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In Los Angeles, the Saucer Is Ready to Land Again

By JENNIFER STEINHAUER

LOS ANGELES — Before they face traffic on the 405 freeway, grab an In-N-Out burger or zip off to Rodeo Drive to see whatever they think is there, visitors who arrive here through LAX first stare up at the futuristic spider-shaped building at the center of the airport, welcoming them to the edge of America.

The structure, the Theme Building at Los Angeles International Airport, is one of the most famous emblems of this city, right up there with palm trees, surfers and the Hollywood sign.

For the last three years, it was shrouded in scaffolding after a 1,000-pound chunk fell off one of the upper stucco-covered arches and landed on the roof of a restaurant. No one was injured, but the need for serious renovation was highlighted.

As the building was being repaired, and retrofitted to better withstand earthquakes, it served as a disorienting eyesore, rather than a welcoming icon.

Its completion was delayed several times, to the consternation of airport officials.

But now the $12.3-million project is nearly done — all but some roof treatments and a few coats of paint — and it will soon be back to its former glory, only with earthquake protection.

Maintaining the Theme Building's midcentury flying-saucer shape while correcting for significant flaws in the design that threatened its structural integrity was a major challenge for architects, engineers and contractors.

Rather than reinforcing the building with lots of new concrete, which would be expensive and change its physical features, the designers built a 1.2 million-pound steel weight that sits on flexible bearings — known as a tuned mass damper. It anchors the existing roof of the central cylinder of the building and essentially serves to counteract the movement of the structure in an earthquake.

"This is a more elegant way to go," said Nato Flores, president of Tower General Contractors, which ran the project. "Because it doesn't affect the architecture the way that reinforcing it would have done."

The Theme Building, designed by the futuristic architects William Pereira, Charles Luckman Associates, Welton Becket & Associates and Paul R. Williams, was built in 1961 to serve as the center of the airport, a ticketing spot through which all passengers would pass.

But as a result of the manner in which LAX developed — highly decentralized without a single point of orientation, much like the city it serves — that plan never came together. However, the building's other features, like the observation deck — where people could watch planes take off and land and peer through the mini-telescopes — still attracted visitors. (The deck was closed to the public after the Sept. 11, 2001, terrorist attacks, but airport officials are contemplating a way to make it accessible again to visitors, possibly by appointment.)

The building's modern design and references to air and space travel came to stand for a new Western city on the edge of greatness.

"From a historical point of view," said Paul Danna, president of the Los Angeles chapter of the American Institute of Architects, "the building really symbolized the forward-looking spirit that Los Angeles had in the '50s and '60s and hope that Angelenos of that generation held for the future."

In 1997, the Encounter, a totally round restaurant, was opened in the building, with interiors and retro lighting created by Walt Disney designers, and it has remained a trendy drink spot.

After the chunk of building fell onto the Encounter in March 2007, the restaurant was closed for eight months, while the Theme Building was dressed for renovation and its flaws were attacked.

The center of the 135-foot-high arches, for instance, had inadvertently allowed condensation to collect on the steel supporting the plaster around them. The architect Gin Wong Associates addressed that by having the air outflow from the restaurant — once directed outside — piped through the arches as a continual drying system. The arches themselves were reinforced with new steel and flexible polymer-based plaster.

A screen wall that surrounds the building — a disaster waiting to happen, according to Jaime Garza, a project manager for Miyamoto International, the earthquake engineers behind the renovation — was reinforced at the top with carbon fiber.

By far the biggest feat was the tuned damper, 22 layers consisting of six two-inch steel plates each, and each layer ranging from 8,000 to 11,000 pounds, lined up with 164 bolts through the plates on top of the existing center cylinder of the building to absorb shocks.

"It was a challenging project," said Mr. Flores, the Tower General Contractors president.

Cranes had to squeeze in under the arches. Oh, and the restaurant had to remain open the entire time, or the contractors would face a daily $5,000 penalty for any day it was closed.

Bringing the building back to full visual life is a matter of much excitement for those who care about urban history of Los Angeles, a growing interest among lawmakers, residents and preservationists in the last decade.

"The word 'icon' can be overused," said Linda Dishman, the executive director of the Los Angeles Conservancy. "But this building truly is. Anyone who enters or leaves here is greeted by the Theme Building. The city knew they had a treasure, and it preserved it."

http://www.nytimes.com/2010/04/18/us/18lax.html?ref=design

The Science of Green Microbes

Terry Hazen finds, studies and then uses microbes to clean up pollution deep underground, to refine oil before it is pumped and to produce the next generation of green fuels. He catches alligators sometimes, too.

By Bijal Trivedi

Terry Hazen at one of his microbe-feeding wells. (Bijal Trivedi)

A ribbon of blacktop lined with telephone poles is the only human signature for 10 miles beyond the security checkpoint at the Hanford Site in the high plains desert of southeastern Washington. The gently rolling hills are stark, an uninterrupted sprawl of sagebrush and brown cheatgrass, until the harsh geometric silhouettes of entombed nuclear reactors begin to punctuate the landscape. The once prolific nuclear production site has the aura of an Old West ghost town, except for the incongruous presence of bulldozers, trucks and workers in hazmat suits. Today, Hanford is the site of the "world's largest environmental cleanup project."

Terry Hazen, an environmental microbiologist at Lawrence Berkeley National Laboratory, is my guide through this nuclear wasteland. Hazen follows a long line of cleanup specialists who are trying to decontaminate the land, but he has different tools in his arsenal, and they are alive. Hazen plans to cultivate an army of microbial janitors that will use evolved alchemy to convert hexavalent chromium — a carcinogen that, along with the Pacific Gas and Electric Company, played co-villain in the film *Erin Brockovich* — into chromium III, a benign form of the element.

After 20 miles, we turn left onto a gravel road marked only by one of many generic "Hazardous Area" signs warning of contaminated soil. Within a few hundred yards, we reach a patch of gravel in Hanford's 100-H Area, where Hazen is about to launch an ambitious $500,000 field experiment.

"I told you it wasn't much to look at," Hazen says almost defensively, gesturing to five metal pipes, each protruding from concrete slabs spaced about 5 feet apart. Unremarkable as they seem, the pipes are actually wells, through which Hazen's team will deliver nutrients deep underground, to trillions and trillions of microbes. The goal is to feed subterranean microbes so they multiply, forming a huge underground treatment zone. When chromium-contaminated water in the aquifer flows through this zone, the microbes will pluck out the toxic chromium VI and convert it to chromium III, cleansing the water that will then continue to flow into the Columbia River.

Notorious as they may be for doing harm — making us sick and spoiling our food, among other things — microbes play vital roles in the ecosystems where they have evolved over the past few billion years. Hazen recognizes the incalculable skill set of these tiny forms of life and has built his career figuring out how naturally occurring microbes can best serve man: as cleanup crews, as sentinels of human disease, as factory workers for underground oil-refining operations and as producers of the next generation of clean, green fuels.

Although he's seeking out microbes with particular skills, his approach is more than straight bioprospecting. Hazen tries to understand the microbial dramatis personae in an environment, the role each plays and the company it keeps, and how these organisms work together to react to changing temperatures, acidity and chemistry. Such a global or "systems biology" approach is essential to answering pressing scientific questions like how, for example, microbes in the tundra regions of the world will increase the production of methane, a critical greenhouse gas, as permafrost warms. Together, his various microbe-research projects address a swath of A-list environmental issues facing the country.

Hazen's approach at Hanford is based on an idea, popularized by Martin Alexander of Cornell University more than 40 years ago, called the doctrine of infallibility. It contends there is no known compound, man-made or natural, that microorganisms cannot degrade. The trick is to figure out which microbe will degrade what, and when.

Hanford's contamination dates to the 1940s, when the site hosted a frenzied effort to produce plutonium for the Manhattan Project; it was Hanford plutonium that was used in the Fat Man bomb dropped on Nagasaki. The site continued to produce plutonium for the atomic arsenal through the mid-1980s.

The legacy of that plutonium production is a staggering quantity of radioactive and other contaminants buried, stored and discharged into pits or dumped onto the ground, polluting 5 million cubic yards of soil and spoiling 270 billion gallons of groundwater over 80 square miles.

Hazen believes the only practical way to clean up toxic chemicals that escaped beyond the reach of shovels and bulldozers is to encourage the microbes dwelling in the soil and rock to do it for us. Soil of all types teems with life; each gram nurtures anywhere from about 1 million to 10 billion bacteria, representing 4,000 to 10,000 species, each one bringing something different to the table.

Although Hanford ranks as one of the worst, it is just one of more than 70,000 or so dangerously contaminated sites scattered across the United States. Cleanup traditionally involves costly measures like carting dirty soil to distant decontamination plants or entombing toxic material in pits, a process that is often ineffective, Hazen says, because the tombs inevitably leak. The price tag to clean up all these sites is estimated at $1.7 trillion. If Hazen's Hanford field experiment succeeds, it could reveal a significantly less expensive route to remediate toxic sites nationally and around the world.

In college, Hazen seemed an unlikely candidate to lead the field of environmental microbiology. He attended Michigan State University from 1969 to 1974 and imbibed the culture on which the "party" school rep is based, he says with a grin. At one of those parties, he met his future wife and, he says, "the drinking stopped." He got married, graduated with honors and stayed on a year to snag a master's in parasitology before pursuing his doctorate in parasitology and ecology at Wake Forest University.

Hazen didn't begin his career as an advocate for microbes, or "bugs" as he calls them. Early on, he was interested in how microbes caused disease and how pathogens could survive in different conditions. For his doctorate, he investigated the parasite *Aeromonas hydrophila*, which causes "red sore" disease in fish.

He took his newly minted degree to the University of Puerto Rico in 1979, lured not just by the chance to cruise the Caribbean in his 27-foot sailboat but by the opportunity to explore how microbes, like the bacterium *E. coli*, survive in tropical environments. *E. coli* was thought to always signal the presence of human waste, but Hazen guessed that wasn't the case in warmer climes.

While in Puerto Rico, Hazen overturned the almost universal assumption that the microbe *E. coli* was always associated with human feces. By collecting water from pristine streams and the leaves of bromeliads in the top of the rainforest canopy, he proved that *E. coli* was indigenous to the Puerto Rican environment. During his eight years on the island, Hazen rose to tenured full professor and chairman of the Department of Biology at the University of Puerto Rico in Rio Piedras, with more than 30 publications within four years — all before he was 30.

In 1987, Hazen received an offer to move to what is now the Savannah River National Laboratory, at the Department of Energy's 310-square-mile Savannah River Site near Aiken, S.C., where he was hired to study life deep underground, a little-explored field.

At Savannah River, Hazen's interest in microbes grew exponentially; today he is regarded as one of the pioneers of microbial ecology. In the early 1990s, he led the Department of Energy's first efforts to identify deep subsurface microbes and figure out what they were doing in uncontaminated sediments and groundwater. While drilling in the Savannah River Site, Hazen noticed methanotrophs, or microbes that consume methane, 2,000 feet below — which surprised scientists because the rock there was thought to lack the nutrients to support life. These microbes possessed an almost magical property. They produced a powerful enzyme that could break down more than 300 types of toxic organic contaminants and convert them into carbon dioxide and water.

Hazen reasoned that if he "fed" these methanotrophs, they would multiply, creating swarms of microscopic cleaners that would transform pollutants. All that was needed to encourage these bugs to break down trichloroethylene — the most common organic contaminant, used in dry cleaning, motor degreasing and decaffeination processes — was "a little bit of oxygen and a little bit of methane gas," which he injected into the ground using oil-drilling technology. The approach proved highly successful in field tests — his team cleaned up TCE contamination in a football field-size zone about 300 feet below ground — and the technique became a patented remediation tool.

"What [Hazen's] really known for is pioneering the use of large-scale field studies to understand how key microbes can change soil ecology and do things like remediation," says Adam Arkin, who, with Hazen, co-directs the Virtual Institute for Microbial Stress and Survival at Lawrence Berkeley National Laboratory. "He's almost an engineer, in a sense, because he works on how to use microbes to effect environmental change."

In 1995, the DOE sent Hazen to spearhead the cleanup of an abandoned oil refinery in southern Poland where oil had been dumped in open ponds for more than a century, forming what Hazen called a "sludge lagoon." He showed that cleaning up such sites could be done quickly, to a high standard, just by providing the right mix of air and food to indigenous microbes, which cleaned up the oil-soaked dirt by doing what comes naturally. The project showcased the DOE's expertise and served as the training ground for bioremediation teams all over Europe. "I don't believe in doing the most expensive and the most cool, that sort of thing, unless it is practical," he adds.

When met with an environmental disaster, Hazen doesn't get emotional. He doesn't rant about the extent of the disaster or the impact on the wildlife. Often, he admits, his first impulse is to get a sample. That's exactly what he did when he saw the old sludge lagoon.

When Hazen eventually analyzed the bugs in the Polish sludge, he discovered new acidophiles — microbes that thrive under very acidic conditions and have the rare ability to degrade oil contaminants. Savannah River later patented them.

Hazen began working at the Hanford Site in 2002, when hexavalent chromium concentrations ranged from 100 to 200 parts per billion — 10 to 20 times the allowable limit. The source of the contamination lies about 2 miles west of Hazen's wells, where two reactors operated from the 1940s to the 1960s. Sodium dichromate, used to prevent corrosion, was added to filtered river water and used to cool the reactors. During the 1950s and 1960s, this water was dumped in unlined trenches, which then leaked into the porous soil and aquifer.

The form of chromium known as chromium VI is toxic at high concentrations — with health effects varying depending on the type of exposure; the substance can be absorbed through the skin, ingested or inhaled. The chemical's effects on humans were vividly portrayed in the film *Erin Brockovich*, in which the residents of Hinkley, Calif., were exposed to chromium VI via contaminated drinking water and

probably inhalation. The Pacific Gas and Electric Company used chromium VI to prevent corrosion in cooling towers and then dumped the chromium-laced wastewater into unlined ponds during the 1950s and 1960s. Among a laundry list of diseases that Hinkley residents suffered were lung, breast, stomach, kidney and prostate cancer, which are believed to be caused by ingesting chromium VI. The levels that Hazen sees at his wells can cause deformities in or kill salmon fry.

Hazen's team began feeding the Hanford microbes in 2004. They injected 40 pounds of nutrients — a viscous, honey-like substance — into the wells and a few days later began taking samples of water and soil to be analyzed in Hazen's Berkeley lab. Within three weeks, it was clear that the microbes were enjoying the new diet and thriving; the population boomed 1,000-fold and "the chromium levels were undetectable," Hazen says, holding back a triumphant smile. "It lasted for almost four years."

Unlike other microbiologists, Hazen isn't interested in studying bacteria one species at a time in the lab. He wants to understand how they work together in the real world to perform complex chemistry that would be tremendously impractical and expensive for humans to mimic.

In 2008, after the hexavalent chromium levels rose again to 100 parts per billion, Hazen's team fed the microbes a second meal of about 10 pounds of nutrients. Within 24 hours the odor of hydrogen sulfide — rotten egg gas — began wafting out of the wells. It's the "sweet smell of success," says Hazen with a smile, an indication that the toxic chromium was now being downgraded into the relatively harmless form that will cling to sediments and stay out of water — and out of the Columbia River, an important breeding ground for salmon. Hazen notes that there seems to be some type of "memory response" that occurs when the microbes are fed a second time, triggering a faster reaction.

In March, Hazen's team began the largest chromium bioremediation effort at Hanford to date by shooting 55 gallons of lactate into one of the wells. Lactate — a compound similar to the one that builds up in your muscles when you exercise — is an environmentally friendly food that allows bacteria to grow and multiply. The team will pump the liquid 40 feet down into the aquifer where it will disperse over an area about 50 by 100 feet — creating a treatment zone.

Hazen's approach exploits a fundamental mechanism of metabolism. When humans digest food, they take electrons from the foods they eat and pass them off to the oxygen they breathe in. Similarly, microbes in the soil metabolize the nutrients that come through the wells, strip off some of the electrons and, through a series of chemical reactions, transfer the electrons to an electron acceptor. But different microbes have evolved to breathe different substances. Some microbes breathe oxygen, some nitrate, some carbon dioxide, and others breathe chromium.

Once the oxygen in the soil runs out, the microbes that breathe nitrate thrive. Hanford soil is rich in nitrate because it was used to process nuclear material and then dumped. Once nitrate runs low, then chromium-breathers dominate. These microbes will use the lactate and channel their electrons to chromium VI, converting it to chromium III (which is actually an essential element in the human diet, with a recommended daily intake). When the chromium VI runs out, which is Hazen's goal, then microbes breathing iron, sulfate and carbon dioxide dominate, sequentially converting these substances into iron II, hydrogen sulfide (the rotten egg gas) and methane. So when Hazen smells rotten egg gas, he knows that the chromium has been modified.

Chromium III doesn't disappear. But rather than leaching into the water and flowing into the river, it sticks to the soil. Hazen says the site will need perpetual monitoring as shifting environmental conditions — in particular the oxygen and nitrate levels — could kick the chromium back to its more dangerous state.

Manipulating a cast of thousands of different types of bacteria to perform a set task is a huge leap forward in bioremediation. It is only in the last 10 to 15 years that scientists have had the technology to even

identify the thousands of species of microbes living down there. “Giving the microbes the right food to do the job — he’s been one of the masters at making that happen,” Arkin says.

Long-term, difficult experiments like the one at Hanford are what compels Terry Hazen, says Judy Wall, a biochemist at the University of Missouri and a collaborator. “Terry can anticipate the trajectory of an experiment, ask long-term questions and collect a range of data that can still be mined years down the road with new technology,” she says. “That really takes great insight and long-term vision.”

Hazen anticipates that the microbial-remediation approach used at Hanford will become increasingly important. Studies in the last decade have shown that even ultra-low concentrations of many contaminants — like petroleum products — can disrupt the reproductive systems of humans and other animals, suggesting that many sites will need to meet a higher standard of cleanup. The only way to reach safe levels may involve the use of microbes. “Methanotrophs can get contaminants to parts per trillion and basically degrade until there is nothing there,” Hazen says.

In 1998, Hazen was lured to Lawrence Berkeley National Laboratory, a renowned center for biotechnology research. There, he now runs an empire with many projects and hundreds of collaborators; he leads the ecology department, the environmental biotechnology center and the microbial communities department of the Joint BioEnergy Institute, to name just a few of his efforts. All of his projects are somehow tied to remediation.

While an adamant environmentalist, Hazen is unapologetic about working both ends of the energy equation, using microbes not just for cleanup, but to improve oil extraction and refining, and to produce biofuels. “We can’t say, ‘Oh we don’t want to work on oil because of greenhouse gas and all this crap,’” Hazen says softly but with a tinge of impatience. “We’re going to need oil and some of those products anyway. So why not change it to something that is less toxic to the environment?”

Hazen says that he knew all along that microbes could be used for in situ oil refining. But, he says, “Until we hit this energy crisis here recently, nobody was interested in it.” When oil prices spiked, interest grew; in 2007, the University of California, Berkeley, received $500 million from BP to set up the Energy Biosciences Institute. Before becoming Secretary of Energy, Steven Chu, then the director of the Lawrence Berkeley National Laboratory, tapped Hazen to lead the search for oil-refining microbes.

“Terry was an easy choice to run the Microbially Enhanced Hydrocarbon Recovery program because he is both an excellent scientist and a strong manager,” Chu said in e-mail interview. “He has been a leader in microbial environmental biology and ecology, and the results of his research [are] now being applied in the bioremediation of many contaminated sites.”

In the petroleum reservoirs of Alaska, the Gulf of Mexico and Colorado, Hazen has launched projects seeking out microbes that can make oil easier to extract by making it less viscous or by converting it to hydrogen or methane gas. Hazen says that if microbes could perform such chemical processing underground, it would eliminate, or at least reduce, the environmental damage and pollution caused by oil refineries, the use of chemicals to fracture underground formations and other methods of extracting oil and gas from underground reservoirs.

Hazen is confident he’ll hit pay dirt. In 2008, he co-authored a paper announcing the discovery of a new bacterium that resides 2.8 kilometers down a South African goldmine. Hazen says that microbes like this extremophile, which can survive a hot, salty environment, could provide clues to how microbes could survive oil reservoirs. “I suspect that we’ll find even that same exact bug in some of these oil wells, too,” he says.

‘OK, a story,” Hazen says abruptly. “Have I told you about catching alligators?”

Hazen doesn't particularly look like an outdoorsman. He's tall — about 6 feet 5 inches — with a heavy physique. Bespectacled, ruddy cheeked, with an almost grandfatherly demeanor, Hazen speaks softly, his voice often trailing off at the end of his sentence. But all that changes when he tells the story of the alligators that were dying in South Carolina's Par Pond from 1976 through 1977. Rumors hinted that warm water released from a nuclear reactor on the pond was to blame. Hazen quickly brushed up on the problem, wrote a proposal on a Friday and sent it off to the Department of Energy. By Monday, he had funding and a permit to catch alligators.

Leaning forward, he describes paddling though the steamy swamps of Green Pond, S.C., on a moonless June night, searching for alligators while dodging water moccasins falling from trees. With the help of a postdoctoral researcher, Hazen would haul a thrashing alligator into the boat, mouth gaping, and "quickly put a rubber band around it."

After much hard work on samples drawn from the captured gators, Hazen proved that a microbe was killing them. But the warmer waters from the reactor's cooling system had played a role, creating cozier conditions for the microbe. Hazen clearly cherishes the alligator adventure; a picture on his Web site's home page shows him sitting next to a gator, holding its mouth open.

Hazen's latest adventure returns him to the warm and wet clime of his old stomping grounds in the Puerto Rican rainforests, where he's looking for microbes that degrade cellulose and lignin, tough structural components of plants that are currently foiling attempts to produce ethanol from them. From roaming these forests more than 20 years ago, Hazen knows that in the lush rainforest, organic matter disappears fast and that microbes are responsible. He reasons that the chances of finding new organisms and new enzymes for degrading plant material would be "astronomically greater" in such a place.

To attract the "right" type of microbe — one that efficiently breaks down cellulose, which can be converted to ethanol that can be used as fuel — Hazen's team filled 400 little mesh bags with switchgrass, a tough native grass that can grow to 10 feet tall and dominated the American prairie a century ago. The bags were then buried in various locations in the rainforest. Switchgrass is considered a better choice for biofuels production than corn because the net energy output is more than 20 times higher.

By analyzing the DNA of microbes munching on the switchgrass, Hazen can get a rough idea of which microbe families are present and which genes are at work. Because genes that make cellulases "have a characteristic look," Hazen's team can fish out promising DNA sequences from the microbes and use them to reconstruct enzymes that might break down cellulose; they are then tested in the Berkeley lab. This past summer, his team made a breakthrough. "Two of them look like they are golden — like they really degrade things fast and are much better than a lot of things that we've seen," Hazen says.

Back at Hanford, Hazen's microbial army is preparing for an epic cleanup. As bone-chilling winds stiffen our faces and hands at the Hanford Site, the microbes await peacefully 40 feet below at a constant 53 degrees Fahrenheit. If all goes according to plan, Hazen's generous food delivery in March will kick the microbes into high gear, triggering a growth spurt and population boom, particularly of the chromium-breathing microbes that will transform a toxic chemical to a beneficial form.

But Hazen isn't one to sit back and marvel at the bugs and the chemical stunts they perform. Like a boss who expects the most from his employees, he explains that they are just doing what they have evolved to do. "It's more surprising," he says, "when they don't do what I expect them to do."

http://www.miller-mccune.com/science-environment/the-science-of-green-microbes-11438/?utm_source=Newsletter105&utm_medium=email&utm_content=0420&utm_campaign=newsletters

Peak Wood Forges an Industrial Revolution

When it was no longer easy or cheap to burn trees for development, a new economy had to be forged from fossil fuel.

By John Perlin

"Coalbrookdale at Night" by Philipp Jakob Loutherbourg, 1801. When trees ceased being a cheap resource for development, a new economy had to be forged from fossil fuel. (Wikipedia.org)

As England entered the 18th century, manufacturers could not get enough wrought iron. The problem had nothing to do with a deficiency of ore. “In that respect,” an anonymous pamphleteer of the period observed, “nature has been very liberal.”

“But,” he added, “for lack of wood and charcoal they are not being worked.” The country’s rich supply of coal was of no help. “No art or method is known and practiced,” one familiar with the iron trade of the time attested, “of making iron from ore but with charcoal.”

Accessible wood supplies, those that could be delivered at a profit, had greatly diminished over the years; as the pamphleteer wrote, they had been “grub’d up and destroyed.”

In short, the era of peak wood had arrived. A growing population needed more land cleared for agriculture. A more affluent society demanded greater amounts of wood for an ever-increasing number of applications.

The first railroads, called wagonways, sprung up in the 18th century. Manufacturers needed wood to build their horse-drawn wagons and to construct the track on which they traveled. Canals, too, abounded as time went on. They used wood for their locks and for the boats that passed through them. The public’s thirst for beer forced hop farmers to cut down trees for poles to hold up the hop vines, for charcoal to dry their leaves after the harvest, and staves for barrels in which to hold the brew.

The first factories — textiles — that emerged during these years required wood in all aspects of operation. Wooden water wheels ran spinning machinery also made of wood. Even the fabric worked in the mill had to be heated with charcoal to keep the fibers soft, flexible and elastic.

Owners of such businesses could outbid ironmasters for the wood they all had to have. One of them, Abraham Darby, found himself competing with the other tradesmen for the charcoal to stoke the furnaces he owned at Coalbrookdale. And while veins of coal there sold at a lower rate than anywhere else on the island, charcoal in turn commanded a higher price than just about any other place in England.

So Darby tried substituting coal, a fossil fuel, for charcoal made expensive by peak wood.

The iron that resulted typically lacked sufficient quality for the commercial market. Coal's impurities adulterated the metal. Darby recalled from his time as apprentice to a malt maker that in the brewing industry, coal was purged of its unwanted elements — the "distilled" coal was known as "coke" — before using it for fuel. He tried the same for smelting iron ore, conducting many experiments in altering the coal, but he died before fully attaining his goal.

His son continued his father's investigations. After numerous attempts, the younger Darby came up with coal as pure as charcoal. Independent analyses found he could convert with such coal "iron brittle or tough as he pleases." The son went on to build a full-scale furnace and produced more high-quality iron with coal than had any charcoal furnace in the history of the industry.

Had he failed, according to his wife, "the iron of our own produce would have dwindled away as cordwood and charcoal had become scarce."

Manufactured iron soon became plentiful. In 1750, around the time of Darby's discovery, English ironworks produced a mere 19,000 tons of the metal. Fifty years later, the amount rose to 250,000 tons. By 1850, the country turned out 2.5 million tons.

Coal production likewise rose from 5 million tons in 1750 to 10 million tons in 1800. Over the next 50 years, it jumped to 50 million tons. With sufficient quantities of iron and coal at the nation's disposal, as many steam engines as needed could be built. The plethora of iron also provided the necessary machinery, powered by coal-fired steam engines, for factories to turn out more goods than the world had ever seen before. The limiting factor, wood, had been usurped by an apparently limitless fossil fuel.

Steam engines also revolutionized transport. Prior to the steamboat, railroad, automobile, and plane, people had traveled by land or sea at the same speed from millennia to millennia no swifter than feet, hooves or sails could move. The steam engine and its successor, the internal combustion engine, turned wheels and paddles and later propellers to convey people and goods faster than even the most prophetic could dream. England became the preeminent power in the world during the 19th and early 20th centuries as a consequence. Wars became more deadly and widespread, too. Environmental damage took on a global aspect. Peak wood pushed the developed world into this new age, separating us and our recent ancestors from the rest of history.

http://www.miller-mccune.com/science-environment/peak-wood-forges-an-industrial-revolution-14608/?utm_source=Newsletter105&utm_medium=email&utm_content=0420&utm_campaign=newsletters

Counting Wins and Losses on Earth Day

Three prominent environmental activists reflect on the state of the American green movement for the 40th anniversary of Earth Day.

