maintaining harmony in their relationships,” or that “men have a higher threshold for both physical and social pain,” the researchers write.

Either way, this disconnect creates “unfortunate consequences for mixed-gender interactions,” Schumann and Ross note. “For example, if women perceive offenses that their male romantic partners do not notice, women might interpret an absence of an apology as evidence that their partners are indifferent to their well-being. Similarly, men may regard their female partners as overly sensitive and emotional.”

Nevertheless, arguments based on faulty premises are particularly toxic and difficult to resolve, and the assumption that men know very well they’ve done something wrong but petulantly refuse to apologize for it, is often inaccurate. So before a disagreement escalates, it might be wise to take a step back and compare your perceptions of the situation in question. According to this research, “men and women unwittingly disagree at an earlier stage in the process: Identifying whether or not a transgression has occurred.”

http://www.miller-mccune.com/blogs/news-blog/real-men-do-apologize-23241/

Actuaries Insist We've Got to Retire Later

Early retirement, bah! The people who measure our life spans say Social Security should be less something that kicks in at 65 and more something Americans tap for, say, their last 20 years.

By Emily Badger

Is it time to retire yet? Not according to the American Academy of Actuaries. The group has been quietly advocating raising the retirement as central to any type of Social Security reform. (Richard Dudley / stockxchange.com)

Mention fixing Social Security — projected by various accounts to be insolvent within a decade or three — and politicians of all stripes begin to lose their cool. George W. Bush's domestic agenda in his second term was largely undone by an aborted attempt to partially privatize the program. Election-year officials regularly trade barbs over who cares less about protecting our grandmothers. Former House Majority Leader Dick Armey just this week called the program a Ponzi scheme.

The quagmire calls out for some eminently sensible — boring, even — pragmatists. Into this void steps the least sexy association in town, the American Academy of Actuaries. The group has been quietly, methodically advocating for one solution central to any suite of reforms: We must raise the retirement age. And they should know, right?

"People are living longer, in short," said Frank Todisco, the academy's senior pension fellow. "When people live longer and you have a fixed retirement age, it means a program like Social Security is going to get more and more expensive."

Actuarially speaking, a 65-year-old man in 1940 was expected to live on average for another 11.9 years into retirement. Come 2035, that same 65-year-old man can look forward to another 19 years of life (for his lucky wife: 21.1 years).

When actuaries talk in this context about increased longevity, they aren't looking at trends in life expectancy at birth. Those statistics have changed dramatically over the last several generations due largely to improvements in the infant mortality rate. The stat more relevant to Social Security, Todisco says, is how much longer you're expected to live once you reach retirement age.

That number has been expanding thanks to advances in medical technology and health care, particularly for elderly ailments like cardiovascular disease. Some critics cast the suggestion that people should therefore

work longer and wait another few years until Social Security kicks in as a cut in benefits. But Todisco frames it differently.

"If you keep the retirement age the way it is, that's equivalent to an automatic expansion of the system, because as people live longer, they'll collect more and more in lifetime benefits," he said. "Increasing the retirement age is a way of stemming that automatic expansion of the system."

At play is how we define Social Security's goals: Should the program ensure security for a set period of our final years (counting backward from the end of life expectancy), or ensure security for the expanding remainder of our lives (going forward from an arbitrary age like 67)?

When Social Security was created in 1935, no mechanism was built into the program to periodically adjust for changes in longevity. Through separate amendments, the retirement age has been adjusted once, in 1983, from 65 to 67. That change is being slowly phased in over time — as Todisco says we should also do with any new adjustments — and won't be fully in place until 2027 (when the cohort born in 1960 reaches retirement age).

Ideally, Todisco says, raising the retirement age would signal to people that they should also work longer (we don't want 68-year-olds sitting around with neither paycheck nor pension). But he's aware of the counterarguments to this logic: Physically demanding jobs are harder to do as a person gets older, and older workers have a tougher time finding employment. And those improvements in life expectancy that actuaries cite have not been evenly distributed across socioeconomic groups, so that an increase in the retirement age would unfairly penalize segments of the population not expected to live to their late 80s.

"Those are all really important and legitimate concerns, but addressing them by holding down the Social Security retirement age for everybody is a very, very expensive way to address those concerns," Todisco said. "It would be more cost-effective to address them outside the Social Security program through other public policies."

The AAA doesn't spell out exactly what those policies should look like or even what age we ought to set for retirement, but the idea needs to be part of any reform, the group has concluded. And maybe in saying so they can create a little political cover. Imagine hot-headed politicians falling back on this boring but convincing slogan: The actuaries say we have to!

"That's not our objective, to give anybody cover," Todisco said. "But obviously, the whole idea of appointing a commission politically is to try to make it easier to get something done and enact some decisions."

http://www.miller-mccune.com/politics/actuaries-insist-weve-got-to-retire-later-23169/

USB Warfare: The Real Electronic Nightmare

Leave those fears about global Internet shutdowns to Hollywood. But be very afraid of regional disasters launched from an innocent thumb drive.

By Michael Scott Moore

It's just a thumb drive, right? Wrong. The reality of cyberwarfare is that a tiny piece of equipment, like the thumb drive, can do untold amounts of damage and are tougher to fight. (stockxchange.com)

The gist of this column lately has been that threats of "cyberwarfare" waged through the public Internet are the stuff of Hollywood schlock and patriotic pulp fiction. But there are other ways to wage electronic war, and they tend to be more terrifying precisely because they're tougher to fight.

Siemens announced in July that a malicious bit of code called Stuxnet could spread on USB thumb drives and try to lift industrial secrets from its clients around the world. It's the first large-scale worm of its kind, an act of sophisticated industrial espionage that indicates the real future of electronic warfare.

"Stuxnet," according to *PCWorld*, "marks the first time that someone has targeted the factory floor" with a software virus.

The Munich-based Siemens corporation specializes in "automated systems," from fire alarms to robotic factories to power grids. This worm in particular went after a Siemens industrial software suite called WinCC. A company spokesman said WinCC is used by "thousands" of plant managers worldwide, and the worm reportedly found its way — without causing major damage — into 14 plants in Germany, Indonesia, India, North America, the United Kingdom and (primarily) Iran.

None of the infections spread through the public Internet, and the reason cyberwar scenarios over the Web may remain the stuff of fiction is that vital networks like nuclear power plants can be kept well away from the Internet – meaning safe from remote, and presumably foreign, hackers. Yes, Estonia suffered a massive denial-of-service attack in 2007, probably from Russian nerds, and some important Estonian government sites went down, but such a denial-of-service attack will probably not cause a disaster, say, in a nuclear power plant.

What could cause a nuclear disaster is an inside job. A spy could infect a power plant's control system with a bug on a USB drive, just as a soldier with security clearance and a CD-ROM marked "Lady Gaga" can sneak

out thousands of classified military documents. Or perhaps establish a "digital beachhead," as occurred in 2008 when a flash-drive-launched virus infected the Department of Defense.

Alternatively, the author of a worm like Stuxnet could find a way to install it on a USB stick bound for certain machines. (Siemens reportedly sends software license keys to its clients on USB sticks.)

No one is sure where Stuxnet originated, but cyberwarfare experts have been predicting similar attacks for years. WinCC is so-called SCADA software ("supervisory control and data acquisition"), and a SCADA attack could, in theory, shut down a power grid or hand essential controls to an outside user.

"It could be very valuable to a nation-state for war-like espionage," Reuters quoted Randy Abrams, a researcher at a security firm called ESET, which studied Stuxnet. "It could be very valuable to terrorist organizations."

Happily, this kind of intrusion still requires the old-fashioned presence of a human being, what older generations would have called a spy. It's just that a spy can now cause unheard-of mayhem. A military leak is one thing; the airing of 91,000 military documents relating to the war in Afghanistan, useful as they might be to the public discourse, must have blindsided American generals – who in turn started crafting tighter security known as Cyber Insider Threat.

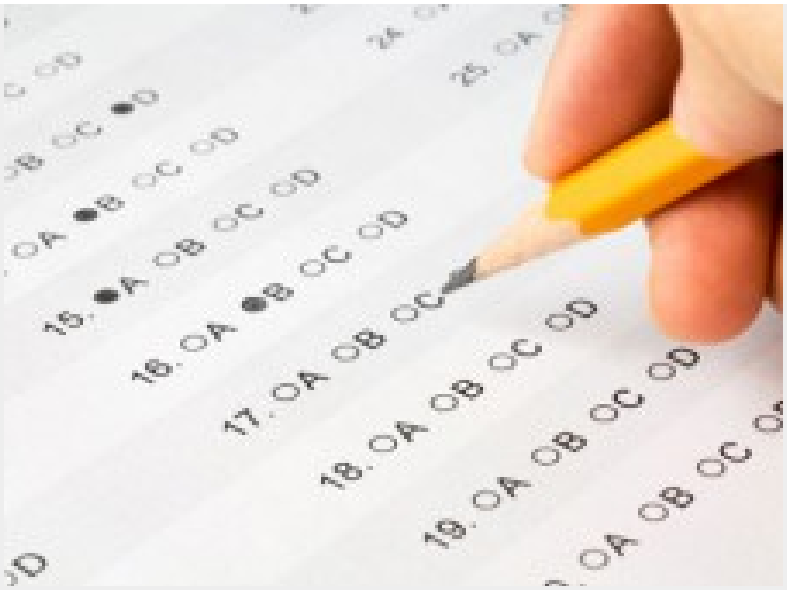
The glimmer of light is that neither Stuxnet nor the Wikileak sensation could have been perpetrated by some clever kid with just a broadband connection. The threat of massive cyberwarfare or terrorism over the Web, for now, is small, so average Internet users don't have to tolerate horror stories that threaten to close down their freedom and privacy.