By Lewis Beale

It's the 40th Anniversary and Miller-McCune talks with three prominent environmental activists about their views of the American green movement progress the last two decades. (A.E. Knost / istockphoto.com)

April 22 marks the 40th anniversary of the first Earth Day, and with it, the symbolic beginning of the environmental movement. The event was the culmination of a number of trends that began in the 1950s when scientists began to note how industrialization was impacting the Earth's ecosystem. Then, in 1962, Rachel Carson's groundbreaking book *Silent Spring*, which documented the effects of pesticides on the environment, caused an international sensation and led eventually to the banning of the pesticide DDT in the United States.

By 1970, concerns about population growth, mass starvation, and water and air pollution had coalesced into a movement to support a cleaner, and saner, environment.

All this and more is told in *Earth Days*, which will be broadcast on PBS's *American Experience* on April 19. Director Robert Stone's film not only tells how the green movement began, but delves into it successes and failures since that seminal day in 1970.

"What we were trying to do is create a brand-new public consciousness that would cause the rules of the game to change," Denis Hayes, national coordinator of the first Earth Day, says in the film.

Hayes is one of nearly a dozen key environmental activists interviewed in the documentary. Miller-McCune.com caught up with three of them and asked them to assess the state of environmentalism in 2010:

• Paul Ehrlich authored the best-selling book *The Population Bomb* in 1968. He is currently the Bing Professor of Population Studies and president of the Center for Conservation Biology at Stanford University.

• Stephanie Mills became famous thanks to her 1969 Mills College commencement speech, "The Future Is A Cruel Hoax." She is a writer and editor who has been involved with Planned Parenthood and currently is an advocate for bio-regionalism, a movement dedicated to locally sustainable economies and cultures.

* Denis Hayes was the main organizer of the original Earth Day. He has since become a major proponent of solar energy and continues to chair the board of the international Earth Day Network.

Miller-McCune: Forty years after the first Earth Day, what do you think are the biggest successes and failures of the environmental movement? Why?

Paul Ehrlich: Success — getting the environmental movement onto the political agenda. Basic environmental legislation (Endangered Species Act, Clean Water Act, etc.). Failure — to get enough attention paid to two of the most fundamental drivers of environmental deterioration, human population size and growth, and over-consumption by the rich.

Stephanie Mills: Given the state of the planet, with a human population nearly doubled since the first Earth Day, with extinction now outpacing evolution, and ocean acidification and climate change intensifying, it doesn't look like the environmental movement has been terribly successful in limiting the damage of industrial civilization or saving the Earth. Some successes:

In the U.S., the Endangered Species Act stands out as an unequivocal biocentric law that activists are using to great effect to rein in heedless development and protect biodiversity, which, ultimately, means protecting the conditions human beings require in order to flourish.

Also in the U.S., the environmental justice movement has integrated campaigns against pollution, and for social and racial justice, somewhat broadening the larger movement's purview. Far more solidarity across class lines is called for, though.

Dennis Hayes: As late as the 1960s, there was no real awareness of the large ecological issues and their relevance to humans. Concerns over DDT or wilderness or 12-lane freeways were thought of as independent, unrelated issues. Now these issues, and thousands of others, are seen as part of an integrated whole, and they have traction all over the planet. We understand with increasing clarity what humans are doing to the environment, and we are coming to appreciate what this means for the well-being of society. In scores of countries, including the United States, strong laws have been passed and are being enforced to safeguard important aspects of the environment.

The movement has had much less success addressing global environmental issues than the local and national issues. Most people are not aware of the enormity of the human impacts on, for example, the carbon cycle, the hydrological cycle, the nitrogen and potassium cycles, extinction rates, ocean acidification and overfishing, loss of topsoil, and the other trends that are undermining nature's health and services.

Similarly, we have failed to articulate a persuasive alternative vision of how to have a healthy, prosperous, innovative society in the emerging era of constraints. National policies virtually everywhere are guided by an assumption that energy use and the physical throughput of economic production will continue to grow exponentially. Even the most scientifically illiterate economists understand at some level that this cannot continue forever.

M-M: Is there any one program or aspect of environmentalism that seems to be most accepted by the population at large?

Ehrlich: Recycling, because it's easy and makes one feel good.

Mills: Recycling, because it doesn't involve fundamental change.

Hayes: There is widespread acceptance of those environmental measures that reduce or eliminate things that are clear, convincing, immediate threats to human health. Few people will argue that we should restore tetraethyl lead to gasoline or allow dioxins to be dumped into rivers. There is also almost universal support for protecting the national parks.

M-M: Climate change naysayers seem to be gaining ground these days, especially in this country, where polls show that the majority of Americans are not convinced that human activity contributes to global warming. Why do you think this is, and what can be done about it?

Ehrlich: [This is] largely due to a well-funded and expertly handled campaign of disinformation funded mostly by the major culprits — especially the fossil fuel industries. Start requiring realistic science education in schools and universities, and try to inject at least a little into the mass media.

Mills: Because climate change is being addressed, however ineffectually, in the political arena, the public may believe that it's as negotiable a matter of debate and compromise as a spending bill rather than an intransigent matter of physics, chemistry and widespread scientific consensus. Denial — the implications are nothing I want to believe, either; and genuine remedies portend a dramatic restructuring of everyday life — and the global economy.

The fact that responsible scientists can only say that phenomena like melting glaciers, prolonged droughts, increasingly severe storms and earlier onset of spring are consistent with their models, rather than declaring a simple cause-and-effect relationship leaves room for ambiguity.

Disinformational PR campaigns handsomely funded by fossil fuel producers probably account for much of the naysaying.

What can be done? Phenomenal mobilizations like the 350 campaign [an international movement designed to unite the world around solutions to the climate crisis] and other efforts by civil society groups help, but until ecology can trump economics, adequate understanding and action are unlikely.

Hayes: The number of people disputing the reality of climate change does not appear to be changing radically here or abroad. What has changed in the United States is a growing percentage of people who believe either that humans are not primarily responsible for climate change or else that, on balance, climate change may be more good than bad. The reasons for this are legion: The fossil fuel industry, operating under the aegis of the Global Climate Coalition, spent huge sums of money over many years fostering uncertainty over the science.

The reporting techniques of the modern mainstream media led them to strive more for an artificial type of balance (he said; she said) regardless of the ascertainable facts than to weigh the evidence, apply a crap detector and provide some guidance to their readers.

Talk radio and blogs are designed to rev up their audiences with rhetorical red meat.

The best scientists behind the last three decades of climate research have rarely taken their messages directly to the public, and when they have they have often proven to be very poor communicators.

Some climate reports have contained some mistakes. Rather than view this as a natural part of the scientific process where errors are caught and corrected as the process moves forward, even trivial errors are seized upon as evidence of perfidy.

Finally, high school and even undergraduate science education in the United States is often embarrassingly poor.

M-M: Are other industrialized nations more or less environmentally conscious? Why?

Hayes: Certainly most other industrialized nations have adopted more aggressive climate policies than the United States, but in lieu of U.S. action, their enforcement has ranged from lackluster to lousy. There is also a huge swing in many nations when governments change — the equivalent of a shift from the environmental policies of George W. Bush to those of Barack Obama. In the early 1970s, I would have said the global leaders environmentally were the United States and the Nordic nations. The U.S. explicitly abandoned its leadership in fields ranging from solar energy to pollution prevention, and it remains to be seen whether we can return to the prominence we once enjoyed.

M-M: What do you see for the near future? Do you feel the younger generation, those now in college or in their 20s, will make a difference, or are we essentially back to square one when it comes to environmental consciousness?

Ehrlich: We're not back to square one, since most young people at least know there are environmental issues. But we're in much worse shape than we were [in the 1960s] because all significant trends are moving in the wrong direction, and most are accelerating. I hope the youngsters will make a difference, but I don't see how they can without understanding the problems.

Mills: [I see] rather a lot of difficulty and confusion as the effects of climate change, fossil fuel depletion and economic collapse beset us and the power structure keeps throwing scarce resources into the effort to maintain the status quo. Nevertheless I think there's a can-do willingness to power down, apply ingenuity, re-localize production for basic needs and restore community throughout society and across generations, and that it's growing. The potential for a great transformation, diversely manifested, is inherent in these crises, and people sense this.

We can't be back to square one. The world has changed so dramatically and in so many ways, for good and ill. Young people today are going forward into a whole other biosphere than the one we Earth-Day-1970 geezers were born into. So many of the young are ecologically aware planetary citizens, insisting that another world is possible.

Hayes: The greatest remaining challenges and opportunities are at the global level — and there is substantial evidence that the younger generation has a far less parochial worldview than its parents. Part of this is doubtless due to having grown up amid an information revolution that allowed them to become part of a world culture with affinity groups of various types that span the planet. Whereas the first Earth Day dealt principally with threats to individuals — their children, their neighborhood, their watershed — Earth Days are increasingly becoming more reflective of the whole "Earth."

http://www.miller-mccune.com/science-environment/counting-wins-and-losses-on-earth-day-14547/?utm_source=Newsletter105&utm_medium=email&utm_content=0420&utm_campaign=newsletters

ESP Study Suggests Lack of Trust in Science

Newly published research on belief in ESP suggests a public disregard for — and perhaps even hostility toward — the scientific consensus.

By Tom Jacobs

Newly published research on belief in ESP suggests a public disregard for — and perhaps even hostility toward — the scientific consensus. (sapandr/istockphoto)

Scientists wondering just how low faith in their field has fallen will get some uncomfortable answers in a study examining belief in Extrasensory Perception, recently published in the online journal *Current Research in Social Psychology*.

In the experiment, conducted by a University of Maryland research team led by sociologist Heather Ridolfo, 160 participants watched a short video in which an individual is remarkably successful at a card-guessing game. In fact, the film's star was informed of the answers, but it appeared to the study participants that she was either extremely lucky or had some sort of sixth sense.

After viewing the video, participants completed a series of questions, including whether they believed in ESP and whether they thought the card-guesser they just saw was demonstrating that ability.

The participants were broken up into four groups. Those in Condition One were informed that 25 percent of the public believes in ESP, but the scientific community rejects the concept. Those in Condition Two were told that more than 90 percent of the public believes in ESP, but the scientific community considers it bogus.

Those in Condition Three were told that 25 percent of the public believes in ESP, and the scientific community is becoming more open to the idea. Those in Condition Four were informed that more than 90 percent of the public believes in ESP, and the scientific community is beginning to warm to the possibility it is real.

"We found relatively strong evidence that individuals are more likely to accept paranormal claims as true when they believe such claims have popular support," the researchers write. However, "We found no effects indicating that science rejecting a claim led individuals to be less likely to believe the claim.

"In fact, when participants believed that science rejected a claim, they moved in the direction of being more likely to accept the clam as true. This finding ran counter to our expectations, but is consistent with findings that trust in science is decreasing."

To put it another way: Those told ESP had widespread popular support were likely to express agreement with that consensus, regardless of the scientific consensus. But among those who were informed that only one-quarter of the population believed in the phenomenon, support was actually higher when science gave it a thumbs-down.

That collective gulp was from the climatologist community, which has every right to worry whether its warnings of the consequences of global warming are not only being tuned out, but actively discounted by a cynical public. Perhaps a study of paranormal beliefs is too specific to indicate a widespread distrust of lab-coated authority figures, but perhaps that's precisely what it suggests.

"These findings may be due to individuals seeing paranormal belief as a matter of faith rather than evidence, and therefore reacting against science," the researchers conclude. "Alternatively, perhaps endorsement from peers provides a stronger source of legitimacy for paranormal beliefs than authorization from a higher authority. Or the findings may result from a decreasing trust in the institution of science."

If the latter interpretation is true, you don't need ESP to foresee troubling times ahead.

http://www.miller-mccune.com/science-environment/esp-study-suggests-lack-of-trust-in-science-14659/

Convincing the Public to Accept New Medical Guidelines

When it comes to new treatment guidelines for breast cancer, back pain and other maladies, it's the narrative presentation that matters.

By Christie Aschwanden

New evidence-based mammography guidelines ran headlong into a strong but mistaken belief that all breast cancers must be treated aggressively. (wikimedia)

They call it "vitamin I." Among runners of ultra-long-distance races, ibuprofen use is so common that when scientist David Nieman tried to study the drug's use at the Western States Endurance Run in California's Sierra Nevada mountains he could hardly find participants willing to run the grueling 100-mile race without it.

Nieman, director of the Human Performance Lab at Appalachian State University, eventually did recruit the subjects he needed for the study, comparing pain and inflammation in runners who took ibuprofen during the race with those who didn't, and the results were unequivocal. Ibuprofen failed to reduce muscle pain or soreness, and blood tests revealed that ibuprofen takers actually experienced greater levels of inflammation than those who eschewed the drug. "There is absolutely no reason for runners to be using ibuprofen," Nieman says.

The following year, Nieman returned to the Western States race and presented his findings to runners. Afterward, he asked whether his study results would change their habits. The answer was a resounding

no. “They really, really think it’s helping,” Nieman says. “Even in the face of data showing that it doesn’t help, they still use it.”

Nieman’s tale is no anomaly. A surprising number of medical practices have never been rigorously tested to find out if they really work. Even where evidence points to the most effective treatment for a particular condition, the information is not always put into practice. “The First National Report Card on Quality of Health Care in America,” published by the Rand Corporation in 2006, found that, overall, Americans received only about half of the care recommended by national guidelines.

A $1.1 billion provision in the federal stimulus package aims to address the issue by providing funds for comparative effectiveness research to find the most effective treatments for common conditions. But these efforts are bound to face resistance when they challenge existing beliefs. As Nieman and countless other researchers have learned, new evidence often meets with dismay or even outrage when it shifts recommendations away from popular practices or debunks widely held beliefs. For evidence-based medicine to succeed, its practitioners must learn to present evidence in a way that resonates.

Or, to borrow a phrase from politics, it’s not the evidence, stupid — it’s the narrative.

By walking into the race forum convinced that runners would alter their ibuprofen habits based on his new evidence, Nieman fell prey to what University of California, Berkeley, social psychologist Robert J. MacCoun calls the “truth wins” assumption — the idea that when someone correctly states the truth, it will be universally recognized. Ibuprofen use during a long-distance running event presents serious risks, including gastrointestinal bleeding and a condition called rhabdomyolysis, which can lead to acute kidney failure. If runners were exposing themselves to those risks without any reasonable expectation of benefit, Nieman assumed they’d want to know.

Instead, he butted up against a phenomenon that philosophers have dubbed naive realism. “It’s the idea that whatever I believe, I believe it simply because it’s true,” MacCoun says. Ultra runners honestly believe that ibuprofen reduces inflammation in the joints and muscles, and allows them to run with less pain. This explanatory story about the drug is known as a “mental model” — a conceptual framework and mental representation about how something works that helps people make sense of the world. Once a mental model is in place, the mind tends to force new information to fit within it.

“There’s this common assumption that we’re just going to educate people about the facts, and then they’re going to make use of them,” says Brendan Nyhan, a health policy researcher and political scientist at the University of Michigan. “But that’s not how people process information — they process it through their existing beliefs, and it’s hard to override those beliefs.”

Several years ago, I interviewed a runner who was hospitalized for a severe case of rhabdomyolysis after taking ibuprofen during an ultramarathon. Despite her experience, attributable in part to the 12 ibuprofen pills she popped during the 24-hour run, she continues to take ibuprofen while racing, albeit in lower doses. “Ibuprofen absolutely does work for me both in terms of pain management and decreasing joint inflammation,” she said.

Nieman’s results contradict these beliefs, and other studies show that using ibuprofen and other nonsteroidal anti-inflammatory drugs prior to exercise may actually impede tissue repair and delay the healing of bone, ligament, muscle and tendon injuries. And yet the belief that NSAIDs should help athletes perform with less pain is so ingrained that a quarter of the athletes competing at the Sydney Olympics in 2000 reported using them. The notion that a medication belonging to a class of drugs whose very name includes the word “anti-inflammatory” could actually increase inflammation strikes many runners as not just improbable, but impossible — even though that’s exactly what Nieman’s study showed via quantifiable blood markers.

But when facts contradict a strongly held belief, they're unlikely to be accepted without a fight. "If a researcher produces a finding that confirms what I already believe, then of course it's correct," MacCoun says. "Conversely, when we encounter a finding we don't like, we have a need to explain it away."

In a series of experiments, MacCoun described fictitious studies on gun control, the death penalty and medical marijuana to volunteers. When the study results supported the volunteers' own views on the issue, they considered the study unbiased, but when the results contradicted their existing views, they were quick to dismiss them. "If you favor gun control, and I show you a study that suggests that gun control doesn't save lives, you think, 'Well that researcher must be conservative and work at some kind of right-wing think tank,'" MacCoun says.

In a classic 1977 experiment, researchers asked experts to evaluate a technical manuscript. Except for the results section, all versions of the paper were identical. Reviewers not only gave the paper higher marks when it confirmed their previous views on a technical issue in their field, they were more apt to detect an inadvertent typo in the manuscript when the results contradicted their pre-existing beliefs. Studies have confirmed it again and again: We easily accept results we like and nitpick the evidence that we don't.

The U.S. Preventive Services Task Force is an independent board of experts convened to come up with evidence-based guidelines for medical practice, without considering cost. Last fall, after poring over years of studies, the task force released new mammography recommendations. Previous guidelines had recommended yearly mammograms for women age 40 and older, but the new guidelines instead called for women age 40 to 49 to discuss the benefits and risks of mammography with their doctors to decide whether a mammogram made sense.

This recommendation, along with the call for mammograms in women age 50 and older to be done every two years, rather than annually, seemed like a radical change to many observers. Oncologist Marisa C. Weiss, founder of Breastcancer.org, called the guidelines "a huge step backwards." If the new guidelines are adopted, "Countless American women may die needlessly from breast cancer," the American College of Radiology said.

"We got letters saying we have blood on our hands," says Barbara Brenner, a breast cancer survivor and executive director of the San Francisco advocacy group Breast Cancer Action, which joined several other advocacy groups in backing the new recommendations. Brenner says the new guidelines strike a reasonable balance between mammography's risks and benefits.

Yet Brenner was not surprised by the outcry. For years, women were taught the necessity of early detection for breast cancer based on the notion that breast cancer is a relentlessly progressive disease that will inevitably kill you if you don't remove it in time. That story about breast cancer — call it the "relentless progression" mind model — is easy to grasp, makes intuitive sense and offers a measure of comfort: Every cancer is curable as long as you catch it in time.

But it turns out that this mental model of breast cancer is wrong. Science has shown breast cancer to be far less uniform than the relentless progression model suggests, says H. Gilbert Welch of the Dartmouth Institute for Health Policy and Clinical Practice in Lebanon, N.H., and author of *Should I Be Tested for Cancer?* A more accurate description might be called the "uncertain future" model. Instead of starting small and gradually growing and becoming more dangerous, cancers can behave in a variety of unpredictable ways.

Most fall into one of three general patterns, which cancer expert Barry Kramer, director of the National Institutes of Health Office of Disease Prevention, has dubbed turtles, bears and birds. Turtles move so slowly that they'll never become dangerous and so don't require treatment. Bears can escape, but move slowly enough that you can catch them if you remain alert, and birds are so fast and flighty that the first time you spot them is when they're flying out the window. Screening tests like mammograms can only make a difference for the bears.

Dartmouth medical professor Lisa Schwartz has interviewed women to find out how they view breast cancer and mammography with the goal of helping them make informed decisions. "What we found is that people didn't see it as a decision," she says. The women Schwartz studied almost universally believed in the relentless-progression model, and under that belief system, the only possible risk to mammograms and other breast cancer screenings is the chance you'll get called back for more tests on something that turns out to be harmless. Under this mental model, there is no downside to screening because every cancer is destined to kill you and thus you can never find a cancer too early. These notions are reinforced by public service announcements promising that "early detection saves lives."

But look at the breast cancer screening debate through the "uncertain future" lens, and an entirely different picture emerges. As of now, doctors can't reliably determine which pattern an individual cancer will follow, and that means they must treat each one they find as if it's a bear — lest they miss an opportunity to prevent a cancer death. But bears only represent a fraction of cancers, and it turns out that mammograms are most adept at finding turtles, Welch says. Women with turtle-like cancers can only be harmed by mammograms and other screenings because they result in the diagnosis and treatment of cancers that would have never threatened their lives. In fact, a Norwegian study published last year suggested that some breast cancers, perhaps as many as 22 percent of symptomless ones found via mammography, can regress on their own without any treatment at all.

A *British Medical Journal* study published last July suggests that for every life saved by a mammogram, 10 women needlessly get diagnosed and treated for cancers that never would have killed them. Meanwhile, research suggests that the most aggressive breast cancers can spread long before they're large enough to be detectable via any currently available technology, so many women with the most deadly cancers will not be helped by a mammogram, either. The evidence favoring mammograms is strongest for women age 50 to 74 and that's why the task force focused its recommendations on that age group. "Even if you had all the money in the world, and the best doctors and lawyers, [the decision about whether to get a mammogram] is still a close call, and different people will make different choices," Welch says.

The dispute over the mammography guidelines is not about evidence; it's about belief. Is the goal of cancer screening to find as many cancers as possible? Or to save as many lives as possible? How many people can be harmed to save one life? What kind of harm is acceptable? These are not easy questions, and when the people answering them are operating under different belief systems, agreement may be impossible.

The mammography debate has become a virtual religion, and the more entrenched beliefs become, the less amenable they are to new evidence. In a study to be published in *Political Behavior*, Nyhan and his colleague Jason Reifler at Georgia State University presented volunteers with mock news stories that included either a misleading claim from a politician or a misleading claim and a correction. Subjects presented with corrective information that ran counter to their pre-existing ideology did not update their beliefs accordingly, and the corrections actually *strengthened* misperceptions among some of the most strongly committed subjects.

Last summer at the Aspen Health Forum, I asked representatives from the breast cancer advocacy group Susan G. Komen for the Cure about a paper that had just come out in the *British Medical Journal* calculating that as many as 1 in 3 breast cancers diagnosed via a screening mammogram represented an overdiagnosis and thus had needlessly turned a healthy woman into a cancer patient.

Was her organization worried about this problem? I asked then-Komen CEO Hala Moddelmog. "I don't think there's evidence of overdiagnosis," she said. Overhearing our conversation, Elizabeth Thompson, vice president of health sciences, chimed in: "We're very concerned that insurance companies will stop funding mammograms when these kinds of studies come out." When I asked what they were telling women about the risks associated with mammograms, Thompson continued, "We believe early detection saves lives, and we need to focus on getting out that message."

'I don't want knowledge, I want certainty!" So begins the David Bowie song "Law (Earthlings on Fire)," and it provides an apt description of the human psyche, at least when it comes to medicine. Consider the problem of back pain.

Approximately 90 percent of Americans will experience low back pain at some time in their lives. "When someone comes in with acute back pain, they're worried that there's something very seriously wrong, and they want to know what's causing their pain," says Michael Von Korff, a back pain expert at the Group Health Research Institute in Seattle. Yet efforts to pinpoint the cause of back pain rarely succeed. With so many potential pain generators in the back, it's often difficult to determine an exact source of the pain. "Is it coming from a disc, muscles? Impingement of a nerve? It's hard to say," Von Korff says. Only about 15 percent of all back pain episodes are diagnosable to a specific cause.

Numerous high-tech imaging systems can visualize apparent abnormalities, such as slipped discs, but these findings are more likely to instill a false sense of certainty than to pinpoint an actual cause of the pain, says Richard A. Deyo, professor of evidence-based family medicine at Oregon Health and Science University. Many of the scary-looking problems that turn up on imaging tests simply don't correlate to pain, Deyo says. A 2005 study found bulging discs on the MRIs of 73 percent of volunteers without back pain, and a study of 558 Finns published last year showed that almost half of the study's 21-year-old participants had at least one degenerated disc.

Visual evidence is compelling, yet studies show that imaging tests rarely improve a patient's chances of resolving the pain. A randomized trial published in the *Journal of the American Medical Association* in 2003 found that back pain patients who received MRIs had more surgery but no better outcomes than similar patients who hadn't done the scans. Rates of spinal fusion surgery climbed 220 percent between 1990 and 2001 without a concurrent improvement in outcomes or disability rates.

The overwhelming majority of back pain cases resolve on their own without aggressive treatment. About 90 percent of back pain sufferers recover within two months, and 70 percent recuperate in three weeks or less. Even herniated disks, which may seem like a problem worth fixing, often spontaneously disappear without surgery. "Usually the source of the pain isn't critical because it's going to be managed the same way," Von Korff says. Conservative treatments, like pain medications, ice or heat, and exercise remain the standard treatment for most back pain.

But this evidence-based message isn't an easy sell. "Sometimes it's better to do less, but that answer doesn't sit well with Americans; it sounds like a loss of resolve or capitulating to the enemy," Berkeley psychologist MacCoun says. People go to the doctor seeking a quick cure, not advice on how to make themselves more comfortable while they wait for natural healing to occur.

And plenty of doctors are willing to offer aggressive means. "There's a real bias for action on [the] part of patients and physicians," Deyo says. An examination of more than 3,500 patient visits published in the Feb. 8 issue of *Archives of Internal Medicine* found that even though practice guidelines recommend against routine imaging for low back pain, 1 in 4 patients was nonetheless referred for imaging tests. Doctors want to offer their patients a tangible solution, and most genuinely believe the treatments they're offering are helpful. "If you do something to a patient, chances are pretty good that he's going to get better," Deyo says. "So you come to believe that what you're doing is very effective when in fact it may be only marginally so over the natural course of the condition."

Not long ago, Deyo's wife developed a shoulder condition that left her in terrible pain for nearly a year. After exhausting other options, she decided to look into acupuncture, but before she could start, the pain suddenly eased. "She jokes that if she had started the acupuncture two weeks earlier, she would have been convinced that acupuncture cured her," Deyo says.

Whether or not the "do something, anything" approach is effective, aggressive action feels empowering to doctor and patient alike. In fact, studies have shown that patients who get more high-tech spine imaging

are more satisfied with their care than those who don't, even though their outcomes are no better, and in some cases worse, than those who didn't get the imaging, Deyo says. "The people in these clinical trials have worse outcomes, but they're more grateful — they think they had the best care."

This is the conundrum facing those trying to inject evidence-based medicine into health care reform: How do you convince doctors and patients to dump established, well-loved interventions when evidence shows they don't actually improve health?

First, recognize that the facts alone are unlikely to change anyone's mind, University of Michigan political scientist Nyhan says. "People get defensive when you tell them they're wrong," he says. In one set of experiments, Nyhan took volunteers who believed that Saddam Hussein had weapons of mass destruction in Iraq and presented them with evidence that this belief was wrong. Instead of causing people to adjust their erroneous beliefs, the corrections often reinforced them. Presenting people with facts in conflict with their belief spurred them to re-examine all the reasons they'd held this belief in the first place, and this process of remembering served to reinforce the initial belief, despite the contrary evidence, Nyhan says.

Belief is a very difficult thing to overturn, especially when the belief is held by people with a vested interest in the old message. Sometimes these investments are monetary (back doctors make more money on procedures than on conservative treatment), but they can also be altruistic — breast cancer advocacy groups want to offer women something to protect themselves from a scary disease.

When the evidence presents a messy, unsatisfying picture, people are likely to take refuge in a more comforting story, even in the face of evidence that it's wrong. It comes down to something the satirist Stephen Colbert calls "truthiness," a term he coined in a 2005 episode of his Comedy Central show, *The Colbert Report*. "Truthiness is what you want the facts to be, as opposed to what the facts are," Colbert said. "It is the truth that is felt deep down, in the gut." The backlash against the new mammography guidelines stemmed in part from the truthiness of the message that mammography could prevent breast cancer. No matter that it wasn't true, it was what people wanted to believe.

For new evidence to overcome truthiness, it must be framed in an appealing story, one that acknowledges the existing narrative. For supporters of the new mammography guidelines, that means addressing, head on, the widespread notion that breast cancer is a single, relentlessly progressive disease. "When the [new screening guidelines] came out, they might have said, 'We know that for years you've heard this, and the reason we're changing course now is that we realize that there are harms associated with screening, and we're changing our guidelines because we want to protect you," Schwartz says. The task force needed to emphasize in its message that the new guidelines have the same goal as the previous one — to save lives.