http://www.miller-mccune.com/politics/usb-warfare-the-real-electronic-nightmare-23118/

Testing College Applicants' Wisdom, Common Sense

What good is a high SAT score if you make a mess of your life? For a possible answer, peer into Robert Sternberg's book, "College Admissions for the 21st Century."

By Melinda Burns



Psychologist Robert Sternberg argues that students should be tested for critical thinking, creativity, practicality and wisdom. (bluestocking/istockphoto)

As a small boy he was ignored and passed over by his teachers — he scored poorly on IQ tests and was obviously going nowhere. Ever since, Robert Sternberg, the new provost and senior vice president of Oklahoma State University, former dean of the School of Arts and Sciences at Tufts University, former professor of psychology at Yale University and summa cum laude Phi Beta Kappa graduate of Yale, has been on a mission: He doesn't want it to happen to anyone else.

"In the 1950s, when I was growing up," Sternberg said in his new book, *College Admissions for the 21st Century*, "the elementary school I attended gave group IQ tests every couple of years. As a result of my low scores, my teachers thought I was stupid, and I did too. They never came out and told us our IQ scores, but one could tell from the way teachers acted. In first grade, I was a mediocre student, which made my teachers happy because they got what they expected. I in turn was happy that they were happy, and in the end, everyone was quite happy. By second grade, I was slightly worse as a student, and in third grade, still worse."

Sternberg was lucky. A fourth-grade teacher with high expectations saved him from being labeled as a perennial loser, and he began to get straight A's. He went on to make his name as a psychologist who challenged mainstream notions about human intelligence, testing and ability. In his book, Sternberg argues that the SAT and ACT, the standard achievement and ability tests required for college admission, are too narrowly focused on memorization and analytical skills to predict leadership in today's world. Also, he says, the scores on these tests correlate highly with socioeconomic class, unfairly penalizing students whose families can't pay for tutors.

Meanwhile, grade-point averages, or, the numbers that typically count most in getting accepted to college, do not reflect the different academic standards of different high schools. GPAs can be inflated, too, and so can letters of recommendation. What's needed, Sternberg said, is a more inclusive approach that would incorporate these traditional yardsticks but also try to identify students who are good critical thinkers or who are practical, creative or wise. "Why should a four-hour standardized test taken under intense pressure count more than years of effort and dedication?" he asks.

"Academic knowledge alone will not get one through; the world simply changes too quickly," Sternberg said. "…Those whose talents and abilities are not well recognized by the current system may well be tomorrow's inventors, community leaders and generators of fresh ideas in the arts, music, business and the sciences — if we only learn to recognize their potential and give them the education they need to shine."

Sternberg's book comes out at a time when achievement testing in the U.S. is more prevalent than ever. The national No Child Left Behind program, enacted in 2001, rewards the schools that show improvement on standardized tests and punishes those that don't. In Sternberg's view, U.S. education is going in the wrong direction. He believes in fostering what he calls "successful intelligence," which he defines as the ability to succeed in life. A person who has this ability can adapt to changing circumstances, come up with novel ideas and persuade others to accept them, Sternberg said.

"In the end," he said, "no one is good at everything, and no one is bad at everything. People who are successfully intelligent are those who figure out their strengths and find a way to capitalize on them."

Sample Questions

Here is a sample of optional Kaleidoscope questions from past applications for admission to Tufts University:

• The human narrative is replete with memorable characters like America's Johnny Appleseed, ancient Greece's Perseus or the Fox Spirits of East Asia. Imagine one of humanity's storied figures is alive and working in the world today. Why does Joan of Arc have a desk job? Would Shiva be a general or a diplomat? Is Quetzalcoatl trapped in a zoo? In short, connect your chosen figure to the contemporary world and imagine the life he/she/it might lead.

• Kermit the Frog famously lamented, "It's not easy being green." Do you agree?

• Create a short story using one of the following topics:
a. The end of MTV
b. Confessions of Middle School Bully
c. Toast
d. Seventeen Minutes Ago

• Use an 8.5 x 11-inch sheet of paper to create something. You can blueprint your future home, create a new product, draw a cartoon strip, design a costume or theatrical set, compose a score, or do something entirely different. Let your imagination wander.

• Engineers and scientists like astronomer Edwin Powell Hubble discover new solutions to contemporary issues. "Equipped with his five senses," Hubble said, "man explores the universe around him and calls the adventure Science." Using your knowledge of scientific principles, identify "an adventure" in science you would like to pursue and tell us how you investigate it.

Many colleges today have adopted a system of flexible admissions, in which they go beyond test scores to look at a student's background, artistic ability, scientific accomplishments and service work. Sternberg believes that the program he developed at Tufts, the Kaleidoscope Project, can augment that approach to increase student diversity.

Kaleidoscope is an extra section on the Tufts college application, a voluntary take-home test that about two-thirds of prospective students elect to complete. In a given year, they may choose to write a 400-word story titled, "Drama at the Prom"; analyze a favorite novel or film; draw a cartoon or compose a musical score; write an open letter to the president, submit a one-minute video about themselves on YouTube or imagine what Joan of Arc would be doing if she were alive today.

Kaleidoscope does not replace merit-based college admissions, Sternberg said; it expands them. It does not bar high-achievers from admission or lower the bar so that low-achievers can squeak by. According to the U.S. News & World Report's 2011 college rankings (which Sternberg abhors), Tufts is one of the 30 most selective colleges in the U.S., admitting only one out of every four students who apply.

Kaleidoscope has proved most helpful, Sternberg said, in helping admissions officers choose among the upper middle group of applicants. He noted that the mean SAT scores of the incoming freshman class at Tufts have improved every year since Kaleidoscope was introduced, and so has student body diversity. In the first year of its implementation, for the Class of 2011, Tufts admitted 30 percent more African Americans and 15 percent more Latinos than the year before. Today, people of color represent about 26 percent of the undergraduate student body of 5,000.

"We need diversity in our colleges and universities to teach students to understand, appreciate and even value viewpoints other than their own," Sternberg said. "…Parents sometimes fail to realize that, when they send their children away to college, they are paying as much for the fellow students their child will meet as they are for the professors and campus facilities."

When he was at Yale, Sternberg developed the Rainbow Project, in which 800 students at 15 schools, including high schools, community colleges and four-year colleges, were tested for creativity, practicality and critical thinking. Rainbow was a multiple-choice test administered by a proctor, and, in addition, students were asked to write a short story, tell a story out loud based on a picture collage, plan a route by map and solve hypothetical workplace problems. According to Sternberg, Rainbow proved to be twice as effective as SAT scores in predicting students' success in the first year of college, and 50 percent more effective in predicting success than SATs and high school GPAs together.

Academics alone do not produce good leaders, Sternberg said: Bill Clinton and George W. Bush, both Yale graduates, made a mess of their presidencies; the "best and the brightest" cabinet members of the 1960s led the U.S. into the quagmire of Vietnam; and the "once brilliant" Defense Secretary Donald Rumsfeld led the country into the quagmire of Iraq. Even the recent Wall Street debacle, Sternberg said, can be traced back in part to a bad educational system, one that produced individuals with "excellent grades at terrific business schools" but with no ethics or common sense or sense of the common good.

"No doubt greed had a lot to do with it," he said. "But one must also step back and ask how we developed a culture where greed was, and to some extent still is, treated with respect."

Sternberg is the first to admit he's fighting an uphill battle. Cost may be a problem for some schools. With Kaleidoscope, additional evaluators must be hired to rate the extra student essays, videos, drawings and short stories. But it was easy to raise private money at Tufts to pay for the program, Sternberg said, because so many alumnae had had a bad experience with tests.

A bigger obstacle to change is more than a century of entrenched practices (Sternberg calls them "superstitions") in college testing. Even with his 11 honorary degrees, Sternberg said, it's been hard for him to make a dent in what he calls the "deification" of the SAT, ACT and GPA.

"My success has been modest," he said in an interview. "I've never had the skill to diffuse my wonderful ideas through all of society. They'll just have to wake up!"

http://www.miller-mccune.com/education/testing-college-applicants-wisdom-common-sense-23004/