For truth to win, stakeholders must also have a shared vision of what the problem is, so they can mutually recognize the correct solution once it's found, Berkeley psychologist MacCoun says. For those seeking to identify the most effective medical interventions, that means establishing agreement on what "effective" means. Should the efficacy of back pain treatments be measured by pain levels six months post-intervention, by cost, by provider profits or by patient satisfaction? This isn't a scientific question, but a value judgment, and different criteria yield different answers.

And then there's the question of what constitutes evidence. Proponents of comparative effectiveness research look for answers in large-scale trials, but these studies hinge on statistics about large groups of people. Such number crunching rarely has the power of personal anecdote. "Studies have shown that powerful anecdotes trump data; we see that again and again," Nyhan says. The runners who attended Nieman's talk were not moved by his study results, because the findings contradicted their own personal experiences, which felt truer.

Women whose breast cancers were diagnosed with a mammogram will never be persuaded by the new mammography guidelines, Breast Cancer Action's Brenner says. "They all say, 'If it weren't for that

mammogram, I'd be dead right now,'" she says, "even though we know from the data that this wasn't the case for most of them."

Science works in data and statistics, but medicine is made up of stories, says Elizabeth Rider, an assistant professor of pediatrics at Harvard Medical School. Narratives form the backbone of medicine — they're the way people make sense of the evidence.

"Victims of overdiagnosis don't say, 'Look what the system did to me.' They say, 'Thank God the doctor saved me,'" says Thomas B. Newman, a physician and narrative medicine expert at the University of California, San Francisco. "Nobody can say I had an unnecessary mastectomy, and nobody would want to; it doesn't make a good story."

Howard F. Stein, a physician and medical anthropologist at the University of Oklahoma Health Sciences Center, tells the story of a farmer in Oklahoma who had come in for an appendectomy but developed a rapid heartbeat that required treatment before surgeons could operate. "The cardiologist tried to explain supraventricular tachycardia to the family, but he might as well have been talking to a rock," Stein says. The family was very upset and couldn't understand why they were putting off the surgery.

Finally, another doctor happened in and told the family, "His heart is shimmying like the front end of an old Chevy truck, and as long as it's shimmying, we can't do the surgery." The tactic worked.

"He translated biomedical evidence into the kind of framework that would count as evidence in the patient's world. The doctor knew damned well that the patient's heart was not a pickup truck," Stein says. "But this story allowed the doctor and family to come to a common understanding, without agreeing on cardiology 101."

Yet it's not enough to weave the facts into a story. To take hold, evidence-based messages must also meet the human need for comfort and empowerment. "Medical uncertainty is very hard, so you need to find a way to reframe it so that you can say, 'The good thing about this is…,'" Rider says. The relentless-progression model of breast cancer has persisted in part because it offers comfort and certainty by implying that every cancer can be cured, if only women do the right thing. This message about mammograms offers a sense of empowerment and security, and women are unlikely to accept the new guidelines unless they're presented in a way that addresses these needs.

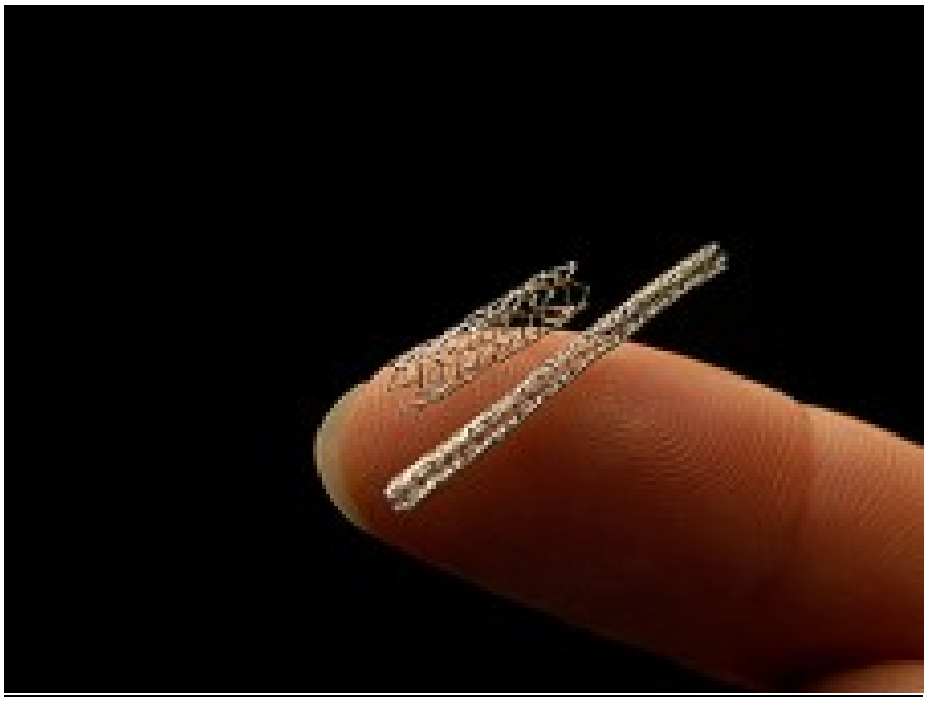
Explanations that offer hope and empowerment will always hold more appeal than those that offer uncertainty or bad news, and when new evidence offers messy truths, they must be framed in a positive light if they're to gain traction. You can ask doctors to give up ineffective interventions, but you must never ask them or their patients to abandon hope.

http://www.miller-mccune.com/health/convincing-the-public-to-accept-new-medical-guidelines-11422/

Is American Medicine Too Stent Happy?

For heart attack patients, a stent is the medical device that provides the best chance of recovery. But studies comparing the use of stents to medical therapy alone have sparked controversy.

By David Rosenfeld



The coronary stent industry in the United States is large and lucrative, but it may be opting for surgery too often.

Chances are you know someone with a stent. Hundreds of thousands, maybe millions, of Americans walking around today owe their lives to a miniscule piece of mesh called a coronary stent used to prop open a clogged artery. For heart attack patients, stents provide the greatest chance of recovery of any medical device out there. That's not where researchers disagree.

Since 1994 when the Food and Drug Administration first approved doctors implanting stents as a voluntary procedure — for instance, to relieve chest pain from stable heart disease — the use of stents in America became more than a lifesaving breakthrough. It became big business.

Over the past decade, hospitals opened up cardiac catheterization labs in record numbers and interventional cardiologists made huge amounts of money for a relatively easy procedure. By 2005, the stent market had reached nearly $4 billion. But like most things that provide quick relief, there was a cost in both dollars and possible side effects.

Coronary stents (stents are used elsewhere, such as the carotid artery) represent an easier fix for addressing a clogged artery than bypass surgery, which demands a longer recovery period. While the price of a stent could be less than $1,000 for the bare metal kind and up to $4,000 for the newer drug-eluting type, the cost of the procedure and the hospital stay can be anywhere from $30,000 to more than $100,000. Compared to bypass surgery, stents cost less. As a result, the worldwide stent market, especially in the United States, boomed in the mid-'90s then surged a decade later with drug-eluting stents — meant to prevent arteries from re-clogging by slowly emitting drugs embedded in the device.

Common medical-device makers dominate the stent industry, such as Abbott Laboratories, Boston Scientific, Johnson & Johnson and Medtronic, which jostle back and forth as industry leaders almost year to year. In the latest market wrangling, Boston Scientific recently agreed to pay Johnson & Johnson $1.7 billion to settle a patent infringement case.

Despite upheaval, the stent market continues to grow, overcoming several recalls and hundreds of pending lawsuits brought by patients. Stenting is by and large a safe practice, but with each of the major advancements in stent technology came setbacks in which people died. Doctors today better understand the precautions and limitations, though based on the numbers, physicians still do not fully comply with what many researchers see as appropriate medicine.

Courage

Sorting out which medical interventions work best is no simple task. The Obama administration in the Recovery Act last year gave $ 1 billion in additional funding for comparative effectiveness research. While badly needed, the increase may prove a drop in the bucket compared to the onslaught of industry-funded research geared toward advancing the latest technologies and beating the competition.

Industry research largely compares the latest technology with the even newer one, omitting whether the latest technology is better than something even older. In the case of coronary stents, Abbot Laboratories recently published a series of studies comparing its drug-eluting Xience stent to the drug-eluting Taxus stent by Boston Scientific, the market-leading stent at the time. The studies helped make Abbot the current market leader.

In contrast, researchers who challenge a multibillion-dollar industry face intense pressures. Just ask Dr. William Boden, co-author of multiple studies and editorials that compare stents to standard medical therapy alone. A paper Boden co-authored on the Courage trial sparked widespread controversy in 2007 along with a similar trial last year with diabetics called Bari2D, both published in the *New England Journal of Medicine*.

Both were randomized controlled studies that concluded that in patients with chronic stable chest pain, stents did not lower the risk for heart attack and death compared to medical therapy alone. Stents simply relieved their chest pain, Boden said.

"[In response to Courage,] the industry unleashed a media blitz with publications and slide sets broadly disseminated that were designed to denigrate and discredit the study," Boden said from his office in Hartford, Conn., where he's a cardiologist. "It was very clear this was orchestrated, and it was deliberate. Everybody would be using the same slides over and over again, which more likely than not was aided and abetted by the device company."

When Courage first appeared, critics downplayed the results. "They tried to minimize the findings," Boden said. "As it turns out, data we obtained from the American College of Cardiology national cath lab data registry, a large registry of participating hospitals with 2.5 million patients over the past three years, the percentage of patients [receiving a stent] with elective stable coronary disease or stable angina was 52 percent."

Boden told me he's proud that Courage and Bari2D helped give doctors the confidence to practice medical therapy, such as exercise and eating healthy, as opposed to falling back on expensive interventions where it can be avoided.

To understand the response to Courage is to understand what was happening in the stent market and professional cardiology at the time. The industry was on the road to taking a billion-dollar hit and doctors were looking for answers to serious red flags raised a year earlier around drug-eluting stents. "It was a perfect storm," Boden said.

Controversy swirls

Drug-eluting stents are meant to prevent arteries from re-clogging, something called restenosis, which requires a repeat procedure to replace the stent. This was happening in anywhere from 5 to 30 percent of patients with bare-metal stents, depending on what study and what population was examined. To some degree, doctors can now predict in which patients this is more likely to occur. According to some researchers, doctors can effectively limit the probability to around 5 percent, but knowing exactly is still impossible.

So drug-eluting stents have become the fallback choice, representing more than half of all stents implanted by interventional cardiologists in the U.S., France and elsewhere.

But many experts now say bare-metal stents are just as good, especially in heart attack patients. They pose fewer deadly risks such as sudden blood clots and the drawbacks of taking blood-thinning drugs for extended lengths of time. Today, around 1 percent of drug-eluting stents received by patients might cause a blood clot that could lead to heart attack, stroke or death. The likelihood decreases over time and depends on the severity of the original blockage.

Researchers estimate 50 to 60 percent of stents implanted in the U.S. and some European countries today are drug eluting, though one market analyst I talked to said it was around 80 percent. This suggests that not only are doctors likely placing too many coronary stents, they are likely placing too many of the drug-eluting kind.

Dr. Steven Bailey, professor and cardiologist at University of Texas Health Science in San Antonio and president of the Society for Cardiovascular Angiography and Interventions, said doctors are responsive to good science, but he largely dismissed the Courage trial.

"The straw man in the study was that in a very select group of patients, everybody who needed bypass or angioplasty were removed," Bailey said. "The end point [of death] was somewhat unrealistic based on what we know about a population where we understand that with PCI [stenting] we aren't going to change their mortality. The benefit of angina [chest pain] relief is clear."

In other words, we already know stenting doesn't extend lives for these people, that it only relieves pain. Bailey, who has conversations about critical decisions with cardiology students every day, said doctors have to keep adapting to the latest research with a critical eye. Interventional cardiologists have adjusted quickly, he said, to research into drug-eluting stents given that the market changes so fast.

"The most difficult populations we see are more likely to benefit from bare-metal stents," Bailey said. "There are situations where we choose to do angioplastly and use drug-eluting stents. And there are patients we know that they do just as well with a bare-metal stent."

Bailey denied that profits influence medical treatment decisions. "There are individuals who make those statements," he said. "I don't think the general perception is that physicians have been co-opted or coerced to do this."

Part of the perception comes from stories such as one in 2004 involving nine cardiologists suspended from their Tampa Bay-area hospital for performing inappropriate angioplasties and stents. A peer review reported by the *St. Petersburg Times* found that, in some cases, doctors had "performed angioplasty on arteries that were not sufficiently clogged with plaque, propped open clogged arteries with stents of the wrong size or type and used incorrect or inadequate medicines to treat coronary artery disease."

The doctors said the hospital was retaliating against them for choosing stents over what they said were the more expensive and profitable bypass surgeries. Last June, two of those doctors started performing angioplasties at an affiliated hospital in Florida.

Plavix
Drug-eluting stents got off to a rough start as soon as they hit the market in 2003. Several hundred among the first patients to receive them suffered heart attacks and strokes in unforeseen numbers after going off or failing to take clopidigrel, the blood thinner sold as brand name Plavix in the United States. Far more critical than restenosis, blood clotting — called stent thrombosis — could result in sudden death. The FDA issued a bulletin to doctors about the blood clots and to keep patients on Plavix for at least a year and never stop taking aspirin.

Today, close to 300 cases from events in 2003 are still pending in Florida state court as a mass tort claim against Johnson & Johnson. Lead attorney Ted Babbit, in West Palm Beach, Fla., says Johnson & Johnson should have known about blood clotting when it put its Cypher stent on the market.

"Virtually all of them were on Plavix for the recommended three months that the manufacturer indicated was appropriate and then had a stroke or a heart attack after being taken off the Plavix," Babbit said. "Either they knew, they should have known or their underlying research was inadequate to tell doctors what they should have been told, which is we don't know how long people should be on Plavix."

Since 2004, doctors are cognizant of the blood clots and make sure patients can take Plavix and aspirin. Both medications have side effects and consequences. Plus, Plavix — an antiplatelet drug — remains under brand-name patent in the U.S., where it can cost more than $4 a day. (The U.S. Supreme Court recently rejected an appeal challenging the patent by Sanofi-Aventis and co-marketed by Bristol Myers-Squibb.)

The cases against Johnson & Johnson recently won exemption to another Supreme Court ruling that shields medical device makers from lawsuits if the FDA approved it. Discovery was expected to begin in February.

"The idea that the FDA can possibly catch all of these problems is ridiculous," Babbit said. "The FDA under the Bush administration was tremendously under-funded. They didn't have the wherewithal to really go behind what the manufacturers were saying. They had to rely on the manufactures to tell them their products were safe. In my opinion, that's the fox guarding the hen coop. The only thing keeping them honest are lawsuits like ours."

Not out of the woods yet
In 2006, the stent market was hit with another blow. The possibility of late stent thrombosis, the same as before but this time blood clotting after one year, came up in a series of studies published in the New England Journal of Medicine. The FDA convened a panel of experts shortly after to sort out the evidence and physicians once again were bogged down in comparative research.

Then came Courage, which questioned whether stents were a good idea at all in stable patients. Later that year in 2007, a paper based on a large worldwide registry of data from 100 hospitals in 14 countries, called Grace, further raised the risk of late stent thrombosis. The results gave doctors greater understanding about which patients are best suited for drug-eluting stents, though actual medical practice seems to still be lagging.

Dr. Gabriel Phillipe Steg, a professor of cardiology and director of a coronary care unit in France, co-authored dozens of articles based on the Grace registry over the past 10 years, including the paper on late stent thrombosis that got so much attention in 2007. Since the study came out, additional research into late stent thrombosis indicates it's less of a risk than originally thought. Still, Steg said the more conservative approach for heart attack patients is to implant a bare-metal stent rather than drug-eluting. Steg said that in an emergency room setting, when a cardiologist is saving a patient's life, re-clogging of the artery — which drug-eluting stents are supposed to prevent — is "a footnote in the medical history."

"There are circumstances where drug-eluting stents might not be the best choices but they are an advance in angioplasty overall," Steg said. "They are progress, but we have to be careful. We shouldn't use them across the board for everybody. There are good candidates for drug-eluting stents, mostly for those who undergo a procedure electively, but for those who receive stents as a heart attack patient, maybe some patients would do better off under bare metal stents."

Today, drug-eluting stents comprise up to 80 percent of the nearly $4 billion U.S. stent market, said Venkat Rajan, research analyst with market consultants Frost & Sullivan (www.frost.com/). In 2005, the drug-eluting to bare-metal share was closer to 90 percent, he said. Outside the U.S., the share is closer to 70 percent.

Mattias Neyt, an economist at Belgium's Healthcare Knowledge Center, which performs health technology assessments, co-authored a paper in the journal *Health Affairs* last year that said drug-eluting stents were not a cost-effective choice even in patients with a greater likelihood of an artery re-clogging. The paper analyzed the costs of bare-metal stents versus drug-eluting relative to repeat procedures and the gain in expected life years. Drug-eluting stents costs a few thousand dollars more than the bare metal kind, not much in the total bill for the procedure, but enough to tip the balance.

"This extra cost was not in balance with the extra benefit," Neyt said. "We see that there are other interventions with better cost-effectiveness ratio to invest your money in as a policymaker instead of doing it in a drug-eluting stent."

Registry data from patients in Belgium, Neyt said, suggested that repeat procedures needed from bare-metal stents occurred in about 15 percent of patients, and that restenosis was the cause of just half, a portion of which could be avoided, leaving just about 5 percent of unavoidable restenosis. Given this relative risk makes the cost-effectiveness of drug-eluting stents much less, he said.

An estimated 700,000 Americans will have a stent implanted this year in one of their arteries either after a heart attack or stroke, to prevent one from happening or simply to relieve their chest pain. There's no doubt these tiny devices are a medical breakthrough, but whether doctors are implanting too many and whether as a society we're paying for too many is a question for future expert panels to decide.

http://www.miller-mccune.com/health/is-american-medicine-too-stent-happy-12861/

Spare tyre health risks 'ignored'

People are blinkered to the health dangers of carrying excess weight around the waist, say experts.

Most people have no idea that their spare tyre or muffin top puts them at increased risk of cancer, diabetes and heart disease, a poll of 2,085 shows.

In all, 97% of people were unaware of a link despite 71% of those surveyed saying they had an expanding waistline.

Three leading UK charities are launching a new Active Fat campaign to raise awareness of the dangers.

" **That 'harmless' spare tyre around your waist is actually a major health hazard** "
Dr Mike Knapton of the British Heart Foundation

Excess weight around the middle generates oestrogen and excess chemicals in the stomach, which put people at higher risk of killer diseases.

Women are at risk of Type 2 diabetes and heart disease if their waist measures more than 80cm (31.5 inches) while men are at risk at more than 94cm (37 inches).

Dr Mike Knapton, of the British Heart Foundation charity which is working alongside Cancer Research UK and Diabetes UK, said: "That 'harmless' spare tyre around your waist is actually a major health hazard.

"While you might be relaxing at home, your fat cells are working overtime to pump out excess hormones and other chemicals that can cause disease.

"Wrapping a tape measure around your middle takes just a few seconds, but it could be your vital first step towards a healthier future."

Waist size is likely to increase throughout life, but many are in denial about their spare tyre, say the charities.

In the poll, women were less likely than men to worry about the health consequences of their muffin top and instead were more concerned with how they looked and whether they could fit into their clothes.

Less than half of men and women (44%) had tried to do more exercise as a way to avoid going up in belt size.

Some 27% of people had bought bigger sized clothes.

As part of the campaign, the charities are calling for standard labelling on foods, highlighting the "traffic lights" system for nutrition.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8629768.stm

Published: 2010/04/20 00:24:36 GMT

Sunbed-users can get 'addicted'

Around a third of people who use sunbeds may become addicted to the tanning effects, a study suggests.

Researchers also found those sunbed-users users who were addicted were also more likely to suffer from anxiety and more prone to alcohol and drug use.

The US researchers said tackling these underlying problems may be the key to encouraging people to quit using sunbeds and cut their skin cancer risk.

A bill to ban sunbeds for under-18s was recently passed by the House of Lords.

The study published in the Archives of Dermatology looked at 421 college students, 229 of whom said they used sunbeds or sun lamps.

" **Despite ongoing efforts to educate the public about the health risks associated with natural and non-solar UV radiation, recreational tanning continues to increase among young adults** "
Study researchers

The sunbed-users had visited the salon an average of 23 times in the past year.

The researchers asked these individuals to fill out questionnaires designed to screen for addictive behaviours.

Depending on the definition used, between 30% and 39% of sunbed users were classed as being addicted.

These people reported feeling guilty about using sunbeds too much and wanting to cut down on usage, for example.

Further questioning showed that students who met the criteria for addiction to sunbeds were more likely to show signs of anxiety and use drugs such as alcohol and marijuana.

'Tanorexia'

The researchers from Memorial Sloan-Kettering Cancer Center in New York said steps to reduce people's risk of skin cancer should address the addictive nature of sunbeds and the potential relationship to other addictions.

"Despite ongoing efforts to educate the public about the health risks associated with natural and non-solar UV radiation, recreational tanning continues to increase among young adults," they warned.

They added that research should look at whether screening for anxiety and depression screening would be useful for people who use sunbeds frequently.

But the chairman of the Sunbed Association, Gary Lipman, discounted the findings, saying: "I am not a scientist but I have read enough scientific studies over the years to be able to see immediately that this one has little if any scientific merit."

Cancer Research UK had been among those campaigning for a ban for under-18s after a study showed some 250,000 11-to-17-year-olds in England are risking skin cancer by using sunbeds.

Scotland has already put legislation in place to restrict the use of sunbeds to adults, and Wales has proposed a similar move with Northern Ireland planning a consultation on the issue.

Sarah Woolnough, Cancer Research UK's head of policy, said the findings on addiction to indoor tanning highlighted the importance of the ban on sunbed use by under-18s.

She added: "It is also vital that the new government ensures that all sunbed salons are staffed and that information is provided warning users of the health risks."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8625840.stm

Published: 2010/04/20 00:15:04 GMT

Well-done meat 'is a cancer risk'

Eating lots of meat, especially if it is overcooked, increases the risk of bladder cancer, say experts.

Frying, grilling and barbecuing until meat is charred can form cancer-causing chemicals, research shows.

In a study, people whose diets included well-done meats were over twice as likely to develop bladder cancer than those who preferred meats rare.

The research findings, based on over 1,700, people were presented at a US cancer research conference.

The University of Texas investigators found the risk was highest for those who ate well-done red meat such as steaks, pork chops and bacon.

" **These results strongly support what we suspected - people who eat a lot of red meat, particularly well-done red meat, such as fried or barbecued, seem to have a higher likelihood of bladder cancer** "

Lead author of the study Professor Xifeng Wu

But even chicken and fish, when fried, significantly raised the odds of cancer.

Three major types of the cancer-causing chemicals, collectively called heterocyclic amines (HCAs), raised cancer risk by more than two-and-a-half.

And some people appear to be genetically more susceptible to this diet-linked cancer risk, the researchers found.

In the study, which took place over 12 years, the researchers analysed the DNA of all the participants to look for any differences in the way individuals metabolised the cooked meat.

Having particular genes made some people almost five times as likely to develop bladder cancer when they ate a lot of red meat.

Stacking up risks

Lead author of the study, Professor Xifeng Wu, told the American Association for Cancer Research: "This research reinforces the relationship between diet and cancer.

"These results strongly support what we suspected - people who eat a lot of red meat, particularly well-done red meat, such as fried or barbecued, seem to have a higher likelihood of bladder cancer."

According to the National Cancer Institute in the US, experts have identified 17 different HCAs that "may pose human cancer risk".

Charred meat has already been linked to pancreatic cancer.

Cancer experts said that more research was needed before we can say for sure whether or not regularly eating red meat affects bladder cancer risk, and if the way it is cooked has an impact.

Slow-cook

Dr Panagiota Mitrou, of the World Cancer Research Fund, said: "When we looked at all the evidence on meat and cancer, it did not suggest meat increases risk of bladder cancer.

"There is, though, convincing evidence that red and processed meat increase risk of bowel cancer.

"This is why we recommend that people aim to limit consumption of red meat to 500g - cooked weight - per week and to avoid eating processed meat."

Dr Alison Ross of Cancer Research UK said: "Smoking is the most important preventable cause of bladder cancer, so giving up is the best way to cut your chances of getting the disease."

The UK Food Standards Agency says people can reduce their risk from chemicals that may cause cancer by not allowing flames to touch food when barbecuing or grilling, and cooking at lower temperatures for a longer time.

But warns that undercooked meat can cause food poisoning.

More than 10,000 new cases of bladder cancer are diagnosed each year in the UK.

Around 5,000 people die from it every year, and almost 90% of deaths are in people over 65.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8629358.stm

Published: 2010/04/19 16:56:59 GMT

Why the tropics are hotbeds of evolution

- 21 April 2010 by **Emma Young**
- Magazine issue 2757.

Being warm and wet does wonders for life in the Amazon (Image: Pete Oxford/Minden Pictures/FLPA RM)

1 more image

The United Nations has made 2010 its Year of Biodiversity. While there could be as many as 30 million species on this teeming planet, so far fewer than 2 million have been identified. That includes a staggering 114,000 catalogued in the past three years alone. Our exploration of life is just beginning. No wonder the UN is keen that this year should be one of celebration.

*It is also time to take stock, though. Human activities are causing a mass extinction, but the right action now could pull life back from the brink. At last we are beginning to understand what generates biodiversity (this article, below) and what makes a good conservation programme (*How to save an island*). We can also predict how our activities today will shape biodiversity in the future (*The shape of life to come*). It is a sobering vision – but one that is still in our power to change.*

DEEP in the western Amazon lies the Yasuni National Park. Packed within an average hectare of this dense, steamy Ecuadorian rainforest are more species of tree than are native to the US and Canada combined, as well as 150 types of amphibian and an estimated 100,000 insect species. "It's hard to get very far, because every few minutes you see or hear something new," says Matt Finer of Save America's Forests, based in Washington DC. According to work by Finer and others, published in January, there are more different life forms in Yasuni than anywhere else in South America. It may well be the most biodiverse place in the world.

If Yasuni does indeed hold this title, its tropical location will come as no surprise to biologists. The tropics boast more than 10 times as many species of animal and plant as the Arctic, with diversity decreasing steadily as you approach the poles. This gradient holds true for both land and the abyssal ocean depths. The big question, though, is why? What is it about the tropics that so fosters biodiversity? It is a mystery that has puzzled biologists for decades, and Yasuni might help us find an answer.

According to one classic theory, the reason is simply that there is more habitable space around the equator than at the poles. On the face of it, this seems to make sense. The tropics encompass an area nearly five

times the size of the Earth's polar regions, and there is some evidence that habitable space is correlated with the number of species on land. Research in the ocean tells a different story, however.

David Jablonski at the University of Chicago and his colleagues are involved in a long-term study of living and fossil marine bivalves, a group that includes oysters, mussels, cockles, clams and scallops. Looking at present-day biodiversity patterns in 4000 bivalve species, they have found no relationship between habitable area - in this case, continental shelf - and the number of bivalve species. "Habitable area just doesn't explain marine diversity gradients," Jablonski says.

Perhaps biodiversity at sea and on land are governed by different rules. The traditional explanation for patterns of marine biodiversity is known as Rapoport's rule. The idea here is that ocean-dwelling species in the tropics are very sensitive to temperature, so are restricted to small ranges where the water is just right, whereas species in cooler waters can tolerate a broader range of temperatures, and so spread out. This could explain why large numbers of species are packed together in the tropics, but it doesn't seem to hold consistently. "There are more exceptions to this rule than strong examples," says Jablonski, "which means it's not much of a rule."

So what are the alternatives? Some researchers have argued that speciation rates, both terrestrial and marine, could be much higher in the tropics, making them a "cradle" of biodiversity. Others have suggested that extinction rates are the decisive factor, with species less likely to become extinct near the equator than at higher latitudes, making the tropics a "museum" of biodiversity.

Speciation rates could be particularly high at the tropics, making them a cradle of biodiversity

To tease out these alternatives, Jablonski and his colleagues focused on three key factors: the rate at which species have evolved in any given location, the local extinction rate, and the immigration rate of new species. In painstaking work published in 2006, they found that three-quarters of the genera of marine bivalves that exist today evolved in the tropics and then spread out towards the poles, while also remaining in their original habitat. So the tropics are a cradle of biodiversity. But that's not all. There are also a number of old genera in the tropics, indicating that tropical extinction rates are lower than in temperate regions. So the tropics are also a museum of diversity. The researchers conclude that their findings support an "out of the tropics" theory to explain decreasing diversity towards the poles (*Science*, vol 314, p 102).

Since then, a few other teams have found more evidence that the tropics are both a cradle and a museum of biodiversity. Not all research backs the idea, though. Last October, Martin Buzas of the Smithsonian Institution in Washington DC and Stephen Culver of East Carolina University in Greenville, North Carolina, published a study of the 259 species of foraminifera - single-celled, seabed-dwelling animals that secrete a durable shell - living along the Atlantic coast of North America. They found not only that equal numbers of these originated in tropical and temperate regions but that three-quarters of the species that had evolved at higher latitudes were now also found in the tropics (*Geology*, vol 37, p 879). These results are very interesting, says Jablonski, although he points out that the Caribbean underwent a major extinction event between 2 and 3 million years ago, which might at least partly account for Buzas's findings.

Some like it hot

If the tropics are indeed the "engine" of biodiversity, with more species evolving here than anywhere else, why could this be? Shane Wright at the University of Auckland, New Zealand, has a possible explanation. He compared the genes of 45 common tropical plants with plants from cooler regions, and found that the tropical species had more than twice the rate of molecular evolution (*Proceedings of the National Academy of Sciences*, vol 103, p 7718). Warmer temperatures could increase metabolic rates and rates of DNA replication, Wright suggests. This would raise the mutation rate, which, via natural selection, could lead to a proliferation of new species.

The idea has its detractors, however. "I don't think DNA replication rates are driving speciation," says Stuart Pimm at Duke University in Durham, North Carolina. "If it were just temperature, then deserts would have more species." He also points out that marine diversity varies considerably within equatorial regions.

Conserving the tropics is essential. Disrupt them and you cut off the source of diversity at all latitudes

Nevertheless, warmer temperatures may at least be important for sustaining biodiversity by providing plenty of energy to fuel crowded ecosystems. This seems to be the case in Yasuni National Park. It is consistently warm, with average monthly temperatures between 24 °C and 27 °C, and temperatures by night never dropping below 10 °C, which can damage tender plants. The steady climate means fruit and flowers are always available, providing plenty of food for animals. As well as sunshine, Yasuni also has plenty of that other stuff of life - water - with higher rainfall than the Amazonian average (*PLoS ONE*, vol 5, p e8767). "As best as we can tell, one of the driving forces for Yasuni's extraordinary biodiversity is that it is ever warm and ever wet," says Finer.

Jablonski agrees that such conditions may help explain high tropical biodiversity. "Energy input - perhaps not its mean annual value but some combination of annual average and seasonality - is very likely to be an important factor," he says. In the oceans also, Jablonski's team has found a strong relationship between the amount of energy from the sun entering a region of water and the number of species present. In addition, stable levels of sunlight can mean stable levels of nutrients in the ocean, though more work is needed to understand the impact of this on marine diversity, he adds.

Finding that biodiversity is correlated with temperature and nutrient availability is just the start. The mechanisms by which factors such as these might generate the global biodiversity gradient are still open to debate. Unravelling this puzzle is a huge challenge that will require the analysis of massive environmental and diversity data sets. Improvements in computing power are making this increasingly possible, says Jablonski. But he cautions that there may not be one simple solution to explain global biodiversity. "It might be that we'll look back and think that our biggest step forward was the realisation that different groups of organisms built their latitudinal gradients by different mechanisms and over different timescales," he says.

Meanwhile, the knowledge we already have can be put to good use to guide our conservation efforts. "The tropics aren't just the biggest reservoir of biodiversity, they are also the engine of biodiversity - the crucible where major adaptations and new lineages are formed," says Jablonski. "So the conservation of the tropics is essential. Disrupt that engine beyond recovery, and you have not only stalled tropical diversification, you've cut off the source of diversity at all latitudes. It's a global issue."

Hotspots and high drama

Proximity to the equator may be enough to explain some biodiversity hotspots, but other factors can also lead to the flowering of species. Prominent among them are dramatic, environment-changing events.

For example, asteroid impacts could have underpinned the explosion of new life forms during the Ordovician period, which began 489 million years ago. Birger Schmitz, a geologist at the University of Lund in Sweden, suspects the bombardments created localised extinctions and new habitats, which life then evolved to inhabit.

A similar event is thought to have led to the extinction of 85 per cent of species, including the dinosaurs, at the end of the Cretaceous period. This created an immense evolutionary space for other species to fill.

The evolution of more than 100 species of carnations in Europe - the most rapid speciation of any plant or vertebrate ever recorded - coincided with the start of a change in climate towards greater seasonality and drier summers during the Pleistocene, around 2 million years ago (*Proceedings of the Royal Society B*,

DOI: 10.1098/rspb.2009.2163). Meanwhile, Madagascar's famed biodiversity seems to owe a debt to changing ocean currents, which brought the island's animals ancestors from mainland Africa around 50 million years ago (*Nature*, vol 463, p 653).

A key event influencing biodiversity in the Americas was the formation of a land bridge joining north to south between 3 and 4 million years ago. The big crunch allowed mammals to move into new habitats and diversify. Recent research also indicates that it was responsible for the migration and speciation of various tropical birds (*Proceedings of the National Academy of Sciences*, vol 106, p 21737).

Plate tectonics also appears to play a role in marine biodiversity. The main hotspot in the Malay Archipelago is right in the region where the Eurasian, Australian and Pacific/Philippine sea plates collide, creating lots of new and varied habitats. Indeed, major tectonic events often seem to coincide with marine biodiversity: over the past 50 million years at least three such hotspots have moved across almost half the globe (*Science*, vol 321, p 654).

Emma Young is a writer based in Sydney, Australia

http://www.newscientist.com/article/mg20627571.400-living-world-why-the-tropics-are-hotbeds-of-evolution.html?full=true&print=true

How to save an island

- 22 April 2010 by **Graham Lawton**

Magazine issue 2757.

Cousin Island: paradise regained (Image: Michael Friedel/Rex Features)

A SMALL black-and-white bird lands in front of me in a clearing in the forest. It hops about on the ground almost within touching distance, eyeing me curiously but seemingly unafraid, before vanishing in a flurry of wings. I have just had my first sight of a Seychelles magpie robin, one of the rarest animals on Earth.

My encounter happened on Cousin Island, 29 hectares of glittering white sand and forest in the middle of the Indian Ocean. Once a heavily degraded coconut plantation, Cousin is now a nature reserve managed by the organisation Nature Seychelles, which goes to extraordinary lengths to restore and preserve endangered species. Cousin is internationally recognised as a model of good conservation practice. "The whole island is a success," says David Richardson, a molecular ecologist at the University of East Anglia in Norwich, UK, who has been working on Cousin since 1997. "It's a fantastic example of how conservation and science can go hand in hand."

The rehabilitation of Cousin Island began in 1968, when it was owned by the Seychelles royal family. "It was entirely cultivated with coconuts," says Nirmal Shah, chief executive of Nature Seychelles. It was also the final refuge of another of the archipelago's endemic birds, the Seychelles brush warbler (now simply called the Seychelles warbler). By the 1960s, the warbler was confined to a tiny patch of mangrove swamp, and the population was wavering between 25 and 30 individuals. In a bid to save it from oblivion, a consortium of conservation organisations led by the International Council for the

Protection of Birds (now Birdlife International) offered to buy the island. Its owners let it go for just £17,700.

Today, Cousin Island is priceless. The population of Seychelles warblers is up to 320 individuals, close to the number the island can comfortably support. The species has also been reintroduced to three nearby islands, boosting its total population into the thousands. As a result, it has been reclassified from "critically endangered" to "vulnerable" - the lowest threat level on the Red List of the International Union for Conservation of Nature (IUCN). Shah believes it will be off the list in two years.

While still classed as endangered, the Seychelles magpie robin - actually a species of flycatcher - is likewise heading in the right direction. In 1981, when Nature Seychelles stepped in, the global population was just 18 individuals confined to one island, Frégate (*Biological Conservation*, vol 61, p 93). It is now found on five islands, including Cousin, and numbers are at a far healthier 200. "It is still a very small population," says Shah, "but we have pulled it back from the brink."

Wildlife bonanza

It is not just land birds that are thriving on Cousin Island. Vast colonies of seabirds nest here too, including white-tailed tropicbirds and the ethereally beautiful fairy terns. The forest is crawling with rare skinks and geckos, and giant tortoises plod about. Rare land crabs and hermit crabs abound.

It is also the most important nesting site for hawksbill turtles in the western Indian Ocean. According to a forthcoming paper in *Endangered Species Research*, the past 30 years have seen an eightfold increase in the nesting population on Cousin. "This is long-awaited proof that conservation works even for long-lived and critically endangered species," says Shah, one of the authors of the paper. This season alone, Nature Seychelles has observed hundreds of female hawksbills nesting on the island - though disappointingly there were none around on the day of my visit.

So what's the secret of Cousin's success? Crucially, unlike other islands in the Seychelles, it has never been invaded by rats or cats. This saved the local birds and lizards from the pressure of predation, something they are not adapted to as the archipelago lacks endemic terrestrial mammals. As a result, animals such as the warbler were able to cling on in Cousin even when the native flora was largely replaced by coconuts.

To return the island to a wildlife paradise, the conservationists first had to cut down the coconut palms and allow the native vegetation to regenerate. Most of the plants on Cousin are now endemics, making it the only island in the Seychelles largely free of alien flora - though it is a constant battle to keep it that way. As Shah shows me around, he points out a pawpaw sapling that will have to be removed.

Rigorous monitoring and management have also been essential. Both the magpie robin and the warbler populations are being managed to maximise their limited genetic diversity and so reduce their susceptibility to disease. Transferring birds between islands is one way of doing this, says Richardson.

These measures aside, nobody except Nature Seychelles has the right to land a boat on the island. Unauthorised visitors are likely to be deterred by the treacherous approach, which entails waiting for a lull in the swell, then driving a speedboat at full tilt directly onto the beach. There is also an exclusion zone around the island to prevent fishing and poaching of sea cucumbers and shells. Any materials brought onto the island, for example to repair the plantation workers' huts that are now home to Nature Seychelles' staff, have to be screened for rats.

Ecotourism plays a vital role. Cousin is only a short boat ride from Praslin, the second largest island in the Seychelles, and Nature Seychelles runs educational tours of Cousin from there. Visitors have to abide by strict rules, such as not taking shells so as not to put pressure on hermit crabs. All the money raised goes back into conservation.

Nature Seychelles is now applying the Cousin model to other islands in the archipelago. To succeed, however, they first have to get rid of the rats and cats. "To eradicate rats, we bomb the island with warfarin," says Shah. "The cats we catch or shoot. Once the rats and cats are removed, some animals invade naturally, such as skinks. Then we plant forests and bring back birds. Over the past 10 years we have done five islands." The most successful of these is a privately owned coral atoll called Denis Island. A few years ago it had no native birds; today it has magpie robins, warblers, fodies and paradise flycatchers.

Such "translocations" are helping to save species that had little hope before Nature Seychelles stepped in. "Except for Madagascar, the Seychelles had the most critically endangered bird species in Africa," says Shah. "We have moved these species down the IUCN Red List - that's an indicator of success."

The implications of this remarkable story run far beyond the archipelago, however. "The Seychelles does have a special set of circumstances - islands that are small enough to be de-ratted, an income stream from ecotourists, and good management," says Richardson. "But I think it could work in other places." Even where that is not possible, Shah believes that the successes of Nature Seychelles should inspire anyone working against the tide of biodiversity destruction. "It shows that conservation works, and it can work in our lifetime. You hear so many doom-and-gloom stories. Every year IUCN publishes another list of species on the brink. But we can do it. There are success stories."

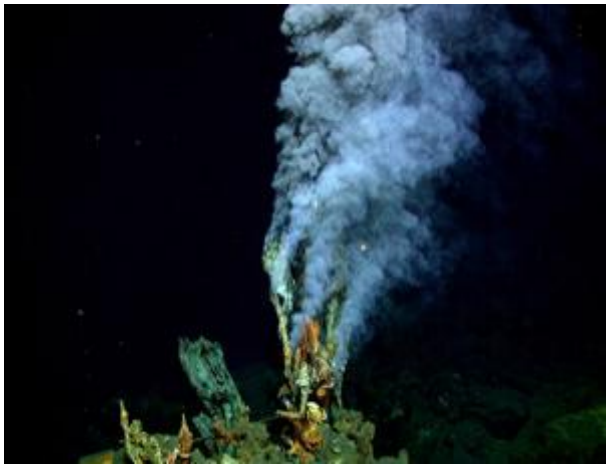
Graham Lawton is deputy editor at New Scientist

http://www.newscientist.com/article/mg20627571.500-living-world-how-to-save-an-island.html

Life got going all on its own

- 21 April 2010 by **Catherine Brahic**

Magazine issue 2757.



Black smokers, hotbeds for life (Image: Charles Fisher/NSF Ridge 2000 programme)

IN THE beginning there were Ida and Luca. The initial Darwinian ancestor - Ida - and the last universal common ancestor - Luca - assembled themselves from the spare parts sloshing around on the early Earth. Once all the ingredients were in place, it looks like life was all but inevitable.

The finding comes from recent discoveries about the behaviour of chemicals thought to have been present on the primordial Earth, relating to two key stages in the evolution of life. Ida was the first molecule that was able to self-replicate. Once it was around, busy making copies of itself, it somehow evolved the ability to store information in the form of the genetic code. That led to the life form from which we all descended: Luca.

Luca probably popped up about 4 billion years ago - some 500 million years after a spinning galactic cloud coalesced into planet Earth and a few hundred million years before complex life evolved and began to leave fossil traces. We can deduce Luca must have existed because all life forms that we know of - from bacteria and viruses to *T. rex*, bananas and humans - share the same genetic code, with a few small exceptions.

Luca is thought to have been based on RNA, the close cousin to DNA, because strands of RNA can act as enzymes. This means metabolism could operate before proteins evolved to take over.

The genetic code consists of triplets of genetic building blocks, or nucleotides, with each triplet coding for a particular amino acid or acting as an on/off switch for amino acid production. Amino acids are the building blocks of proteins and hence of organic life forms.

According to Michael Yarus of the University of Colorado at Boulder, Luca evolved the code as a result of natural chemical affinities between nucleotides and amino acids. Chemical bonding, he says, means that different amino acids naturally like to sit next to some triplets and not others.

The genetic code is the consequence of chemical affinities between RNA and amino acids

In other words, the genetic code is the inevitable consequence of affinities between the molecular building blocks of RNA and those of the proteins they code for. If he's right, it will explain why individual triplets always code for the same amino acids, whether in a virus or a human.

Natural attraction

Yarus works with artificial RNA and has shown that these chemical affinities do exist. Mix strands of RNA with amino acids and the amino acids will more or less spontaneously nestle up to their corresponding triplets. "Yarus found that anticodons [a type of triplet found in some RNAs] were particularly good in this regard and bind the 'correct' amino acid with up to a millionfold greater affinity than other amino acids," says Nick Lane of University College London.

Now David Johnson and Lei Wang of the Salk Institute for Biological Sciences in La Jolla, California, have shown for the first time that these natural affinities occur in real organisms.

Johnson and Wang decided to look for evidence in ribosomes - key components of the cellular machinery that assemble proteins from amino acids. Ribosomes are made of a tangle of RNA and amino acid chains, so if there was natural attraction going on, it should be found there, they reasoned.

Sure enough, when the pair looked at where amino acids sat in the ribosome, they found that 11 of 20 standard amino acids were far more likely than not to be positioned next to the "right" triplet according to the genetic code (*Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.1000704107).

"Not only is there a chemical reason for these affinities between amino acids and their triplets but you can see them in a natural, biological system," says Yarus. What's more, he adds, the ribosome is an evolutionarily ancient structure, supporting the idea that these affinities go way back. All this, he says, backs his theory that relatively simple chemical interactions allowed Luca to evolve the universal genetic code.

It also allows him to speculate about Ida. While the genetic code is central to life as we know it, there is no reason to think that other self-replicating life forms have to use it. However, since Ida gave rise to the RNA-based Luca, it is logical to assume Ida was also made of RNA or something very similar. But that creates a problem: how did RNA - made from a long chain of nucleotides - assemble itself?

Nucleotides don't tend to form chains without catalysts to help them. In living cells, those catalysts are always proteins, yet the first proteins were made by Luca; they did not exist in the time of Ida. Something is needed that is like RNA but simple enough to replicate itself without a catalyst.

Yarus says that the answer lies in small-molecule enzymes called cofactors that help RNA and DNA do their jobs. "They're absolutely universal in biology today and therefore very old," he says. Because they are made of nucleotides, the cofactors could have started RNA chains (*Cold Spring Harbor Perspectives in Biology*, DOI: 10.1101/cshperspect.a003590).

The catalyst that allowed the first RNA chains to form is a missing link in the evolution of early life, says Lane. "There is kind of an assumption that it was there somehow, but no one has ever found it." While Lane agrees that cofactors might have been involved in the early stages of life, he thinks there could be an even simpler way to explain how the first chains of RNA appeared.

That comes from a team led by Ernesto Di Mauro at Sapienza University of Rome, Italy. In their experiments, they have shown that cyclic nucleotides, which are a chemical variation of the nucleotides that make up RNA (see diagram), will spontaneously link to each other and form viable RNA chains (*The Journal of Biological Chemistry*, DOI: 10.1074/jbc.M109.041905).

This suggests that if there were cyclic nucleotides in the primordial soup, there was no need for a catalyst, says Lane. Given the right ingredients, the first self-replicating life forms would have essentially booted themselves up. "Cyclic nucleotides are just as likely to occur in these primordial environments as any other nucleotides," he says.

With the right ingredients, the first self-replicating life forms would have booted themselves up

For Lane, these reactions in all probability happened around the piping hot black smokers of the oceanic abyss, where the Earth's crust is wrenched apart by immense geological forces. "In environments like hydrothermal vents it is likely, but as yet experimentally unproven, that a range of amino acids and nucleotides would be formed by the laws of chemistry," he says. Local currents, he adds, would probably draw the molecules together, making it more likely that self-replicating chains of RNA could form and associate with amino acids.

Once that happened, the emergence of life was all but inevitable. "The Darwinian game was fully on," says Yarus.

http://www.newscientist.com/article/mg20627573.900-selfstarter-life-got-going-all-on-its-own.html?full=true&print=true

Bacterial mat the size of Greece found on Pacific floor

- 21 April 2010 by **Fred Pearce**
- Magazine issue 2757. **Subscribe** and get 4 free issues.
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JUST off the coast of the world's driest desert, the lifeless Atacama in northern Chile, lies one of the largest and densest masses of life anywhere on Earth. The vast tangled mat of white "hair", the size of Greece, was recently mapped as part of the first comprehensive Census of Marine Life.

The ghostly submarine prairie is made of wispy strings of giant bacteria, says Victor Gallardo, a marine biologist at Chile's University of Concepción. The bug thrives in water almost devoid of oxygen by extracting energy from hydrogen sulphide in sediments on the seabed, and feeds on nutrients dispersed by fish in the waters of the cold, fertile Humboldt current above.

Gallardo says the wispy bacteria resemble fossilised bacterial mats dating back 2.5 billion years. In total, he and his colleagues estimate that the mat contains hundreds of millions of tonnes of bacteria, and that the whole system regenerates every 10 weeks. Individual bacteria can reach 7 centimetres long.

The wispy bacteria resemble fossilised bacterial mats dating back 2.5 billion years

The decade-long census, whose aim is to catalogue all ocean life, is rapidly changing our ideas about how many species there are on Earth and where they are to be found. The Amazon rainforest has long been thought to contain the greatest biodiversity on the planet. In fact, the winner is more likely to be the "coral triangle", the region of coral reefs off south-east Asia, according to Ann Bucklin of the University of Connecticut - Avery Point.

Another, entirely unexpected hotspot is the deep ocean below 1000 metres. This huge ocean wilderness may be low in biomass volume, says Bucklin, but it is fabulously diverse.

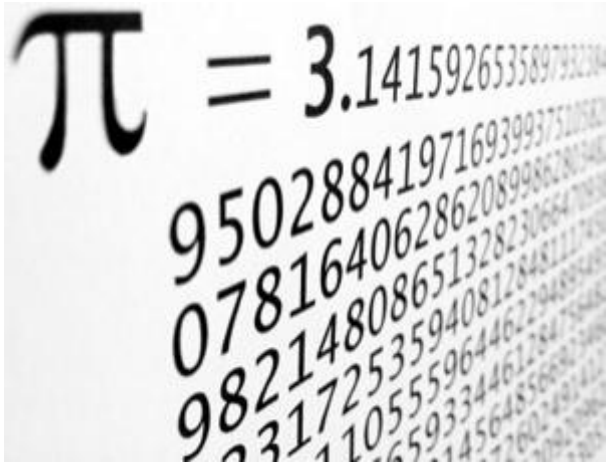
Bacteria and other microbes may make up as much as 90 per cent of the oceans' biomass, and there could be up to a billion species on Earth, says John Baross of the University of Washington, Seattle, more than 10 times as many as previously suspected.

http://www.newscientist.com/article/mg20627574.100-bacterial-mat-the-size-of-greece-found-on-pacific-floor.html

How much can we remember?

- 21 April 2010 by **David Robson**

Magazine issue 2756.



Not so memorable (Image: Krzysztof Zmij / iStock)

Remembering an 11-digit telephone number is hard enough for most of us. Yet one of the current record-holders for a feat of memory, Chao Lu of China, was able to accurately recite 67,890 digits of pi from memory in 2005. But is that a mere drop in the ocean compared to the brain's true capacity?

Our ability to absorb information is vast. In 1986 Thomas Landauer, then at Bell Communications Research in Morristown, New Jersey, looked at studies of how much visual and verbal information subjects stored while examining images and text, and how quickly they forgot it. This led him to estimate that the average adult stores around 125 megabytes of this type of information in their lifetime - enough to store the contents of 100 books the length of *Moby Dick*.

Accurately memorising a long string of digits in the correct order is a more demanding task than memorising ad hoc facts about a text or a picture. To discover the limit of the length of a single memory, it may be more informative to consider the techniques used by the memory champions.

Many of them use a mnemonic method. Before starting to memorise a number, they associate a person or object with each four-digit number from 0000 to 9999. The digits of pi can then be translated into a sequence of these people and objects, which the memoriser links by making up a story. This helps add interest to the random sequence of numbers and pegs down the memory.

Lu takes roughly 1000 hours to memorise 40,000 digits. Assuming this rate would apply no matter how big the memory feat, someone who started memorising a number at the age of 20 and spent 12 hours a day at it, every day, would be able to remember around 8,760,000 digits by their 70th birthday.

http://www.newscientist.com/article/mg20627561.800-maxed-out-how-much-can-we-remember.html

How long can we concentrate for?

- 20 April 2010 by **Clare Wilson**

Magazine issue 2756.

Surgeons have to concentrate for hours on end (Image: OJO Images / Rex Features)

It's a challenge that most of us have faced when up against an essay deadline, a late-night crisis in the office or perhaps a long car drive. Just how long can we push ourselves mentally before our brain needs a break?

For people in jobs where concentration is critical, like truck drivers, power-plant operators or airline pilots, a 12-hour shift is the limit for most. But pity doctors: complex surgery can go on for hours longer than that, although the lengthiest operations tend to be shared by more than one team.

Until 2004, doctors in the UK on weekend shifts used to work from Friday morning to Monday evening - that's 80 hours in total. At best they would snatch a few hours of sleep; at worst, none at all. "You could be working the vast majority of that time," recalls Helen Fernandes, a neurosurgeon at Addenbrooke's Hospital in Cambridge, UK.

Our powers of concentration decline as the hours tick away. We become less efficient, and take longer to make decisions and to sound the alarm when things go wrong. "Vigilance is one of the areas most sensitive to fatigue," says neuroscientist David Dinges at the University of Pennsylvania in Philadelphia.

Dinges's team used MRI to study the brains of people doing a vigilance task. As people's reaction times slowed, activity in certain brain areas waned. Dinges found that performance in the test could be predicted from the level of blood flow in the subjects' right fronto-parietal network.

http://www.newscientist.com/article/mg20627561.600-maxed-out-how-long-can-we-concentrate-for.html?full=true&print=true

What's the human speed limit?

- 20 April 2010 by **David Robson**
- Magazine issue 2756.

Not quite as fast as the speed of light (Image: Seiko Press Service / Getty)

Last year, Usain Bolt stunned athletics fans when he hacked 0.11 seconds off his previous world record for the 100-metre sprint. But what's the ultimate human speed limit?

Intrigued by this question, Mark Denny at Stanford University, California, decided to work out how fast a human could possibly sprint 100 metres. He examined previous records for various athletics competitions - and greyhound and horse races for good measure - since the 1920s, and found that performances in many events followed a similar pattern, improving steadily until they reached a plateau. Horses in the Kentucky Derby, for example, appeared to approach their speed limit in 1949. Since then any improvements have become minimal and increasingly rare.

Human athletes, too, seem to follow this pattern. Timings for the women's 100 metres approached a plateau in 1977. Male sprinters are still improving, but having constructed a model based on other events, Denny says they too seem on the verge of topping out. He predicts an absolute limit of 9.48 seconds for the 100 metres, just 0.1 seconds under Bolt's current record. "If he keeps on course he will soon come close to the absolute limit," says Denny.

What gives rise to this human speed limit? Denny reckons it's as simple as the athlete's power-to-weight ratio. Beyond a certain point, the benefits of stronger muscles and longer limbs will be offset by the increased energy required to shift the greater load.

http://www.newscientist.com/article/mg20627561.500-maxed-out-whats-the-human-speed-limit.html

It pays to remember what made you sad

- 20:00 12 April 2010 by **Jessica Hamzelou**

Magazine issue 2756.

Longer-lasting emotions (Image: Paramount/Everett/Rex Features)

Forgetting your woes might make you feel worse, not better.

People with impaired memory, it turns out, feel sad even when they have forgotten what made them sad in the first place – a finding that suggests emotions and memory are not as connected as we thought.

Neuroscientist Justin Feinstein at the University of Iowa in Iowa City showed a compilation of clips from heart-rending films, including *Forrest Gump*, to five people unable to form new memories because of damage to their hippocampus. Ten minutes later, his team tested the memories of these patients and a group of five people with normal brain function.

The amnesiacs felt a lingering sadness even though they struggled to remember the simplest details of the clips, whereas those with healthy memories felt fine by then (*Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.0914054107).

"I am surprised that the emotion lasted so long in amnesiacs," says Feinstein.

The explanation may be that it is the ability to store and reflect on emotional events that will "relieve some or most of the sad feelings", according to Todd Sacktor at Downstate Medical Center in New York City.

Feinstein's team also showed the two groups a series of funny clips and found a similar pattern of responses, though the difference between the two groups was less marked. "Sadness lasts longer," he says.

The results highlight the importance of being respectful to people with Alzheimer's disease and other memory disorders, Feinstein says. Even if such people do not remember being on the receiving end of insensitive behaviour, they may still feel distressed – and for longer than other people.

It is also possible that using drugs or therapy to block painful memories in people with post-traumatic stress disorder may actually hamper their recovery, Feinstein says. "By not having that memory, you might actually prolong the emotional pain," he says.

Journal reference: *Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.0914054107

http://www.newscientist.com/article/dn18763-it-pays-to-remember-what-made-you-sad.html

How long could you survive without food or drink?

- 22 April 2010 by **Jessica Hamzelou**

Magazine issue 2756.

David Blaine went without food for 44 days (Image: Scott Barbour / Getty)

How long can a human survive without food or water? In theory, when you finally run out of body fat, protein and carbohydrates, your body runs out of energy and stops functioning. Jeremy Powell-Tuck, a retired clinician who fed David Blaine after his starvation stunt in London in 2003, isn't so sure that this is the lethal point. "You're more likely to die before then," he says. Fat people would only be able to survive for longer if they had enough vital water-soluble B vitamins in their system to help metabolise fat stores. So it is possible that a person could die of starvation and still be fat.

The longest recorded starvation was by the Irish hunger-striker Kieran Doherty in 1981, who died after fasting for 73 days. With a supply of vitamins and water, people have been known to survive over a year without eating. "It used to be a very fashionable way of losing weight around 30 years ago," says Powell-Tuck.

With vitamins but without water, survival time is sharply reduced. A human can be expected to survive for weeks without food, but a thirsty person deprived of water would last a matter of days. "It depends on the rate of water loss," says Michael Sawka at the US Army Research Institute of Environmental Medicine in Natick, Massachusetts. Without water, the volume of blood in your body drops, and with it your blood pressure. Blood becomes thicker and stickier, making it harder to pump around the body, so your heart rate increases to compensate. Even in a cool environment, you wouldn't last for more than a week without water.

http://www.newscientist.com/article/mg20627562.000-maxed-out-how-long-could-you-survive-without-food-or-drink.html?full=true&print=true

Quantum broadband becomes reality

- 10:52 20 April 2010 by **Colin Barras**

The first high-speed network link that is so secure it is theoretically unbreakable has been created, thanks to quantum physics.

A team at Toshiba Research Europe in Cambridge, UK, has sent encrypted data at over 1 megabit per second along 50 kilometres of optical fibre. That's fast enough to stream video.

Secure links like Toshiba's involve one user sending a secret "key" to the other, encoded into the quantum properties of a string of single photons. Quantum mechanics ensures that any attempt to intercept this quantum key will change it, revealing the attack.

Until now, the fastest way to send the encoded photons was through the air, but the best spanned not much more than 700 metres. For quantum encryption to be practical, the photons need to travel further and use existing infrastructure, such as the optical fibre that already forms the internet's backbone.

Unfortunately, optical fibre can only transmit light over long distances when it is of a certain wavelength. Individual photons of that wavelength are difficult to detect, but Toshiba has now developed a detector that can pick them up.

Journal reference: *Applied Physics Letters* (DOI: 10.1063/1.3385293)

http://www.newscientist.com/article/dn18795-quantum-broadband-becomes-reality.html?DCMP=NLC-nletter&nsref=dn18795

Blingtronics: Diamonds are a geek's best friend

- 21 April 2010 by **Jon Cartwright**
- Magazine issue 2757.

Diamond power

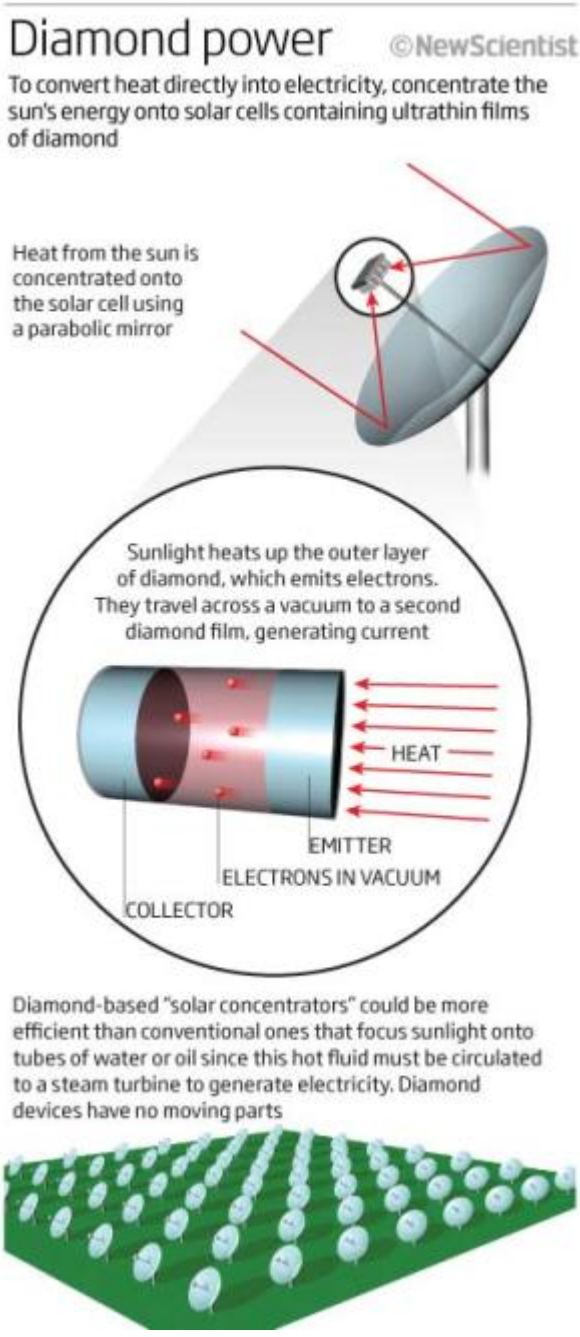
IT'S LIKE walking into a bank vault. Pass codes secure the doors. The walls and floor are made of reinforced concrete up to 2 metres thick - all built on solid sandstone. The ventilation ducts have automatic shut-offs. Not even cellphone signals can sneak in.

All this might seem fitting given that the place houses diamonds by the hundred. Yet this is no vault. It's a lab in the Centre for Nanoscience and Quantum Information at the University of Bristol, UK, and the diamonds stored here are each no bigger than a speck of dust. Diamonds this size might not interest a bank robber, but they are turning out to be a physicist's best friend.

And it's not just diamonds. Gold and silver, too, are acquiring new allure in the lab. These materials' superlative hardness, lustre and resistance to corrosion have been prized for centuries, but reduce this stuff to the nanoscale and other characteristics emerge; valuable properties which promise to transform the way we build electrical gadgets of every kind. Welcome to the shiny new world of "blingtronics".

Unravelling the remarkable riches of this nano-world takes an exceptionally steady hand - which is why the Bristol lab is so solidly built. Here physicist Neil Fox spends his day manipulating delicate films of diamond as thin as a human hair. The experiments are so sensitive that even the faintest vibration could spell failure.

Fox aims to turn these diamond films into a new kind of solar cell, one that generates electricity by absorbing heat rather than visible-light wavelengths. He is exploiting "thermionic emission", the propensity of some materials to spit out electrons when heated, and it turns out that ultrathin diamond is better at this than most. Fox plans to use a reflective dish to focus sunlight onto a device made from two thin films of diamond that are separated by a vacuum a few hundred micrometres thick. As sunlight heats the



outer film, the hottest, most energetic electrons fly off and are collected by the other film, generating current (see diagram).

Conventional devices for capturing the sun's heat do it by focusing sunlight onto tubes containing oil or water. The heated fluid can then be used to produce steam to drive a turbine and generate electricity. With no moving parts, a diamond solar cell should be more efficient, says Fox. Nor must the technology rely on the sun: the cells could also be used to harvest waste heat from power stations, industrial plants or vehicle exhausts.

To make the diamond films work effectively, Fox must first implant lithium atoms into them. These atoms form positive charges near the film surface and this helps hot electrons leave. Unfortunately, the very arrangement of carbon atoms that gives diamond its hardness makes it devilishly difficult to insert alien atoms. Lithium atoms will seep in slowly if the diamond film is red hot, but they end up in clumps, where they are ineffective. So Fox has turned his attention to lithium ions, which he believes will diffuse more easily throughout the structure. "It's a bit of a game trying to get these things where you want them," he says.

Nano-diamonds could also offer an alternative to the silicon circuitry used in microchips, if a project led by the US Defense Advanced Research Projects Agency (DARPA) succeeds. It aims to replace silicon-based electronic circuits with microscopic mechanical components made from diamond. DARPA engineers believe that such devices will offer significant advantages over a swathe of electronic components, particularly if they can be built out of ultrananocrystalline diamond (UNCD), a material developed by the Argonne National Laboratory in Chicago.

Nano-diamonds could offer an alternative to the silicon circuitry used in microchips

UNCD can be etched away to form nanoscale cantilevers or vibrating membranes that are able to operate over a broader range of frequencies than conventional electronic switches and oscillators. And thanks to the fact that UNCD can be layered onto silicon, these components can be directly integrated into silicon chips, making them cheap to build. "Diamond is a very unique material," says Jan Isberg, an engineer at Uppsala University, Sweden, who is studying its uses in electronics.

The DARPA-funded researchers hope to use their diamond components to create a military radio that operates at broadband speeds, akin to a souped-up smartphone. And UNCD is just the stuff for the job, they say, thanks to its toughness and resistance to corrosion.

While diamond offers new tricks for manipulating electrons, other forms of bling could allow us to replace electrons altogether, using photons. Unlike electrons, which are subject to collisions and interference as they travel through a circuit, photons can whizz round optical fibres without interfering with each other. This means photons can be packed together at higher densities than is possible with electrons, so optical circuits should be able to carry more data.

Finding a way to control these photons remains a big challenge. One solution is to use plasmons, which can be thought of as light waves trapped on the surface of a metal by the sea of electrons inside. Unlike photons, plasmons can easily be manipulated with electric fields or even beams of light. A team at the Electronics and Telecommunications Research Institute in Daejeon, South Korea, recently transferred data between computer chips using plasmons to channel a broadband light signal along gold wires. Some manufacturers, including Intel, are beginning to use connections of this type to replace conventional wiring in personal computers.

The ultimate aim, though, is to have light itself perform the processing in every microchip. Part of the trick here lies in the ability to generate pulses of light and switch them on and off at high speed, all in a tiny space. The smallest conventional lasers measure several hundred nanometres across and so are

simply too big for the task. To compete with transistors, a laser would need to be less than 50 nanometres across, an impossibility with conventional designs.

Then last year teams of physicists in the US and China created the first examples of a device known as a spaser, which gets its name from the fact that it amplifies surface plasmons in a similar way to how a laser boosts light. The spaser has a gold core wrapped in silica and dye molecules. When it is switched on - using an external light source at present, though the goal is to use an electric current - the gold core ripples with plasmons. These excite the dye molecules, which emit light. This light in turn creates more plasmons. The result is a beam of light from a device tens of nanometres wide.

Inside your body

It will be years before engineers can use such nano-bling to build an optical computer. In the meantime, nanoparticles of gold and silver have other gifts to offer. Injected into human tissue and exposed to light, gold nanoparticles can generate plasmons that then emit light of a different wavelength. This can be used to analyse the chemistry of cells spectroscopically, which could play a useful role in medical diagnostics or, if the wavelengths emitted are in the infrared, kill cancerous cells.

As for silver nanoparticles, they can help make LEDs more efficient. Much used in consumer electronics, LEDs produce light when electrons and "holes" - gaps in a semiconductor where electrons should be - recombine. It turns out that adding silver nanoparticles to LEDs can boost their output eightfold (*Applied Physics Letters*, DOI: 10.1063/1.2195695). This could ultimately lead to new types of low-power display screens or lighting. "It's a very large area of research that's really just taking off now," says Teri Odom, who works in nanotechnology at Northwestern University in Evanston, Illinois.

Yet the most marketable bling technology might be wrapped into something that you take with you everywhere. It could transform your favourite gadgets, including cellphones and music players - by incorporating them into your clothing. "Rather than carrying your iPod, the whole electronic system could be embedded in your jacket," says Jennifer Lewis, a materials scientist at the University of Illinois at Urbana-Champaign.

Bling could transform your favourite gadgets by incorporating them into your clothing

Lewis is working on making blingtronics wearable. Last year, her group found a way to print tiny micrometre-sized wires in much the same way as an inkjet printer makes an image on paper. Using an electrically conducting ink containing silver nanoparticles, they were able to print wires onto a variety of materials, including glass and plastic (*Science*, vol 323, p 1590). Lewis was also keen to discover if her printing technique would work with flexible materials like fabric, but here she hit a snag.

To make the silver nanoparticles, Lewis precipitates them gradually from a solution of silver salts, adding a polymer "capping" agent which stops the particles growing beyond the required size. The polymer wraps around the particles, preventing any more silver from sticking. The problem is how to remove the polymer once the printing process is complete, since the polymer is an insulator and reduces the conductivity of the wires. Heating does the trick. Unfortunately it turned out that Lewis's team could only get rid of the polymer at temperatures above 100°C - not conditions that are kind to delicate fabrics.

Lewis's most recent work, to be published later this year, suggests an answer. Her group has found that it can minimise the insulating effect of the polymer by carefully adjusting the size of the nanoparticles. Using ink containing particles of this ideal size, they can print wires whose conductivity is one-tenth that of ordinary silver, with no heating required. "We've made quite a lot of progress, but there's more work to do," she says.

Lewis's ultimate goal is to print all the components and circuitry of a phone or music player onto fabric. Most of these components, she points out, are already printed onto circuit boards, by depositing a layer of

conductor or semiconductor and then etching away everything except the pattern required. In principle, she says, there's no reason why the circuitry for any electronic device you'd care to name couldn't be printed onto your clothes, all thanks to nanoparticle ink.

Whether or not the cuff of your next coat or cardigan comes with its own circuitry, it seems certain that there's a bright future for electronics made using gold, silver and diamonds. And even if this bling isn't your style, never fear - how can you look gauche when the stuff is too small to see?

Jon Cartwright is a freelance journalist based in Bristol, UK

http://www.newscientist.com/article/mg20627571.200-blingtronics-diamonds-are-a-geeks-best-friend.html?DCMP=NLC-nletter&nsref=mg20627571.200

The secrets of intelligence lie within a single cell

- 21 April 2010 by **Brian J. Ford**
- Magazine issue 2757.

LATE at night on a sultry evening, I watch intently as the predator senses its prey, gathers itself, and strikes. It could be a polecat, or even a mantis - but in fact it's a microbe. The microscopic world of the single, living cell mirrors our own in so many ways: cells are essentially autonomous, sentient and ingenious. In the lives of single cells we can perceive the roots of our own intelligence.

Molecular biology and genetics have driven the biosciences, but have not given us the miraculous new insights we were led to expect. From professional biologists to schoolchildren, people are concentrating on the minutiae of what goes on in the deepest recesses of the cell. For me, however, this misses out on life in the round: it is only when we look at the living cell as a whole organism that wonderful realities emerge that will alter our perception not only of how single cells enact their intricate lives but what we humans truly are.

The problem is that whole-cell biology is not popular. Microscopy is hell-bent on increased resolution and ever higher magnification, as though we could learn more about animal behaviour by putting a bacon sandwich under lenses of increasing power. We know much about what goes on within parts of a cell, but so much less about how whole cells conduct their lives.

Currently, cell biology deals largely with the components within cells, and systems biology with how the components interact. There is nothing to counterbalance this reductionism with a focus on how whole cells behave. Molecular biology and genetics are the wrong sciences to tackle the task.

Let's take a look at some of the evidence for ingenuity and intelligence in cells that is missing from the curriculum. Take the red algae *Rhodophyta*, in which many species carry out remarkable repairs to damaged cells. Cut a filament of *Antithamnion* cells so the cell is cut across and the cytoplasm escapes into the surrounding aquatic medium. All that remains are two fragments of empty, disrupted cell wall lying adjacent to, but separate from, each other. Within 24 hours, however, the adjacent cells have made good the damage, the empty cell space has been restored to full activity, and the cell walls meticulously realigned and seamlessly repaired.

The only place where this can happen is in the lab. In nature, the broken ends of the severed cell would nearly always end up remote from each other, so selection in favour of an automatic repair mechanism through Darwinian evolution would be impossible. Yet something amazing is happening here: because the damage to the *Antithamnion* filament is unforeseeable, the organism faces a situation for which it has not been able to adapt, and is therefore unable to call upon inbuilt responses. It has to use some sort of problem-solving ingenuity instead.

We regard amoebas as simple and crude. Yet many types of amoeba construct glassy shells by picking up sand grains from the mud in which they live. The typical *Difflugia* shell, for example, is shaped like a vase, and has a remarkable symmetry.

Compare this with the better known behaviour of a caddis fly larva. This maggot hunts around the bottom of the pond for suitable scraps of detritus with which to construct a home. Waterlogged wood is cemented together with pondweed until the larva has formed a protective covering for its nakedness. You might think this comparable to the home built by the testate amoeba, yet the amoeba lacks the jaws, eyes, muscles, limbs, cement glands and brain the caddis fly larva relies on for its skills. We just don't know how this single-celled organism builds its shell, and molecular biology can never tell us why. While the home of the caddis fly larva is crude and roughly assembled, that of the testate amoeba is meticulously crafted - and it's all made by a single cell.

The products of the caddis fly larva and the amoeba, and the powers of red algae, are about more than ingenuity: they pose important questions about cell intelligence. After all, whole living cells are primarily autonomous, and carry out their daily tasks with little external mediation. They are not subservient nanobots, they create and regulate activity, respond to current conditions and, crucially, take decisions to deal with unforeseen difficulties.

Whole living cells are not subservient nanobots, they respond and take decisions

Just how far this conceptual revolution about cells could take us becomes clearer with more complex animals, such as humans. Here, conventional wisdom is that everything is ultimately controlled by the brain. But cells in the liver, for example, reproduce at just the right rate to replace cells lost through attrition; follicular cells create new hair; bone marrow cells produce new circulating blood cells at a rate of millions per minute. And so on and on. In fact, around 90 per cent of this kind of cell activity is invisible to the brain, and the cells are indifferent to its actions. The brain is an irrelevance to most somatic cells.

So where does that leave the neuron, the most highly evolved cell we know? It ought to be in an interesting and privileged place. After all, neurons are so specialised that they have virtually abandoned division and reproduction. Yet we model this cell as little more than an organic transistor, an on/off switch. But if a red alga can "work out" how to solve problems, or an amoeba construct a stone home with all the "ingenuity" of a master builder, how can the human neuron be so lowly?

Unravelling brain structure and function has come to mean understanding the interrelationship between neurons, rather than understanding the neurons themselves. My hunch is that the brain's power will turn out to derive from data processing within the neuron rather than activity between neurons. And networks of neurons enhance the effect of those neurons "thinking" between themselves. I think the neuron's action potentials are rather like a language neurons use to transmit processed data from one to the next.Back in 2004, we set out to record these potentials, from neurons cultured in the lab. They emit electrical signals of around 40 hertz, which sound like a buzzing, irritating noise played back as audio files. I used some specialist software to distinguish the signal within the noise - and to produce sound from within each peak that is closer to the frequency of a human voice and therefore more revealing to the ear.

Listening to the results reprocessed at around 300 Hz, the audio files have the hypnotic quality of sea birds calling. There is a sense that each spike is modulated subtly within itself, and it sounds as if there are discrete signals in which one neuron in some sense "addresses" another. Could we be eavesdropping on the language of the brain?For me, the brain is not a supercomputer in which the neurons are transistors; rather it is as if each individual neuron is itself a computer, and the brain a vast community of microscopic computers. But even this model is probably too simplistic since the neuron processes data flexibly and on disparate levels, and is therefore far superior to any digital system. If I am right, the human brain may be a trillion times more capable than we imagine, and "artificial intelligence" a grandiose misnomer.

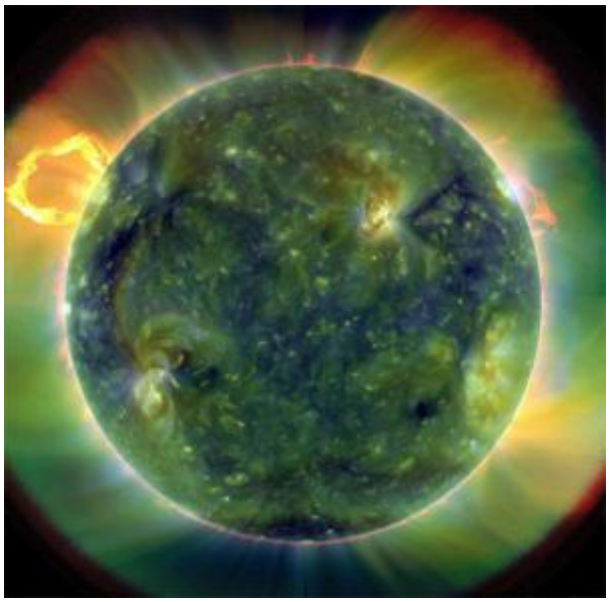
I think it is time to acknowledge fully that living cells make us what we are, and to abandon reductionist thinking in favour of the study of whole cells. Reductionism has us peering ever closer at the fibres in the paper of a musical score, and analysing the printer's ink. I want us to experience the symphony.

Profile

Brian J. Ford is a research biologist based at Gonville and Caius College, University of Cambridge. He is a fellow of Cardiff University in the UK. His books include *Sensitive Souls*. This article is based on his paper in *Interdisciplinary Science Reviews* (vol 34, p 350)

http://www.newscientist.com/article/mg20627571.100-the-secrets-of-intelligence-lie-within-a-single-cell.html?full=true&print=true

NASA's New Eye on the Sun Delivers Stunning First Images



A full-disk multiwavelength extreme ultraviolet image of the sun taken by SDO on March 30, 2010. False colors trace different gas temperatures. Reds are relatively cool (about 60,000 Kelvin, or 107,540 F); blues and greens are hotter (greater than 1 million Kelvin, or 1,799,540 F). (Credit: NASA)

ScienceDaily (Apr. 21, 2010) — NASA's recently launched Solar Dynamics Observatory, or SDO, is returning early images that confirm an unprecedented new capability for scientists to better understand our sun's dynamic processes. These solar activities affect everything on Earth.

Some of the images from the spacecraft show never-before-seen detail of material streaming outward and away from sunspots. Others show extreme close-ups of activity on the sun's surface. The spacecraft also has made the first high-resolution measurements of solar flares in a broad range of extreme ultraviolet wavelengths.

"These initial images show a dynamic sun that I had never seen in more than 40 years of solar research," said Richard Fisher, director of the Heliophysics Division at NASA Headquarters in Washington. "SDO will change our understanding of the sun and its processes, which affect our lives and society. This mission will have a huge impact on science, similar to the impact of the Hubble Space Telescope on modern astrophysics."

Launched on Feb. 11, 2010, SDO is the most advanced spacecraft ever designed to study the sun. During its five-year mission, it will examine the sun's magnetic field and also provide a better understanding of the role the sun plays in Earth's atmospheric chemistry and climate. Since launch, engineers have been conducting testing and verification of the spacecraft's components. Now fully operational, SDO will provide images with clarity 10 times better than high-definition television and will return more comprehensive science data faster than any other solar observing spacecraft.

SDO will determine how the sun's magnetic field is generated, structured and converted into violent solar events such as turbulent solar wind, solar flares and coronal mass ejections. These immense clouds of material, when directed toward Earth, can cause large magnetic storms in our planet's magnetosphere and upper atmosphere.

SDO will provide critical data that will improve the ability to predict these space weather events. NASA's Goddard Space Flight Center in Greenbelt, Md., built, operates and manages the SDO spacecraft for the agency's Science Mission Directorate in Washington.

"I'm so proud of our brilliant work force at Goddard, which is rewriting science textbooks once again." said Sen. Barbara Mikulski, D-Md., chairwoman of the Commerce, Justice and Science Appropriations Subcommittee that funds NASA. "This time Goddard is shedding new light on our closest star, the sun, discovering new information about powerful solar flares that affect us here on Earth by damaging communication satellites and temporarily knocking out power grids. Better data means more accurate solar storm warnings."

Space weather has been recognized as a cause of technological problems since the invention of the telegraph in the 19th century. These events produce disturbances in electromagnetic fields on Earth that can induce extreme currents in wires, disrupting power lines and causing widespread blackouts. These solar storms can interfere with communications between ground controllers, satellites and airplane pilots flying near Earth's poles. Radio noise from the storm also can disrupt cell phone service.

SDO will send 1.5 terabytes of data back to Earth each day, which is equivalent to a daily download of half a million songs onto an MP3 player. The observatory carries three state-of the-art instruments for conducting solar research.

The Helioseismic and Magnetic Imager maps solar magnetic fields and looks beneath the sun's opaque surface. The experiment will decipher the physics of the sun's activity, taking pictures in several very narrow bands of visible light. Scientists will be able to make ultrasound images of the sun and study active regions in a way similar to watching sand shift in a desert dune. The instrument's principal investigator is Phil Scherrer of Stanford University. HMI was built by a collaboration of Stanford University and the Lockheed Martin Solar and Astrophysics Laboratory in Palo Alto, Calif.

The Atmospheric Imaging Assembly is a group of four telescopes designed to photograph the sun's surface and atmosphere. The instrument covers 10 different wavelength bands, or colors, selected to reveal key aspects of solar activity. These types of images will show details never seen before by scientists. The principal investigator is Alan Title of the Lockheed Martin Solar and Astrophysics Laboratory, which built the instrument.

The Extreme Ultraviolet Variability Experiment measures fluctuations in the sun's radiant emissions. These emissions have a direct and powerful effect on Earth's upper atmosphere -- heating it, puffing it up, and breaking apart atoms and molecules. Researchers don't know how fast the sun can vary at many of these wavelengths, so they expect to make discoveries about flare events. The principal investigator is Tom Woods of the Laboratory for Atmospheric and Space Physics at the University of Colorado, Boulder. LASP built the instrument.

"These amazing images, which show our dynamic sun in a new level of detail, are only the beginning of SDO's contribution to our understanding of the sun," said SDO Project Scientist Dean Pesnell of Goddard.

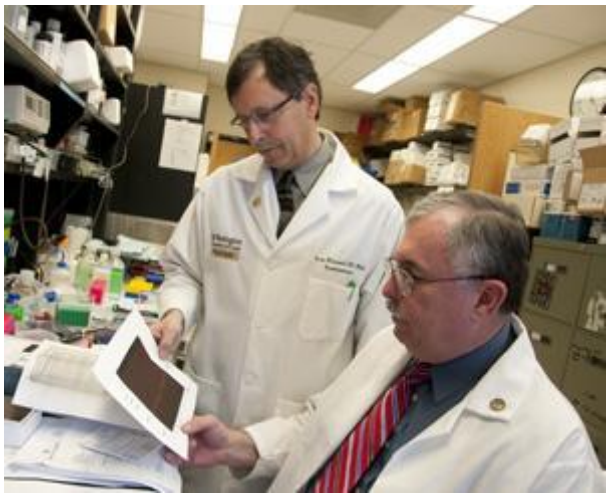
SDO is the first mission of NASA's Living with a Star Program, or LWS, and the crown jewel in a fleet of NASA missions that study our sun and space environment. The goal of LWS is to develop the scientific understanding necessary to address those aspects of the connected sun-Earth system that directly affect our lives and society.

Story Source:

Adapted from materials provided by NASA.

http://www.sciencedaily.com/releases/2010/04/100421150815.htm

Urine Test for Kidney Cancer a Step Closer to Development



Evan Kharasch, MD, PhD (left), and Jerry Morrissey, PhD, in the lab where they discovered that two key proteins are elevated in the urine of patients with the most common forms of kidney cancer, and the findings may be used to develop a screening test for the early diagnosis of kidney cancer. (Credit: Robert Boston)

ScienceDaily (Apr. 22, 2010) — Studying patients with kidney cancer, a team of researchers at Washington University School of Medicine in St. Louis has identified a pair of proteins excreted in the urine that could lead to earlier and more accurate diagnosis of the disease.

The research, published online in the May issue of *Mayo Clinic Proceedings*, is the first to identify proteins secreted in urine that appear to accurately reveal the presence of about 90 percent of all kidney cancers.

Currently, there is no diagnostic test for kidney cancer. About 80 percent of kidney tumors are discovered incidentally, during a CT scan or ultrasound test that has been ordered for an unrelated abdominal complaint.

"Kidney cancer is a silent and frequently fatal cancer," says principal investigator Evan D. Kharasch, MD, PhD. "More than 80 percent of patients die within two years of diagnosis, and more than 95 percent die within five years because by the time the cancer is detected, it often has spread beyond the kidney. When it is identified early, however, kidney cancer is curable in a very high percentage of individuals."

Kharasch and co-investigator Jeremiah J. Morrissey, PhD, looked at urine samples from 42 patients who became aware that they had kidney cancer during an abdominal imaging test and from 15 individuals who did not have cancer but were scheduled for surgery. Another 19 healthy volunteers were included who were not having surgery of any kind.

The researchers focused on two proteins that previously had been found in kidney tumors: aquaporin-1 (AQP1) and adipophilin (ADFP). They discovered large amounts of those proteins in urine samples from kidney cancer patients.

The AQP1 or ADFP proteins were not elevated in healthy individuals or surgery patients without cancer. The researchers also found that when the kidney tumors were removed, AQP1 and ADFP levels in the urine declined precipitously.

"We believe that in the same way we use mammograms to screen for breast cancer and blood tests to screen for prostate cancer, we may have the opportunity to detect these proteins in urine as a way to screen for kidney cancer," Kharasch says.

Kharasch, vice chancellor for research at Washington University, the Russell D. and Mary B. Shelden Professor of Anesthesiology and director of the Division of Clinical and Translational Research in the Department of Anesthesiology, has been working with lead author Morrissey, a research professor of anesthesiology, to detect kidney cancer at an earlier stage.

"When patients come to surgery, it tends to be late in the process, and many already have progressed to a stage where the prognosis is pretty bleak," says Morrissey. "Screening patients to find kidney cancer when it is still small and treatable could save a number of lives and preserve kidney function in many people. It also may represent the difference between losing an entire kidney or extracting only a tumor while sparing healthy portions of the organ."

About 50,000 patients are diagnosed with kidney cancer each year. And about 13,000 people die from the disease annually in the United States alone. A test that could lead to earlier diagnosis could make a big dent in those numbers, according to Timothy J. Eberlein, MD, director of the Alvin J. Siteman Cancer Center at Barnes-Jewish Hospital and Washington University School of Medicine.

"One of the goals of the Siteman Cancer Center is to diagnose tumors as early as possible, when they are more curable," Eberlein says. "Most kidney tumors are found in more advanced stages, when the patient is symptomatic and less likely to be cured. These new findings open the door for a quick, noninvasive test and could revolutionize our approach to the early, accurate diagnosis of kidney cancer."

Morrissey says further testing will be required to determine whether people with other types of kidney disease also have high levels of AQP1 and ADFP in their urine, too. But based upon their findings, Kharasch and Morrisey have filed a patent application through Washington University's Office of Technology Management for use of aquaporin-1 and adipophilin to diagnose kidney cancer.

Because this study looked only at patients who already had a cancer diagnosis following an imaging test, Kharasch and Morrissey say more research will be needed to see how early in the disease process levels of the AQP1 or ADFP proteins rise and whether the concentration of those proteins in the urine might correspond to the size of a kidney tumor.

If the research continues to demonstrate that AQP1 and ADFP urine levels are good markers of kidney cancer, it may someday be possible for routine screening for the disease in a doctor's office, using a noninvasive urine test to determine whether or not they have the disease.

Story Source:

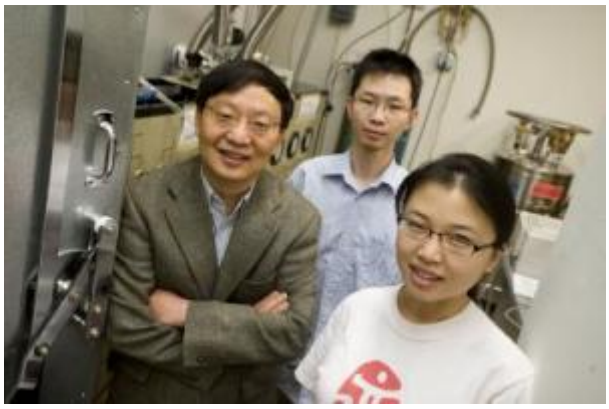
Adapted from materials provided by Washington University School of Medicine.

Journal Reference:

1. J. J. Morrissey, A. N. London, J. Luo, E. D. Kharasch. **Urinary Biomarkers for the Early Diagnosis of Kidney Cancer**. *Mayo Clinic Proceedings*, 2010; DOI: 10.4065/mcp.2009.0709

http://www.sciencedaily.com/releases/2010/04/100407134823.htm

Bizarre Matter Could Find Use in Quantum Computers



From left, Rice physicist Rui-Rui Du, graduate students Chi Zhang and Yanhua Dai, and former postdoctoral researcher Tauno Knuuttila (not pictured) have found that odd groupings of ultracold electrons could be useful in making fault-tolerant quantum computers. (Credit: Jeff Fitlow/Rice University)

ScienceDaily (Apr. 22, 2010) — There are enticing new findings in the search for materials that support fault-tolerant quantum computing. New results from Rice University and Princeton University indicate that a bizarre state of matter that acts like a particle with one-quarter electron charge also has a "quantum registry" that is immune to information loss from external perturbations.

The research appeared online April 21 in *Physical Review Letters*. The team of physicists found that ultracold mixes of electrons caught in magnetic traps could have the necessary properties for constructing fault-tolerant quantum computers -- future computers that could be far more powerful than today's computers. The mixes of electrons are dubbed "5/2 quantum Hall liquids" in reference to the unusual quantum properties that describe their makeup.

"The big goal, the whole driving force, besides deep academic curiosity, is to build a quantum computer out of this," said the study's lead author Rui-Rui Du, professor of physics at Rice. "The key for that is whether these 5/2 liquids have 'topological' properties that would render them immune to the sorts of quantum perturbations that could cause information degradation in a quantum computer."

Du said the team's results indicate the 5/2 liquids have the desired properties. In the parlance of condensed-matter physics, they are said to represent a "non-Abelian" state of matter.

Non-Abelian is a mathematical term for a system with "noncommutative" properties. In math, commutative operations, like addition, are those that have the same outcome regardless of the order in which they are carried out. So, one plus two equals three, just as two plus one equals three. In daily life, commutative and noncommutative tasks are commonplace. For example, when doing the laundry, it doesn't matter if the detergent is added before the water or the water before the detergent, but it does matter if the clothes are washed before they're placed in the dryer.

"It will take a while to fully understand the complete implications of our results, but it is clear that we have nailed down the evidence for 'spin polarization,' which is one of the two necessary conditions that must be proved to show that the 5/2 liquids are non-Abelian," Du said. "Other research teams have been tackling the second condition, the one-quarter charge, in previous experiments."

The importance of the noncommutative quantum properties is best understood within the context of fault-tolerant quantum computers, a fundamentally new type of computer that hasn't been built yet.

Computers today are binary. Their electrical circuits, which can be open or closed, represent the ones and zeros in binary bits of information. In quantum computers, scientists hope to use "quantum bits," or qubits. Unlike binary ones and zeros, the qubits can be thought of as little arrows that represent the position of a bit of quantum matter. The arrow might represent a one if it points straight up or a zero if it points straight down, but it could also represent any number in between. In physics parlance, these arrows are called quantum "states." And for certain complex calculations, being able to represent information in many different states would present a great advantage over binary computing.

The upshot of the 5/2 liquids being non-Abelian is that they have a sort of "quantum registry," where information doesn't change due to external quantum perturbations.

"In a way, they have internal memory of their previous state," Du said.

The conditions needed to create the 5/2 liquids are extreme. At Rice, Tauno Knuuttila, a former postdoctoral research scientist in Du's group, spent several years building the "demagnetization refrigerator" needed to cool 5-millimeter squares of ultrapure semiconductors to within one-10,000th of a degree of absolute zero. It took a week for Knuuttila to simply cool the nearly one-ton instrument to the necessary temperature for the Rice experiments.

The gallium arsenide semiconductors used in the tests are the most pure on the planet. They were created by Loren Pfieiffer, Du's longtime collaborator at Princeton and Bell Labs. Rice graduate student Chi Zhang conducted additional tests at the National High Magnetic Field Laboratory in Tallahassee, Fla., to verify that the 5/2 liquid was spin- polarized.

Study co-authors include Zhang, Knuuttila, Pfeiffer, Princeton's Ken West and Rice's Yanhua Dai. The research is supported by the Department of Energy, the National Science Foundation and the Keck Foundation.

Story Source:

Adapted from materials provided by Rice University, via EurekAlert!, a service of AAAS.

Journal Reference:

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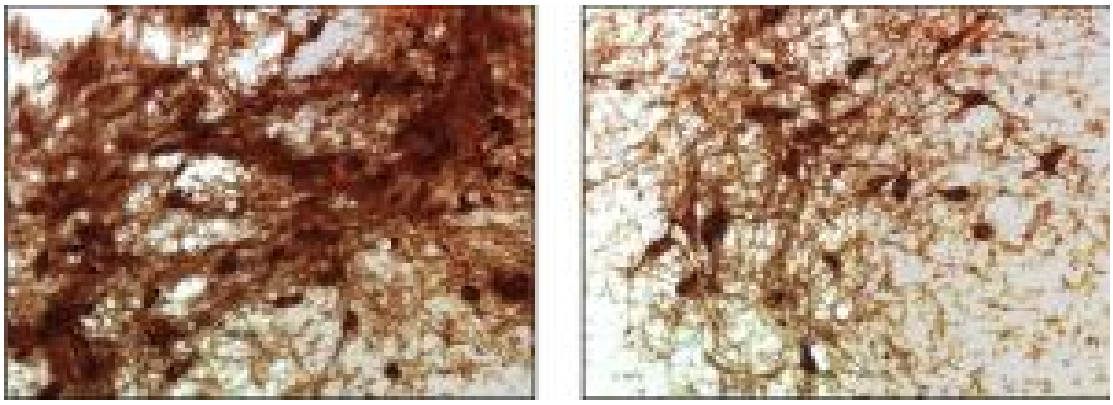
http://www.sciencedaily.com/releases/2010/04/100421133125.htm

Research Sheds Light on What Triggers Parkinson's Disease



In Parkinson's disease, nerve cells die in a structure of the midbrain, the substantia nigra. Compared to a healthy mouse brain (left), the diseased mouse brain (right) shows considerable loss of nerve cells. Max Planck Scientists and their colleagues have now been able to show that such pronounced cell death is triggered only when three conditions are met. (Credit: Max Planck Institute of Neurobiology / L. Aron)

ScienceDaily (Apr. 22, 2010) — In Germany alone, more than 300,000 people are afflicted by Parkinson's disease and the number is growing steadily. However, despite comprehensive research, scientists are still somewhat in the dark as to the molecular changes that trigger this illness. Scientists at the Max Planck Institute of Neurobiology in Martinsried, Germany, together with colleagues from Munich and Hamburg, have demonstrated using a new animal model that nerve cells do not begin to die to the extent found in "Parkinson's" in mice until three conditions come together.

These findings, which are published in the online, open access journal *PLoS Biology*, are an important step forward in understanding this illness.

In the last ten years, various genes that play a role in the outbreak of the hereditary form of Parkinson's disease have been identified. In addition, nerve cell growth factors, such as GDNF, have been found to reduce the rate at which nerve cells are destroyed in the brain areas afflicted in Parkinson's disease, most notably the substantia nigra of the midbrain. However, the treatment with GDNF and other similar growth factors have not yet left the clinical trial phase. As the brain cells dying in Parkinson's disease are embedded in sensitive brain tissue, their detailed investigation is impossible in humans. The development of animal models in which defined genetic and/or pharmacological manipulations can be made is therefore essential for a good understanding of the molecular and cellular causes of the disease.

However, a major drawback of Parkinson's research is that so far most animal models fail to display the accelerated loss of nerve cells typical of the human illness, thus preventing a thorough analysis of Parkinson's disease mechanisms. As the world's population ages, there is an upward trend of the number of people afflicted and the need for effective forms of treatment becomes more urgent. Current treatments aim to ameliorate symptoms, since the underlying disease mechanisms remain unknown.

Rüdiger Klein and colleagues have now been able to show that a significant cell death in the substantia nigra occurs only when three conditions join forces. In a mouse model, three prerequisites had to be fulfilled: a defective disease gene (in this case the DJ-1 gene); a deficiency in responding to a growth factor; and the aging of the animal. In other words, nerve cells which lack the DJ-1 gene and which, in addition, cannot react to the pro-survival signals initiated by the growth factor are particularly prone to die as the mouse ages. "Although we had an inkling that this might be the case, we had no actual proof up to now," Liviu Aron, the first author of this study, explains.

"The discovered connection between the response to a growth factor and the DJ-1 gene is extremely interesting," adds Klein. "Environmental factors influence the supply of growth factors and their

interactions with genetic factors may help us to better understand Parkinson's disease." The detailed analysis of the complex mechanisms that set in during the process of aging is likely to keep scientists busy for some time.

Complementary genetic investigations in the fruit fly Drosophila also revealed a connection between growth factor responses and the DJ-1 gene. The researchers thus assume that this interaction arose early in evolutionary history and has since then been preserved. This newly discovered connection may open up a new form of therapy for patients with certain genetic defects that give them a higher predisposition for the disease: for example, a specific medication with GDNF might be more effective in curbing the development of the illness in these than in other patients.

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Story Source:

Adapted from materials provided by Public Library of Science, via EurekAlert!, a service of AAAS.

Journal Reference:

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http://www.sciencedaily.com/releases/2010/04/100406172644.htm

Dying: Millions of Women in Childbirth, Newborns and Young Children

This map depicts world progress in addressing maternal and child health. (Credit: WHO, UNICEF, UNFPA, World Bank)

ScienceDaily (Apr. 22, 2010) — Widespread global use of known and proven maternal and childcare techniques, practices, and therapies could save the lives of millions of women, newborns and children each year, according to a new analysis prepared for a mid-April meeting of world leaders and technical experts on maternal and child health. The meeting is being held to focus attention on this toll and develop a plan of action to reduce it.

Despite significant advances over the past decades, the detailed analysis shows that an estimated 350,000-500,000 women still die in childbirth each year, 3.6 million newborns fail to survive the first month, and an additional 5.2 million children die before the age of five.

It shows progress has lagged mainly in Sub-Saharan Africa and South Asia where an estimated 82 percent of maternal, newborn, and child deaths take place.

The new analysis comes from members of Countdown to 2015, a global scientific and advocacy movement formed in 2005 to track global progress in reducing the toll of maternal and child deaths, two of the Millennium Development Goals set by 189 member nations of the United Nations General Assembly in 2000. Countdowns focus on 68 countries, most of them in Africa, which together account for 92 percent of maternal, newborn and child deaths and include some of the poorest countries in the world.

Progress on Maternal and Child Health Lags

While considerable progress has been made towards meeting other Millennium Development Goals, the two goals on maternal and child survival have lagged behind, prompting a renewed effort to meet them.

"Because we know what causes these deaths and what would prevent them, major progress is possible," says Jennifer Bryce, a child health researcher at Johns Hopkins University and a member of the Countdown group. "The Countdown analysis provides a road map, helping countries focus on their own data and take action to meet their specific needs."

Already 135 countries have child mortality rates of less than 40 per 1,000 live births or have a rate of reduction sufficient to meet the goal of two-thirds reduction by 2015, according to UNICEF. Currently 39 show insufficient progress and 18 show no progress or a worsening of child mortality, says UNICEF.

"This is a multi-layered problem that can be addressed with a combination of many, very simple interventions, says Flavia Bustreo, M.D., Director of The Partnership for Maternal, Newborn & Child Health (PMNCH), a group of more than 300 organizations, foundations, institutions, and countries that is one of the leaders in this effort.

No Single Intervention

"No single intervention is sufficient," explains Zulfiqar Bhutta, M.D., Ph.D., of Pakistan's Aga Khan University and co-chair of Countdown to 2015. "What is required is a seamless continuum of care including family planning, breastfeeding, hand washing, skilled attendance at delivery and childhood immunizations. There are multiple therapies and practices that have been proven to save lives and the use of national data can prioritize which ones will make the biggest difference in the shortest time.

"Even more, besides additional funding, we need political leadership to guarantee that actions will be taken and will be successful, and we need community engagement to keep leaders accountable," Dr. Bhutta says.

The immense global toll of women and newborns has only just come to public attention, probably because maternal death and newborn death traditionally have been considered separate problems. Also, reducing maternal and newborn deaths were considered too difficult, according to some health professionals.

The new analysis details why these deaths still happen and shows how the toll can be reduced with additional political and financial support from donors and increases in health care budgets in the poorest countries.

It points out that malaria, HIV/AIDS and immunization have received major funding, including attention to drugs and commodities, and major progress was made. Maternal, newborn and child deaths remain a larger problem, yet receive less attention and funding.

Among the reasons are societal and cultural practices. Many stillbirths, newborn and maternal deaths occur at home, unseen and uncounted. The deaths of mothers, newborns and young children are accepted as part of life in some parts of the world, and birth and death certificates are not common. That is why precise data is lacking.

Babies Don't Need to Die

"Millions of babies die without people realizing it can be different," says Joy Lawn, M.D., Ph.D., of Saving Newborn Lives/Save the Children and a Countdown to 2015 member. "This is not high tech. Up to 3 million newborns each year can be saved with simple approaches, like cutting the cord with a clean blade, and kangaroo mother care where the mother acts as an incubator for her preterm baby, or antibiotics to treat infections."

A Countdown to 2015 report, due in June, will show what progress has been made toward meeting the two goals in 68 countries with the highest toll. This information will highlight service gaps and deficiencies so countries and their development partners can focus efforts on areas of greatest need.

Attacking maternal, newborn and child deaths means attention and resources. "When attention is focused on a problem and resources are mobilized, we get results," says Mickey Chopra, M.D., Ph.D., UNICEF's chief of health, and a member of the Countdown group. "For example, immunization, use of vitamin A

and treated bed nets, breast-feeding, and treatment for HIV/AIDS are way up in many countries because of resources directed to these areas.

"It's important to create a supportive environment for maternal and newborn health based on respect for women's rights, and the need to establish continuum of care for mothers, newborns and children that integrate programs for reproductive health, safe motherhood, newborn care and child survival, growth and development." For example, if women go to clinics with trained staff or midwives and proper equipment, an estimated 50 percent of mothers and newborns could be saved. If quality antenatal care is routinely provided for women, up to 2/3 of lives could be saved.

Donor countries have increased their giving for maternal, newborn and child health by almost 100 percent to $4 billion a year from 2003 to 2007.

However, the funding gap will be about $20 billion per year between 2011 and 2015, which includes both maternal and child health programs and the cost of improving health systems.

An innovative health financing task force set up by world leaders in 2008 already is working to increase funding to help close the gap.

"The gap is about $16 billion a year more than we are spending now, but it is not out of range," says Dr. Bustreo.

"The emphasis is always on external aid, but internal funds are the main source of health funding. National authorities need to recognize and honor their financial commitments on maternal and child health," says Peter Berman of the World Bank, another Countdown to 2015 member.

According to the new analysis, if the funding gap were filled by 2015, the increased funding would buy:

- Modern methods of family planning for 50 million more couples;
- About 234 million more births in facilities that provide quality care for both normal and complicated deliveries;
- Quality antenatal care for an additional 276 million women;
- Quality postnatal care for an additional 234 million women and newborn babies;
- Appropriate treatment for 164 million cases of child pneumonia;
- An additional 2.5 million health care professionals and 1 million more community health workers.

The results by 2015 would be enormous in the number of lives saved: up to 1 million women, 4.5 million newborn babies, and 6.5 million children aged 1 month to 5 years.

Why High Death Rates

Beyond poverty, the analysis pinpoints the many reasons for continuing high rates of death during childbirth, both of women and newborns.

Most newborn deaths are due to conditions rarely seen in high-income countries: infections, birth complications, preterm birth -- even babies who are just a few weeks preterm often do not survive for lack of simple care.

Women in childbirth die from hemorrhage, infections, hypertensive disorders, obstructed labor, and unsafe abortions. In some countries, HIV/AIDS and malaria are also important causes.

Many of these deaths could be prevented with a maternal and newborn health program that includes continuing prenatal care, hygienic care during childbirth and the postnatal period.

In some parts of the world, traditions add to the risk faced by families. In parts of south Asia, for example, childbirth is considered dirty, so women are forced to deliver their babies in cowsheds, where they must stay for one month. Cords may be cut with dirty tools, leading to possible infection. "Strong cultural practices hide the problem. Families know many mothers and babies will die so they just accept it," says Dr. Lawn. "But this does not mean they do not care. Mourning is hidden."

"Countries are unlikely to meet the goals unless they prioritize the delivery of life-saving interventions to those who need them most," says Dr. Bhutta.

Another major barrier is a shortage of skilled health care and community workers in many parts of the world. One way to ease this shortage is to upgrade skills of existing workers, so that nurses and outreach workers can provide medications and surgeon assistants can perform caesarean sections where no obstetrician is available, as has been done successfully in Mozambique. Another is to recruit and train additional health workers and provide incentives for work in remote and underserved areas.

And, while the need for more research always exists, the failure to use proven techniques more widely poses yet another barrier to rapid progress. Examples are kangaroo mother care, improved techniques to manage child birth, and providing routine postnatal visits to newborns soon after delivery to advise the family on breast feeding and keeping the baby warm, and to check for cord infection or other problems.

Programs and Interventions Known to Work

The new analysis reports on the usage of specific packages of interventions, which, if scaled up, have been proven to reduce the continuing high toll of preventable deaths.

These packages form the core of effective health systems that can deliver a full range of services to assure that every pregnancy is wanted, that every birth is safe, and that every newborn and child is healthy.

A number of these packages of interventions are underutilized and underfunded including:

- Comprehensive family planning
- Skilled birth attendance
- Emergency obstetric care
- Antenatal and postnatal care
- Breastfeeding and child feeding practices
- Prevention and treatment of diarrhea, pneumonia, and malaria

Ensuring these services are available to all women and children who need them would go a long way in reducing mortality and improving the health of women, newborns and children under 5, and get countries closer to reaching MDGs 4 and 5.

Missed Opportunities

Though progress has been made toward meeting those goals, significant challenges remain.

For example, while the use of contraceptives has increased steadily, an estimated 26 percent of women in least developed countries that want to delay or stop childbearing are not using contraceptives. Unintended pregnancies contribute to high mortality and poor health for both mothers and babies, according to the analysis.

While the percentage of women who give birth with the aid of a skilled attendant, defined as an educated midwife, or similarly trained person, with access to the necessary equipment, resources and services, has increased to more than 60 percent, that leaves some 40 percent of women, mostly in Africa and Asia, giving birth without access to skilled obstetric care -- 60 million births each year.

And although an estimated 70 percent of women receive at least one antenatal care visit, even in the poorest countries, the quality of care may not be sufficient. For instance, many of these visits do not include essential blood pressure readings or HIV testing and drugs to prevent HIV transmission to the baby.

"These are lost opportunities," says Cesar Victora of Brazil's Universidad Federal de Pelotas, a member of the Countdown to 2015 group. "We know the service was provided, but not necessarily what was provided at that visit.

"Even when the coverage is high, poor and disadvantaged women living in remote areas and ethnic groups don't necessarily get maternal, newborn and child services. Progress should be measured not only through national averages, but also by how much the poorest mothers and children are benefiting from overall progress. It is an equity issue."

"No woman should die giving life. All pregnancies should be wanted and every childbirth safe for both the woman and the baby," says Laura Laski, M.D., UNFPA's chief of Sexual and Reproductive Health, and H4 representative (WHO, UNFPA, UNICEF and the World Bank) in the planning of the mid-April meeting.

Progress is Possible Even in Poorest Countries

However, all the news is not bad.

Nineteen of the 68 countries with high incidences of maternal, newborn and infant deaths are now moving forward, and experience in several countries that were lagging shows a quick turn-around is possible, even in the poorest countries.

India's Janani Suraksha Yojana (Women's Protection Scheme) was launched in April 2005 under the Government of India's National Rural Health Mission. The program seeks to reduce maternal and neo-natal mortality by promoting institutional delivery and skilled attendance at birth by offering cash payments to women who fulfill the conditions of attending antenatal appointments and seeking skilled care at delivery. These payments are primarily to women below the poverty line.

These benefits reached only 700,000 women in 2005, increasing to 8,380,000 in 2008, more than a 10-fold increase in just a few years. The government realizes that quality of services now needs to be urgently addressed.

Nepal used national cause of death data to design programs that curb child and maternal deaths, developing innovative approaches to bring care closer to home that included community child pneumonia treatment programs and household visits to promote family planning and newborn care. The effort required recruiting and training additional community workers. Offering skilled birth care is a particular challenge with very low coverage (only 19 percent) and is now being addressed by new investments in training midwives.

Malawi, a low-income country with only four pediatricians, has been declared on track for child survival. The Ministry of Health identified the main causes of child death as pneumonia, diarrhea, malaria, HIV, and newborn problems and planned to address those problems with national scale-up of an essential health package, including programs for immunization, malaria control, prevention of mother-to-child HIV transmission, and improved water and sanitation services. In spite of these efforts, diarrhea, pneumonia,

and maternal and newborn care remained problematic, so Malawi trained health surveillance assistants to deliver selected services closer to the community. Over 800 health assistants now offer malaria, diarrhea, and pneumonia treatment (using the latest malaria drugs, zinc for diarrhea, and appropriate antibiotics), and some are being trained to support home based newborn care. To overcome high maternal mortality, facilities are being improved and additional staff is being hired and trained, including non-physicians to undertake emergency cesarean sections. Death rates for children and women are now declining.

Brazil's success in reducing the under 5 death rate by 4.8 percent each year since 1990 is attributed to a sharp decline in inequalities in access to health care. This decline was done through a nationwide, tax-based Unified Health System with no user fees and specific geographical targeting of family health teams to attend the poorest areas of the country. Reducing regional and socioeconomic disparities in health and development have been a central element in Brazil's political agenda for the last 20 years. As a result, primary healthcare coverage is universal, primary care is free for everyone, and even the poorest Brazilians now have access to skilled attendance at birth.

Rwanda has introduced health reforms, which expand coverage across all areas of health care. One approach gives "performance bonuses" for health facilities and hospitals, based on provision of high quality, priority services. From 2005 to 2008, births in health facilities have increased from 39 to 52 percent, the use of insecticide treated bed nets for children under 5 has risen from 4 to 67 percent, and modern contraceptive use has increased from 10 to 28 percent, contributing to a decline in under-5 mortality from 152 to 103 deaths per 100,000 live births.

"We know this global problem can be solved even in the poorest countries," says Dr. Bustreo. "It will take commitment of donors and recipient countries, and considerable ingenuity. We are seeing that Malawi, Nepal, Brazil, and Rwanda are making progress in saving the lives of women and children."

Story Source:

Adapted from materials provided by Partnership for Maternal, Newborn & Child Health, via EurekAlert!, a service of AAAS.

http://www.sciencedaily.com/releases/2010/04/100413121322.htm

How Do Older People Use E-Mail?

Making it easier and remembering the steps to perform tasks is more important than increasing the size of the elements on the interface. (Credit: SINC)

ScienceDaily (Apr. 22, 2010) — Researchers at the Universidad Pompeu Fabra (UPF) have studied how older people interact and use email in their daily life. The study was carried out in social centres in Barcelona and will be used to design new email systems that are more intuitive and accessible.

Electronic mail or email is the internet application used the most, even by older people, who haven't grown up with Information and Computer Technology (ICT), and have had to put in greater effort to learn to use it than younger people. However, social and technological scientists still know very little about how older people or the elderly interact with email systems in their daily life.

"We wanted to understand how older people use email on a daily basis in terms of accessibility, frequency, type of content, relation with other technology and activities, communication models, motivations and interactive experiences," says Sergio Sayago, main author of the study and researcher at UPF.

The ethnographic investigation, published recently in the *International Journal of Human-Computer Studies*, spent three years analysing email use habits of close to 400 people between 64 and 80 years-old in social centres in Barcelona.

"In this context, ethnography consists of spending a lot of time with the users in real-life interaction situations, observing how they use the technology, speaking with them (informal conversations, interviews in groups or individually), and taking notes on almost everything," Sayago explains.

Up until now the email design was carried out in laboratories and was limited to making prototypes. "We asked ourselves what happens in real life," explains the researcher.

Social use of technology

"Older people feel motivated to use ICT as they see it as an important element for feeling part of contemporary society and fighting against the isolation that can increase with age," the study explains.

Researchers have demonstrated that older people use email within a restricted circle of two different social groups: relatives (a few emails a month, but which are detailed and emotional) and close friends (more frequent and exchanging information based on their social life).

"They use email to communicate with their social circles; they don't use it as a means of establishing relationships with people they don't know. For this, they have other more down to earth strategies in their lives such as going to a social centre to a dance, and meeting people there," confirms the researcher.

Independence with the computer

There are three prototypes of email managers designed for older people: SeniorMail, which proposes a redesign of the email manager Outlook Express; Simple Mail, a simulated email system with a user interface simplified to five functions, and Cybrarian, based on fewer functions and an increase in the size of the features.

"We have observed that making it easier and remembering the steps to perform tasks is more important than increasing the size of the elements on the interface. This is clear from the importance that older people place on their independence. They don't want to depend on someone else to be able to send an email and they want to use the same mechanisms as other people," explains the researcher.

The researchers are facilitators at a social centre in Barcelona where they teach new technology to older people and immigrants, so in addition to information on email, they have gathered information on interaction with other technology such as web 2.0, online forms, office applications, to contextualize the results.

"We plan to combine our results with some controlled experiments to better determine the impact of the accessibility barriers that we have identified," the experts conclude.

Story Source:

Adapted from materials provided by FECYT - Spanish Foundation for Science and Technology, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Sergio Sayago, Josep Blat. **Telling the story of older people e-mailing: An ethnographical study**. *International Journal of Human-Computer Studies*, 2010; 68 (1-2): 105 DOI: 10.1016/j.ijhcs.2009.10.004

http://www.sciencedaily.com/releases/2010/04/100419102411.htm

Research Reveals Genetic Secrets Underlying Remarkable Development of the Domestic Chicken

These lines were developed from a common ancestor and show a ten-fold difference in body weight at eight weeks of age after 40 generations of selections for low or high growth. (Credit: Image courtesy of Uppsala University)

ScienceDaily (Apr. 21, 2010) — The domestication of animals and plants is the most important technological innovation during human history. This genetic transformation of wild species has occurred as humans have used individuals carrying favorable gene variants for breeding purposes. In the current issue of *Nature*, an international team led by researchers at Uppsala University, and including researchers from Virginia Tech, has revealed some of the secrets underlying the remarkable development of the domestic chicken.

The domestic chicken has in recent years become the most important and cost-effective source of animal protein world-wide. In the beginning of the 20th century specialized layer (egg-producing) and broiler (meat-producing) chickens were developed. The approach has been remarkably successful and has led to huge improvements in productivity.

"The strategy to study four different populations of layer chickens as well as four broiler populations allowed us to reveal genetic changes of crucial importance for chicken domestication in general as well as changes that were essential for the development of layers or broilers," says Leif Andersson who coordinated the study.

In 2004, a draft genome sequence of the chicken was established by sequencing a single female red junglefowl, the wild ancestor of chickens. The task required a major economic investment (millions of US dollars) and a large international team of scientists. In the current study the researchers have used new sequencing technologies and a modest budget to analyze pools of individuals representing eight different populations of the domestic chicken and a red junglefowl population.

"This is the first study ever where the genetic diversity within and between populations are examined across the whole genome," says Michael Zody, who did his PhD partially on this project and is now a researcher at the Broad Institute. "The new sequencing technologies allow us to address important biological questions that were impossible to study just a few years ago."

A selective sweep takes place when a favorable mutation becomes fixed in a population. This happens in all species during the course of evolution and it happens in domestic animals as a consequence of human-driven selection for favored traits. One of the most interesting findings in this study was a striking selective sweep at the TSHR gene that codes for the thyroid-stimulating hormone receptor. In vertebrates, this protein has a key role in metabolic regulation but also in determining the timing of reproduction as a

response to changes in day length, a trait that is strictly controlled in most wild animals but which is drastically altered in domestic chickens that can reproduce all year around.

"Our discovery that every domestic chicken that we have studied representing populations from Sweden to China carry a mutant form of the TSHR protein strongly suggests that this genetic change was an important step in the evolution of the domestic chicken," says Leif Andersson.

Another very convincing selective sweep was observed in broiler chickens and involved the TBC1D1 gene, a gene that has previously been associated with obesity in humans and the TBC1D1 protein is involved in the regulation of glucose uptake in muscle cells.

"Our study shows that billions of broiler chickens worldwide carry a mutant form of the TBC1D1 gene and we are now very eager to identify the causative mutation at this locus and to reveal the molecular mechanism by which it impacts growth," says Carl-Johan Rubin who was responsible for the bioinformatic analysis of selective sweeps.

"Our study has direct implications for animal breeding and enhances the importance of the domestic chicken as a model organism for biomedical research since we can so effectively reveal genes associated with changes in phenotypic traits," concludes Leif Andersson.

The research team identified a gene found in all of Virginia Tech's high-growth chickens but few of the low-growth ones that appears to regulate appetite – a finding that could have ramifications for both animal and human health studies involving weight. Previous research has shown that appetite, in addition to metabolism, plays a significant role in weight gain or loss in poultry.

The team is also investigating a gene that encodes the thyroid-stimulating hormone receptor protein to determine whether domestication altered the genetic makeup of chickens thousands of years ago. If true, this would be the first time that scientists have identified a mutation in animals caused by domestication.

Story Source:

Adapted from materials provided by Uppsala University.

Journal Reference:

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http://www.sciencedaily.com/releases/2010/03/100310134154.htm

Simple, Low-Cost Steps Enhance Adolescents' Health

Simple, low-cost measures such as wearing a pedometer to inspire walking and spending a few minutes a day meditating can put adolescents on the track toward better health, researchers report. (Credit: Medical College of Georgia)

ScienceDaily (Mar. 15, 2010) — Simple, low-cost measures such as wearing a pedometer to inspire walking and spending a few minutes a day meditating can put adolescents on the track toward better health, researchers report.

These types of side-effect-free steps can quickly help lower important numbers like blood pressure, heart rate and even weight, counteracting today's unhealthy, upward trends among young people, said Dr. Vernon Barnes, physiologist at the Medical College of Georgia's Georgia Prevention Institute.

A positive attitude and family environment increases the effectiveness of the interventions, Dr. Barnes reported in one of three studies presented at the American Psychosomatic Society Annual Meeting in Portland, Ore. The study comparing breathing awareness meditation to health education and life-skills training found that all methods improved blood pressure.

Dr. Barnes, who has studied the impact of mediation on cardiovascular health for more than a decade at MCG, has documented the improved stress reactivity in black adolescents with high normal blood pressures as well as lower blood pressures in black, inner-city adolescents who meditate twice daily.

Meditation also sharpens the mind for education. "When you come to school with a stressed mind, you can't do as well," Dr. Barnes said. "The benefit of calming your mind is preparing it to learn." A review of school records showed meditating adolescents miss fewer days and generally behave better, he added.

Another study showed that the blood pressure of students in a high school-based walking program decreased after just 16 weeks compared with non-participating peers. Dr. Barnes, part of an adult team competing with a group of high school students to see which can walk the farthest, said the pedometer is an incentive to move. "You think about it: that little extra walking will hopefully benefit your health," said the researcher who finds himself making efforts to increase his step numbers daily.

"It all works together, which makes sense," he said, looking at the impact of the techniques over just a few months. While decreases in blood pressure were small -- a 2.5 point reduction in pedometer wearers compared to a 3.5 point increase in the control group -- it's good momentum.

"If you could maintain that decrease into your adult years, it may decrease cardiovascular disease risk," Dr. Barnes said.

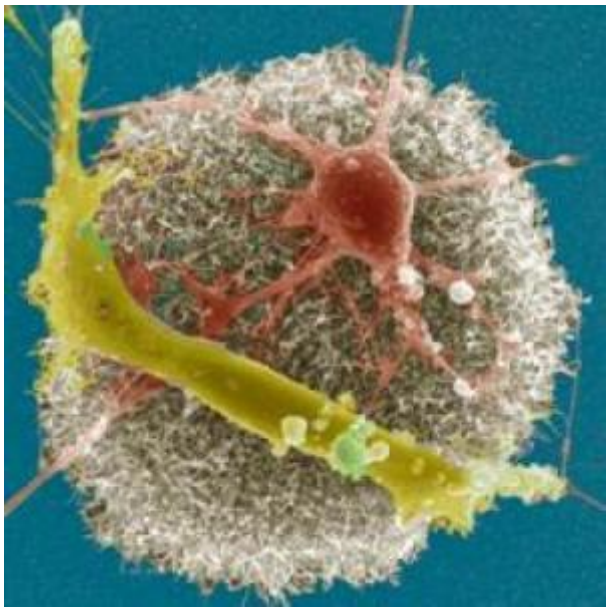
Researchers also reported reductions in anger and anxiety after a dozen, 50-minute classes on the topics taught by health teachers. Psychosocial factors such as anger are known to contribute to a wide range of health problems including elevated blood pressures and heart disease in adulthood. But Williams LifeSkills workshops helped adolescents learn to analyze a situation before responding, to listen and empathize or even stand firm when necessary. "The workshop has scenarios drawn from real life," said Dr. Barnes.

Story Source:

Adapted from materials provided by Medical College of Georgia.

http://www.sciencedaily.com/releases/2010/03/100315181222.htm

Seeing a Bionic Eye on Medicine's Horizon



These are two rat neuronal cells bound to a rough carbon nanotube mat. (Credit: AFTAU)

ScienceDaily (Apr. 21, 2010) — Television's Six Million Dollar Man foresaw a future when man and machine would become one. New research at Tel Aviv University is making this futuristic "vision" of bionics a reality.

Prof. Yael Hanein of Tel Aviv University's School of Electrical Engineering has foundational research that may give sight to blind eyes, merging retinal nerves with electrodes to stimulate cell growth. Successful so far in animal models, this research may one day lay the groundwork for retinal implants in people.

But that's a way off, she says. Until then, her half-human, half-machine invention can be used by drug developers investigating new compounds or formulations to treat delicate nerve tissues in the brain. Prof. Hanein's research group published its work recently in the journal *Nanotechnology*.

Implanting the idea

"We're working to interface man-made technology with neurons," says Prof. Hanein. "It can be helpful in in vitro and in in vivo applications, and provides an understanding of how neurons work so we can build better devices and drugs," she says.

She's developed a spaghetti like mass of nano-sized (one-millionth of a millimetre) carbon tubes, and using an electric current has managed to coax living neurons from the brains of rats to grow on this man-made structure. The growth of living cells on the nano substrate is a very complicated process, she says, but they adhere well to the structure, fusing with the synthetic electrical and physical interface. Using the new technology developed in Prof. Hanein's laboratory, her graduate student Mark Shein has been observing how neurons communicate and work together.

"We are attempting to answer very basic questions in science," Prof. Hanein explains. "Neurons migrate and assemble themselves, and using approaches we've developed, we are now able to 'listen' to the way the neurons fire and communicate with one another using electrical impulses. Listening to neurons 'talking' allows us to answer the most basic questions of how groups of nerves work together. If we can

investigate functional neuronal networks in the lab, we can study what can't be seen or heard in the complete brain, where there are too many signals in one place."

Paging Steve Austin

One application of Prof. Hanein's research is a new approach to aid people with retinal degeneration diseases. There are several retinal diseases which are incurable, such as retinitis pigmentosa, and some researchers are investigating a prosthetic device which could replace the damaged cells.

"Neurons like to form good links with our special nanotechnology, and we're now investigating applications for retinal implants," says Prof. Hanein. "Our retinal implant attempts to replace activity in places of the damaged cells, and in the case of retinal diseases, the damaged photoreceptors."

The team's major breakthrough is creating these man-made living "devices" on a flexible nano-material suited for the small area in the eye where new neuron connection growth would be needed. This is the first step in a long clinical process that may lead to improved vision — and perhaps, one day, a real-life six million dollar man.

Story Source:

Adapted from materials provided by American Friends of Tel Aviv University.

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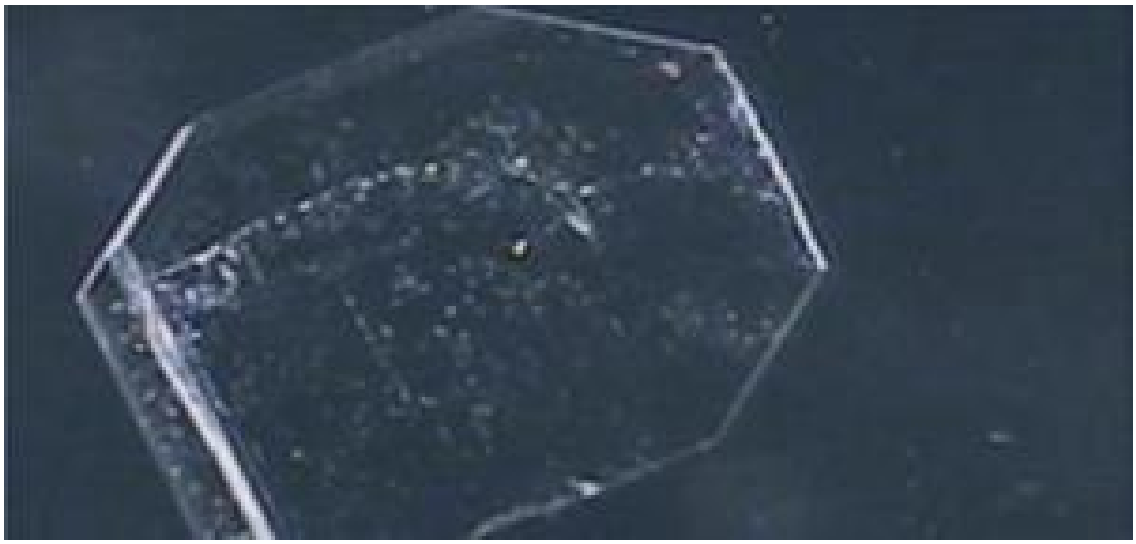
http://www.sciencedaily.com/releases/2010/03/100322143221.htm

'Ancestral Eve' Crystal May Explain Origin of Life's Left-Handedness



Molecules of aspartic acid with a left-handed orientation, shown in crystal form, could be the "ancestral Eve" of all amino acids -- the building blocks of proteins -- in life on Earth. (Credit: American Chemical Society)

ScienceDaily (Apr. 21, 2010) — Scientists are reporting discovery of what may be the "ancestral Eve" crystal that billions of years ago gave life on Earth its curious and exclusive preference for so-called left-handed amino acids. Those building blocks of proteins come in two forms -- left- and right-handed -- that mirror each other like a pair of hands.Their study, which may help resolve one of the most perplexing mysteries about the origin of life, is in ACS' *Crystal Growth & Design*, a bi-monthly journal.Tu Lee and Yu Kun Lin point out that conditions on the primordial Earth held an equal chance of forming the same amounts of left-handed and right-handed amino acids. Nevertheless, when the first forms of life emerged more than 3 billion years ago, all the amino acids in the proteins had the left-handed configuration. That pattern continued right up to modern plants and animals.

The scientists used mixtures of both left- and right-handed aspartic acid (an amino acid) in laboratory experiments to see how temperature and other conditions affected formation of crystals of the material. They found that under conditions that could have existed on primitive Earth, left-handed aspartic acid crystals could have formed easily and on a large scale."The aspartic acid crystal would then truly become a single mother crystal: an ancestral Eve for the whole left-handed population," the article notes.

Story Source:

Adapted from materials provided by American Chemical Society, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Tu Lee, Yu Kun Lin. **The Origin of Life and the Crystallization of Aspartic Acid in Water**. *Crystal Growth & Design*, 2010; 10 (4): 1652 DOI: 10.1021/cg901219f

http://www.sciencedaily.com/releases/2010/04/100421121501.htm

Surfing the Alien Atmosphere of Venus

Venus Express has two solar cell panels per wing comprising alternating rows of standard triple junction solar cells as well as highly reflective mirrors to reduce the operating temperatures. There is twice as much sunlight in Venusian orbit as there is in Earth orbit, plus additional thermal input from the Venusian surface and atmosphere – 75% of sunlight being reflected up from it. In a worst case, this results in worst case to an equivalent of the thermal input from 3.5 Suns. (Credit: ESA)

ScienceDaily (Apr. 21, 2010) — Venus Express has completed an 'aerodrag' campaign that used its solar wings as sails to catch faint wisps of the planet's atmosphere. The test used the orbiter as an exquisitely accurate sensor to measure atmospheric density barely 180 km above the hot planet.

During five aerodrag measurements last week, Venus Express' solar arrays and control systems were operated as one big flying sensor, with the solar arrays rotated at various angles to the direction of flight.

The special configuration exposed the wings to the vanishingly faint wisps of atmosphere that reach to the boundary of space around Venus, generating a tiny but measurable aerodynamic torque, or rotation, on the satellite.

This torque can be measured very accurately based on the amount of correction that must be applied by reaction wheels, which counter-rotate inside the spacecraft to maintain its orientation in space.

Mimicking the vanes of a windmill

Starting on April 19, the solar panels rotated through five daily-changing sets of orientations. While one panel remained perpendicular to the direction of flight, the other rotated in steps, gradually increasing the torque to be counter-balanced by the reaction wheels.

On the last day, 16 April, the solar arrays were rotated at plus and minus 45° to the atmospheric flow, mimicking the vanes of a windmill, in order to gather additional information on the behaviour of the molecules of the atmosphere bouncing off the solar wings.

A very capable satellite

"The aerodrag campaign went without problem, and conclusively demonstrated that Venus Express can be securely and accurately used to sense the density of the planet's atmosphere. Venus Express has shown once again that it is a very capable satellite," said Spacecraft Operations Manager Octavio Camino.

Camino explained that the mission operations team will study last week's results to develop an optimised configuration for aerodrag campaigns in October and in 2011. Aerodrag testing was also conducted in 2008, 2009 and February 2010.

Continued positive results may enable Venus Express to conduct more sophisticated investigations deeper in the atmosphere, which would be of immense interest to planetary scientists.

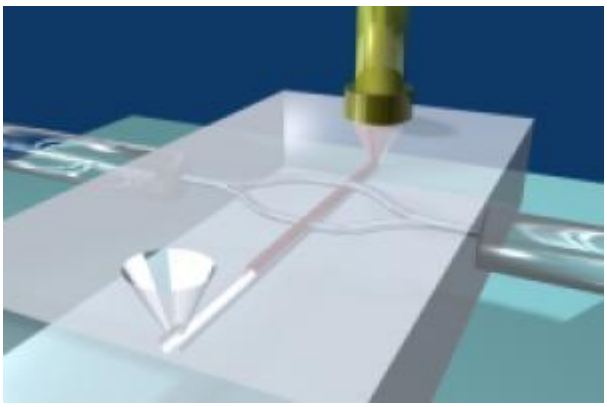
The solar array on Venus Express comprise two symmetrical wings supporting gallium-arsenide solar cells. Their combined 5.7 sq m can generate up to 1400 W of power in Venus orbit.

Story Source:

Adapted from materials provided by European Space Agency.

http://www.sciencedaily.com/releases/2010/04/100421111357.htm

Laser Adds Extra Dimension to Lab-on-Chip



The breakthrough in building optical sensors directly into the structure of labs-on-chips paves the way for on-the-spot medical diagnostics. (Credit: Copyright HIBISCUS)

ScienceDaily (Apr. 21, 2010) — A European research project has shown how to build optical sensors directly into the structure of labs-on-chips. The breakthrough paves the way for on-the-spot medical diagnostics.

People have been working on the 'lab-on-a-chip' concept for more than a decade. The idea relies on microfluidics, where tiny volumes of sample liquids move along microscopic channels cut into a variety of substances including silicon, glass and plastic. True, this technology has progressed phenomenally: it is now possible to separate samples at the molecular level on a chip which is no larger than a postage stamp.

But the lab-on-chip hype usually fails to address a 'big' problem: you usually still need large-scale equipment to detect and identify the molecules flowing inside the microfluidic chips. The fluidics is certainly at the microscale, but the optical molecular detection is still firmly rooted in the macro world of life-size laboratories.

Laser lights the way

Except now an EU-funded project has been able to 'inscribe' features into microfluidic chips, making integrated optical detection a possibility for the first time.

The HIBISCUS consortium (http://www.polimi.it/hibiscus/), involving academic and industrial partners, used a technique called femtosecond laser micromachining. The femtosecond laser emits extremely short light 'flashes' -- each lasting no more than a few millionths of a billionth of a second. This pulsation makes the laser beam extremely intense, and can alter materials in unusual ways. By focusing the beam you can use the laser like a microscopic tool or pen and 'draw' physical features in three dimensions into a thin wafer of glass.

This micromachining technique has already been used to cut intricate components, like gears and motors into silicon. The HIBISCUS team was able to inscribe tracks, called waveguides, into labs-on-chips. The waveguides channel light through the chip, across the microfluidic channels and back out of the chip where it is detected. They could also use the laser to produce the microfluidic channels themselves.

It is now possible to shine a light source (usually a laser) into the sample fluid and detect its absorption or other optical activity directly in the chip, rather than having to take a sample from the chip and analyse it with laboratory equipment.

"This is the first time that waveguides have been put into a lab-on-chip using the relatively straightforward femtosecond laser micromachining process," explains Giulio Cerullo who coordinated the project. "It now means that at last a lab-on-chip can finally be shrunk fully, with optical detection and analysis taking place within the chip."

One exciting demonstration by the project shows that it is possible even to detect small changes in the refractive index of a sample flowing in a microchannel using a three dimensional detector called an

optical interferometer. In this case the waveguides are laid out so that one passes through a microfluidic channel while the other one passes just above it. The liquid flowing in the channel induces a tiny change in the path length of the light between the two waveguides, which is picked up by the interferometer. This makes it possible to detect very small changes in the sample composition.

Immediate results

The project has made prototype labs-on-chips with integrated waveguides for several biological applications, including a DNA-fragment separation and detection assay (which could be used to detect specific disease markers in patient samples) and a chemical microreactor for protein synthesis.

Cerullo's dream is that the lab-on-chip could help doctors perform virtually immediate medical diagnoses in their own practices. They could take a sample from a patient and immediately run it through a small device, which would be able to detect marker molecules -- protein markers for a disease or the telltale DNA sequence of a genetic disorder.

"Once you make detection part of the lab-on-chip, you have miniaturisation of an entire analytical laboratory," remarks Cerullo. "It brings diagnosis to the point of care. A patient goes home without that awful sense of uncertainty hanging over them until they get their test results back. Or they can receive urgent medical treatment -- a day or two's advance on treatment can mean life or death for some cancer patients."

The HIBISCUS consortium includes three commercial SME partners that are all exploiting the results of the project. High Q Laser in Austria is already selling the femtosecond laser that it developed for the project. Lionix, based in the Netherlands, manufactures microfluidic chips and is now looking to make labs-on-chips that incorporate the waveguides. The Dutch firm Zebra Bioscience is developing kits for point-of-care diagnostics.

Disposable diagnostics?

Cerullo reckons that an integrated lab-on-chip would not be prohibitively expensive for medical professionals. He estimates that the initial investment for a lab-on-chip manufacturer to set up the micromachining technology for the waveguides would be around €200,000. Total investment to manufacture fully integrated labs-on-chips may reach several million euros. But this outlay is relatively low once it is spread across the millions of disposable chips that could be sold to medical practices and hospitals around the globe.

The integrated optical detection also makes feasible the idea of using microfluidics as an efficient and more eco-friendly production method for pharmaceutical products.

"Our project is the last piece in the lab-on-chip puzzle," concludes Cerullo. "It will open the door to many exciting applications, especially much faster, on-the-spot medical diagnosis."

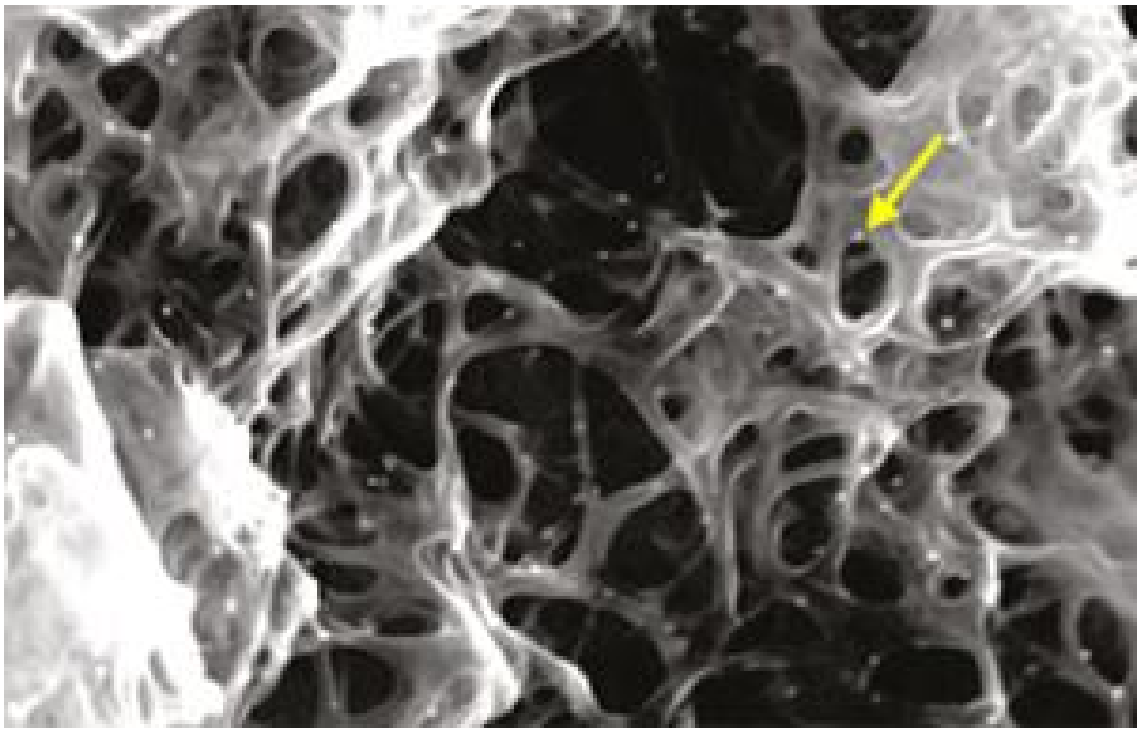
HIBISCUS received funding from the ICT strand of the EU's Sixth Framework Programme for research.

Story Source:

Adapted from materials provided by ICT Results.

http://www.sciencedaily.com/releases/2010/04/100413131937.htm

Carbon Nanotubes Boost Cancer-Fighting Cells



A scanning electron microscope image shows a carbon nanotube bundle used to cluster antigens and boost T cell production. (Credit: Tarek Fahmy/Yale University)

ScienceDaily (Apr. 21, 2010) — Yale University engineers have found that the defects in carbon nanotubes cause T cell antigens to cluster in the blood and stimulate the body's natural immune response. Their findings, which appear as the cover article of the April 20 issue of the journal *Langmuir*, could improve current adoptive immunotherapy, a treatment used to boost the body's ability to fight cancer.

Adoptive immunotherapy involves extracting a patient's blood so that the number of naturally occurring T cells (a type of white blood cell) can reproduce more effectively in the laboratory. Although the body produces its own tumor-fighting T cells, they are often suppressed by the tumor and are too few to be effective. Scientists boost the production of T cells outside the body using different substances that encourage T cell antigens to cluster in high concentrations. The better these substances are at clustering T cell antigens, the greater the immune cell proliferation. Once enough T cells are produced, the blood is transferred back into the patient's body.

The Yale team had previously reported the unexpected effect that carbon nanotubes had on T cell production. They found that the antigens, when presented on the surface of the nanotubes, stimulated T cell response far more effectively than coating other substrates such as polystyrene in the antigens, even though the total amount of antigens used remained the same.

Now they have discovered the reason behind the increased stimulation. They found that the antigens cluster in high concentrations around the tiny defects found in the carbon nanotubes.

"Carbon nanotube bundles resemble a lymph node microenvironment, which has a labyrinth sort of geometry," said Tarek Fahmy, associate professor of chemical engineering and biomedical engineering at Yale and senior author of the paper. "The nanotube bundles seem to mimic the physiology and adsorb more antigens, promoting a greater immunological response."

Current adoptive immunotherapy takes weeks to produce enough T cells, but lab tests showed that the nanotubes produced the same T cell concentration in just one-third the time, Fahmy said.

Carbon nanotubes can cause problems, such as an embolism, when used in the body. But this isn't the case when they are used in blood that has been extracted from the patient, Fahmy said. Next, the team will work on a way to effectively remove the carbon nanotubes from the blood before it is returned to the patient.

"We think this is a really interesting use of carbon nanotubes. It's a way to exploit the unique properties of this material for biological application in a safe way."

Other authors of the paper include lead author Tarek Fadel, Michael Look, Peter Staffier, Gary Haller and Lisa Pfefferle, all of the Yale School of Engineering & Applied Science.

Story Source:

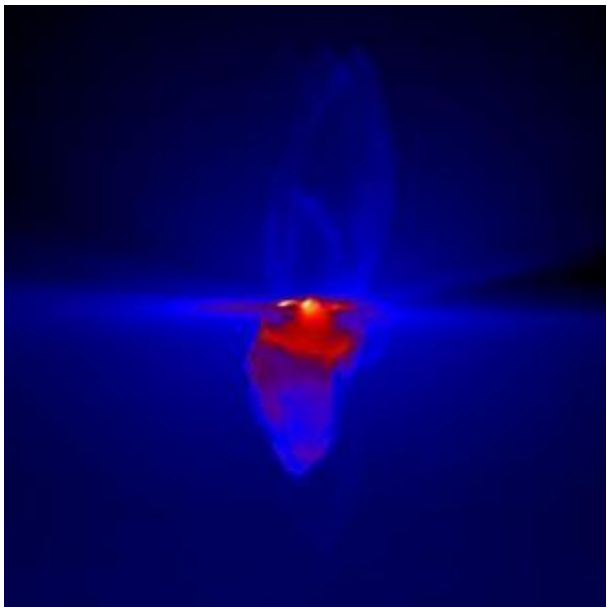
Adapted from materials provided by Yale University.

Journal Reference:

1. Tarek R. Fadel, Michael Look, Peter A. Staffier, Gary L. Haller, Lisa D. Pfefferle, Tarek M. Fahmy. **Clustering of Stimuli on Single-Walled Carbon Nanotube Bundles Enhances Cellular Activation**. *Langmuir*, 2010; 26 (8): 5645 DOI: 10.1021/la902068z

http://www.sciencedaily.com/releases/2010/04/100420132846.htm

Why Nebulae Around Massive Stars Don't Disappear



This is a simulated observation of a massive star viewed along the plane of the disk. This visualization of dust emission traces the density and temperature of the gas cloud that surrounds the star. The regions that are currently ionized (in red) and have been ionized in the past (blue structures) show how the nebula flickers. (Credit: Peters, et al. 2010)

ScienceDaily (Apr. 21, 2010) — The birth of the most massive stars -- those ten to a hundred times the mass of the Sun -- has posed an astrophysical riddle for decades. Massive stars are dense enough to fuse hydrogen while they're still gathering material from the gas cloud, so it was a mystery why their brilliant radiation does not heat the infalling gas and blow it away. New simulations by researchers affiliated with the University of Heidelberg, American Museum of Natural History, the National Autonomous University of Mexico, and the Harvard-Smithsonian Center for Astrophysics show that as the gas cloud collapses, it forms dense filamentary structures that absorb the star's radiation when it passes through them.

A result is that the surrounding heated nebula flickers like a candle flame. The research is published in the current issue of *The Astrophysical Journal*.

"To form a massive star, you need massive amounts of gas," says Mordecai-Mark Mac Low, a co-author and curator in the Department of Astrophysics at the Museum. "Gravity draws that gas into filaments that feed the hungry baby stars."

Stars form when huge clouds of gas collapse. Once the central density and temperature are high enough, hydrogen begins to fuse into helium and the star begins to shine. The most massive stars, though, begin to shine while the clouds are still collapsing. Their ultraviolet light ionizes the surrounding gas, forming a nebula with a temperature of 10,000 degrees Celsius. This suggests that the growth of a massive star should taper off or even cease because the surrounding gas should be blown away by the heating.

First author Thomas Peters, a researcher at the Center of Astronomy at the University of Heidelberg and a former Annette Kade Fellow at the Museum, and colleagues ran gas dynamical simulations on supercomputers at the Texas Advanced Computing Center funded by the National Science Foundation and at the Leibniz and Jülich Computing Centers in Germany. The team's results show that interstellar gas around massive stars does not fall evenly onto the star but instead forms filamentary concentrations because the amount of gas is so great that gravity causes it to collapse locally while falling to the star. The local areas of collapse form spiral filaments. When the massive star passes through them, they absorb its

ultraviolet radiation, shielding the surrounding gas. This shielding explains not only how gas can continue falling in, but why the ionized nebulae observed with radio telescopes are so small: the nebulae shrink again as they are no longer ionized, so that over thousands of years, the nebula appears to flicker, almost like a candle.

"So far, these ionized nebulae were just thought to be expanding bubbles of hot gas, and the measured size of these bubbles was used by observers to infer the age of its central star," says Peters. "Our results are of particular importance because the simulations show that there is, in fact, no direct relation between the size of the nebula and the age of the massive star, so long as the star is still growing. This is the case over a significant fraction of the total lifetime of a massive star."

In addition to Mac Low and Peters, authors include Robi Banerjee and Ralf S. Klessen from the University of Heidelberg, Roberto Galván-Madrid from the National Autonomous University of Mexico, and Eric R. Keto from the Harvard-Smithsonian Center for Astrophysics. The research was funded by the National Science Foundation, the Kade Foundation, and the Deutsche Forschungsgemeinschaft.

Story Source:

Adapted from materials provided by American Museum of Natural History, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Peters et al. **H II Regions: Witnesses to Massive Star Formation**. *The Astrophysical Journal*, 2010; 711 (2): 1017 DOI: 10.1088/0004-637X/711/2/1017

http://www.sciencedaily.com/releases/2010/03/100316101655.htm

Vitiligo 'cancer protection hope'

People with the skin disease vitiligo may have natural protection against skin cancer, a study suggests.

The condition, affecting one in 200, causes pale skin patches that lack pigment and burn easily - leading to an assumed increased risk of skin cancer.

But the University of London study of 4,300 people identified a common gene mutation that both increases the chance of vitiligo and cuts cancer risk.

The findings are reported in the New England Journal of Medicine.

However, study author Professor Dot Bennett, from St George's, University of London, still warned: "Although this may provide some consolation for people with vitiligo, they should still be careful in the sun. As they know, they sunburn quickly, and a lower risk of cancer doesn't mean zero."

" **Although this may provide some consolation for people with vitiligo, they should still be careful in the sun. As they know, they sunburn quickly, and a lower risk of cancer doesn't mean zero** "
Professor Dot Bennett, study author

The findings, reported in the New England Journal of Medicine, emerged from genetic testing of 1,514 patients with vitiligo and 2,813 without.

Seven genes in total were identified that were linked to vitiligo.

Some 70% of the general population had the combination that increases the risk of vitiligo while reducing the risk of malignant melanoma, the most serious form of skin cancer.

The remaining 30% had a different version that raises melanoma risk while lessening the chances of vitiligo.

Although everyone has one of the two variants, neither guarantees that either vitiligo or melanoma will actually develop. Likewise, neither guarantees protection, the study added.

The genes identified were already associated with auto-immune conditions such as type 1 diabetes, rheumatoid arthritis and lupus.

This prompted suggestions the research may even lead to improvements in treatment for vitiligo.

There is currently no cure although the condition can be managed through steroid creams and treatment with ultraviolet light.

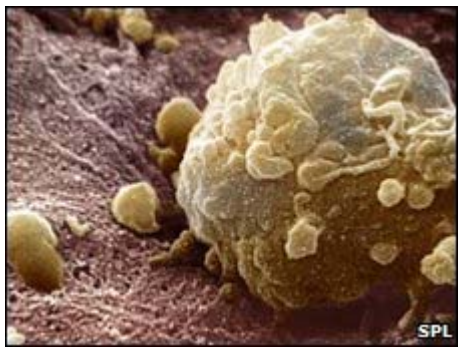
But the study said future therapy may involve some element of "calming down immune response".

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8635844.stm

Published: 2010/04/21 23:21:38 GMT

Cancer gene therapy result hailed

Scientists believe they may have made a "breakthrough" in using gene therapy to treat cancer tumours.



Researchers at Strathclyde University in Glasgow have identified a technique for delivering genes to hard-to-reach tumours without harming healthy tissue.

During lab tests the "seek-and-destroy" therapy resulted in 90% of skin cancer tumours disappearing altogether.

The team is now investigating the technique's effectiveness at treating different forms of the disease.

At present, most gene therapies cannot be delivered to tumours without harming surrounding healthy tissue.

The Strathclyde-led team investigated ways of doing so with the use of the plasma protein transferrin, which carries iron through the blood.

" **To be able to make tumours not just shrink but vanish is a great breakthrough for us, particularly as there's currently no gene therapy of this kind on the market for intravenous administration** "
Dr Christine Dufès Strathclyde University

Carrier proteins for transferrin are often found in large amounts in cancers.

During initial tests on skin cancer cells, it was found that the treatment led to a rapid and sustained regression of the tumours over one month, without any apparent signs of toxicity.

In 90% of cases, the tumours disappeared altogether.

Dr Christine Dufès, a lecturer at the Strathclyde Institute of Pharmacy and Biomedical Sciences, led the research.

"This therapeutic system gave very promising results on cancer treatment in the initial tests we have done," she said.

"To be able to make tumours not just shrink but vanish is a great breakthrough for us, particularly as there's currently no gene therapy of this kind on the market for intravenous administration.

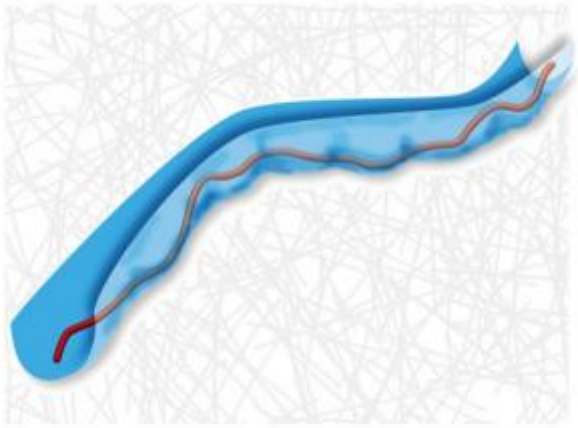
"We have so far tested this seek-and-destroy system in laboratory settings on just one type of cancer - skin cancer- but are currently investigating its efficacy in different cancer models."

The research has been published in the latest edition of the Journal of Controlled Release.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/uk_news/scotland/glasgow_and_west/8634767.stm

Published: 2010/04/21 11:53:11 GMT

New Model of Motion of Molecules That Give Cells Structure



Researchers at the University of Illinois found that actin filaments (red) move in a path (blue) with an irregular diameter, instead of a cylinder as widely accepted. (Credit: Image courtesy of Bo Wang)

ScienceDaily (Apr. 21, 2010) — Understanding the steps to the intricate dance inside a cell is essential to one day choreographing the show. By studying the molecules that give a cell its structure, University of Illinois researchers are moving closer to understanding one of those steps: the conga line.

Led by Steve Granick, Founder Professor of Engineering and professor of materials science and engineering, of chemistry, of chemical and biomolecular engineering, and of physics at the U. of I., the team will publish its findings in the journal *Physical Review Letters.*

Long chains of the molecule actin form filaments that are a key component of the matrix that give cells structure. They play a role in numerous cellular processes, including signaling and transport. Similar polymers are used in applications from tires to contact lenses to the gels used for DNA and protein analyses.

Long actin filaments display snakelike movement, but their serpentine wriggling is limited by crowding from other filaments in the matrix. Researchers have long assumed that actin filaments could move anywhere within a confined cylinder of space, like a snake slithering through a pipe.

However, Granick and his research group have created a new model showing that the filaments' track isn't a perfect cylinder after all. Rather than a snake in a pipe, a filament moves more like a conga line on a crowded dance floor: Sometimes it's a tight squeeze.

To track the filaments' motion, the Illinois team used a novel approach. In the past researchers have observed the entire large molecule, which was like trying to figure out a conga line's trajectory by watching the entire crowd writhing on the dance floor.

"But," Granick said, "if I'm able to follow just one person in the crowd, I know a lot more about how the conga line is moving."

Granick and his team tagged a few individual links in the molecular chain with a tiny fluorescent dye and monitored how those moved as the filament slithered along. In the conga line analogy, this approach would be like giving neon shirts to a few people at various points in the line, turning on black lights, and tracking the neon-clad dancers' motion to map out the conga line's path around the floor.

"What we found is that, as the filaments slither, sometimes they're more free and sometimes they're more tightly tangled up with each other," Granick said. "Just like in a crowded place, you can only move through the empty spaces."

Next, the team will focus on further improving their model to include a molecule's forward motion as well as its lateral wiggling. "So far we've been able to see the conga line bending, moving sideways, and now we want to see it move in the direction it's pointing," Granick said.

"That's the missing link in completing this picture, which will lead to improved understanding of mechanical properties for all the situations where these filaments appear."

The U.S. Department of Energy-funded team also included graduate students Bo Wang (lead author), Juan Guan and Stephen Anthony, research scientist Sung Chul Bae and materials science and engineering professor Kenneth Schweizer.

Story Source:

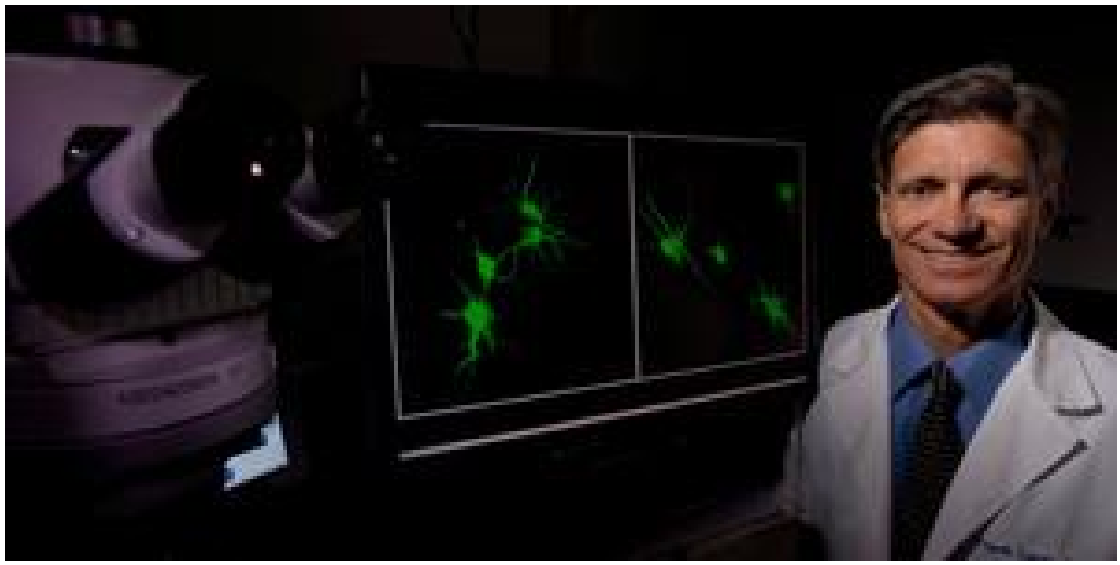
Adapted from materials provided by University of Illinois at Urbana-Champaign.

Journal Reference:

1. Bo Wang, Juan Guan, Stephen M. Anthony, Sung Chul Bae, Kenneth S. Schweizer, and Steve Granick. **Confining Potential when a Biopolymer Filament Reptates**. *Physical Review Letters*, 2010; 104 (11): 118301 DOI: 10.1103/PhysRevLett.104.118301

http://www.sciencedaily.com/releases/2010/03/100316124233.htm

Small Molecules Mimicking Key Brain Growth Factor Identified



Frank Longo says the discovery of several small molecules could open the door to new therapies for a variety of brain disorders. (Credit: Steve Fisch Photography)

ScienceDaily (Apr. 21, 2010) — Stanford University School of Medicine researchers have identified several small molecules that mimic a key but cumbersome protein in the brain, a discovery that could open the door to new therapies for a variety of brain disorders. The protein, designated by the acronym BDNF, is known to be involved in important brain functions that include memory and learning.

"These small molecules could be the basis of drugs that provide entirely new avenues of treatment for a large number of neuropsychiatric disorders such as Alzheimer's, Huntington's and depression," said Frank Longo, MD, PhD, professor and chair of neurology and neurological sciences and senior author of a study to be published online April 19 in the *Journal of Clinical Investigation*.

BDNF belongs to a family of proteins called nerve growth factors, which are critical during development of the nervous system. When a growth factor binds to its receptor on the surface of a neuron, or nerve cell, it can trigger a cascade of signals inside the cell that direct the cell to survive, grow a projection extending to nearby or distant cells, or form a specialized connection with another cell that lets those two cells communicate. And in a few areas of the brain where new nerve cells can be formed, BDNF promotes this process. But its activity is diminished in certain neurodegenerative disorders, such as Huntington's disease. Even in healthy individuals, its levels decline gradually with age.

Using BDNF itself as a therapeutic drug would be tough, Longo said, as protein drugs are not only costly to make but can't be taken orally (our digestive tracts make no distinctions between proteins in pills and proteins in Porterhouse steaks) and so would have to be injected. Even then, BDNF is very rapidly broken down in the body. "It lasts for only about a minute in the blood," said Longo, who also holds the George and Lucy Becker Professorship. Finally, the blood-brain barrier, which has evolved to protect the brain from undesirable foreign substances, would effectively bar entry to blood-borne BDNF. "So for neurologic disease, it won't reach its target."

"BDNF is a dominant and critically important molecule in the central nervous system," said neurologist Dale Bredesen, MD, a professor and founding president at the Buck Institute for Aging Research, in Novato, Calif., who was not involved in the study but is familiar with the research. "This is an important study. It's a first step in being able to develop molecules for human studies that are going to be valuable for a number of conditions, including neurodegenerative conditions and head trauma."

Possibly as important to other researchers as these molecules' therapeutic potential is the method by which they were found. The work was done in collaboration with Steven Massa, MD, PhD, a neurologist at the University of California-San Francisco and at the San Francisco Veterans Affairs Medical Center, who designed the computer search that led to the selection of potentially active molecules to be tested in the Longo laboratory. Massa shares first authorship of the study with Tao Yang, PhD, a senior scientist in Longo's lab at Stanford and, before that, at the University of North Carolina. Yang conducted many of the key bioassays to show that those compounds were, in fact, active in living systems.

First, somewhere around 1 million substances of known chemical structure were screened "in silico," i.e., via a computer search for characteristics that indicated they were structurally similar to a particular portion corresponding to perhaps about 5 percent of the lengthy BDNF protein. This particular part of the molecule is believed critical to BDNF's ability to bind to its receptor, called TrkB, which sits on the surface of brain cells.

Massa, whose lab was responsible for the computer screening operation, said the search took only several hours -- although programming the huge set of virtual compounds (which, like the books in a library, can be checked out time and again by multiple users) took a few months.

Of the million molecules tested, about 2,000 gave signs of having possible BDNF-like TrkB-binding activity. To narrow this list, the investigators used a number of rules of thumb about what kind of molecule makes a drug likely to be nontoxic, more easily absorbed and so forth. "We ended up with 14 that looked pretty good," said Longo.

But those compounds, at this point, were merely virtual, consisting of ones and zeros in electronic circuits as opposed to powders in beakers. It was necessary for the researchers to get their hands on the real ones from commercial sources. "We engaged the service of commercial small-molecule brokers, who go out and find them. These are often molecules that have no known purpose. They might have been a side reaction from a previous project, and the chemist just keeps it sitting on the shelf and there's no known use for it," Longo said.

Longo and his colleagues were able to obtain seven such molecules from commercial sources. Yang then performed laborious biological assays to see if the compounds lived up to their in-silico billing. For instance, did they keep neurons cultured in a dish from dying, as BDNF does?

"We used neurons that come from a part of a mouse's brain that is quite sensitive to neurodegenerative processes," Longo said. "Just growing in tissue culture is challenging for them. When they're in the brain they have access to BDNF. When you pull them out of the brain and grow them in a tissue-culture dish, if you don't give them BDNF, they'll die."

Of the seven tested molecules, five had the BDNF-like ability to prevent neurons cultured in a dish from dying. The four most active are discussed in the new paper.

Importantly, these molecules bound only to TrkB. In contrast, BDNF binds to at least one other nerve-cell-surface receptor called p75. "It's thought that, when BDNF interacts with p75, it may promote pain or other deleterious functions," Longo said. "So a second advantage of our small molecules is that we're selectively targeting TrkB, which gives us an opportunity to avoid the negative effects that the natural protein might cause."

"It's very difficult to develop small molecules that mimic much larger proteins, often because the proteins and their receptors interact along very large surface areas," said Bredesen, the Buck Institute neurologist. "To be able to do that successfully, which they did, is an important step."

The patents for these four compounds are held by the University of North Carolina and UCSF, where Longo worked before coming to Stanford. While at UNC, Longo founded PharmatrophiX, a company

focused on the commercial development of small molecules similar to and including those identified in this study.

Funding for the study was provided by the Institute for the Study on Aging, the Alzheimer's Association and the U.S. departments of Defense and Veterans Affairs. Other Stanford co-authors were research assistant Dean Nehama and neurology instructor Jayakumar Rajadas, PhD.

Story Source:

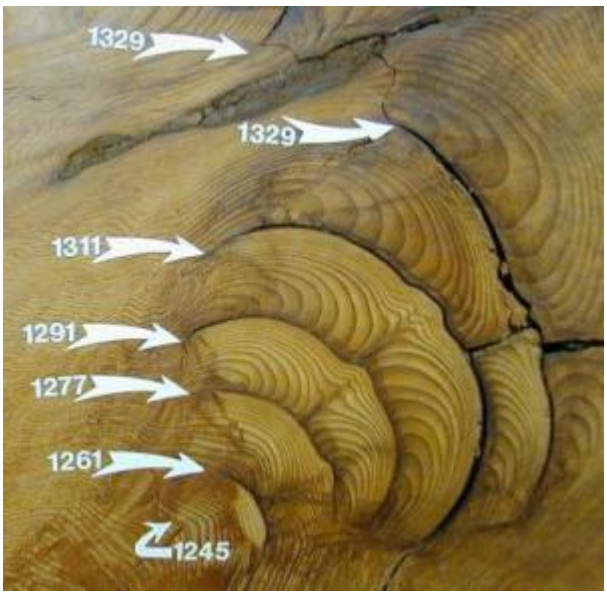
Adapted from materials provided by Stanford University Medical Center.

Journal Reference:

1. Stephen M. Massa et al. **Small molecule BDNF mimetics activate TrkB signaling and prevent neuronal degeneration in rodents**. *Journal of Clinical Investigation*, April 19, 2010 DOI: 10.1172/JCI41356

http://www.sciencedaily.com/releases/2010/04/100419172842.htm

Giant Sequoias Yield Longest Fire History from Tree Rings



This cross-section of a giant sequoia tree shows some of the tree-rings and fire scars. The numbers indicate the year that a particular ring was laid down by the tree. (Credit: Tom Swetnam.)

ScienceDaily (Apr. 21, 2010) — A 3,000-year record from 52 of the world's oldest trees shows that California's western Sierra Nevada was droughty and often fiery from 800 to 1300, according to new research.

Scientists reconstructed the 3,000-year history of fire by dating fire scars on ancient giant sequoia trees, *Sequoiadendron giganteum*, in the Giant Forest of Sequoia National Park. Individual giant sequoias can live more than 3,000 years.

"It's the longest tree-ring fire history in the world, and it's from this amazing place with these amazing trees." said lead author Thomas W. Swetnam of the University of Arizona in Tucson. "This is an epic collection of tree rings."

The new research extends Swetnam's previous tree-ring fire history for giant sequoias another 1,000 years into the past. In addition, he and his colleagues used tree-ring records from other species of trees to reconstruct the region's past climate.

The scientists found the years from 800 to 1300, known as the Medieval Warm Period, had the most frequent fires in the 3,000 years studied. Other research has found that the period from 800 to 1300 was warm and dry.

"What's not so well known about the Medieval Warm Period is how warm it was in the western U.S.," Swetnam said. "This is one line of evidence that it was very fiery on the western slopes of the Sierra Nevada -- and there's a very strong relationship between drought and fire."

Droughts are typically both warm and dry, he added.Knowing how giant sequoia trees responded to a 500-year warm spell in the past is important because scientists predict that climate change will probably subject the trees to such a warm, dry environment again, said Swetnam, a UA professor of dendrochronology and director of UA's Laboratory of Tree-Ring Research.

During the Medieval Warm Period extensive fires burned through parts of the Giant Forest at intervals of about 3 to 10 years, he said. Any individual tree was probably in a fire about every 10 to 15 years.

The team also compared charcoal deposits in boggy meadows within the groves to the tree-ring fire history. The chronology of charcoal deposits closely matches the tree-ring chronology of fire scars.

The health of the giant sequoia forests seems to require those frequent, low-intensity fires, Swetnam said. He added that as the climate warms, carefully reintroducing low-intensity fires at frequencies similar to those of the Medieval Warm Period may be crucial for the survival of those magnificent forests, such as those in Sequoia and Kings Canyon National Parks.

Since 1860, human activity has greatly reduced the extent of fires. He and his colleagues commend the National Park Service for its recent work reintroducing fire into the giant sequoia groves.

The team's report was published in the electronic journal *Fire Ecology* in February.

To study tree rings, researchers generally take a pencil-sized core from a tree. The oldest rings are those closest to the center of the tree. However, ancient giant sequoias can have trunks that are 30 feet in diameter -- far too big to be sampled using even the longest coring tools, which are only three feet long.

To gather samples from the Giant Forest trees, the researchers were allowed to collect cross-sections of downed logs and standing dead trees, he said. It turned out to be a gargantuan undertaking that required many people and many field seasons.

"We were sampling with the largest chain saws we could find -- a chain-saw bar of seven feet," he said. "We were hauling these slabs of wood two meters on a side as far as two kilometers to the road. We were using wheeled litters -- the emergency rescue equipment for people -- and put a couple hundred pounds on them."

To develop a separate chronology for past fires, co-authors R. Scott Anderson and Douglas J. Hallett looked for charcoal in sediment cores taken from meadows within the sequoia groves.

"We can compare the charcoal and tree-ring fire records. It confirms that the charcoal is a good indicator of past fires," Swetnam said.

Such charcoal-based fire histories can extend much further into the past than most tree-ring-based fire histories, he said. The charcoal history of fire in the giant sequoia groves extends back more than 8,000 years.

Increasingly, researchers all over the world are using charcoal to reconstruct fire histories, Swetnam said. Many scientists are analyzing the global record of charcoal to study relationships between climate, fire and the resulting addition of carbon dioxide to the atmosphere.

Swetnam's co-authors are Christopher H. Baisan and Ramzi Touchan of the University of Arizona; Anthony C. Caprio of Sequoia and Kings Canyon National Parks in Three Rivers, Calif.; Peter M. Brown of the Rocky Mountain Tree-Ring Research and Colorado State University in Fort Collins; R. Scott Anderson of Northern Arizona University in Flagstaff; and Douglas J. Hallett of the University of Calgary in Alberta, Canada.The National Park Service, the U.S. Geological Survey, Mountain Home Demonstration State Forest and Calaveras Big Trees State Park provided funding.

Story Source:

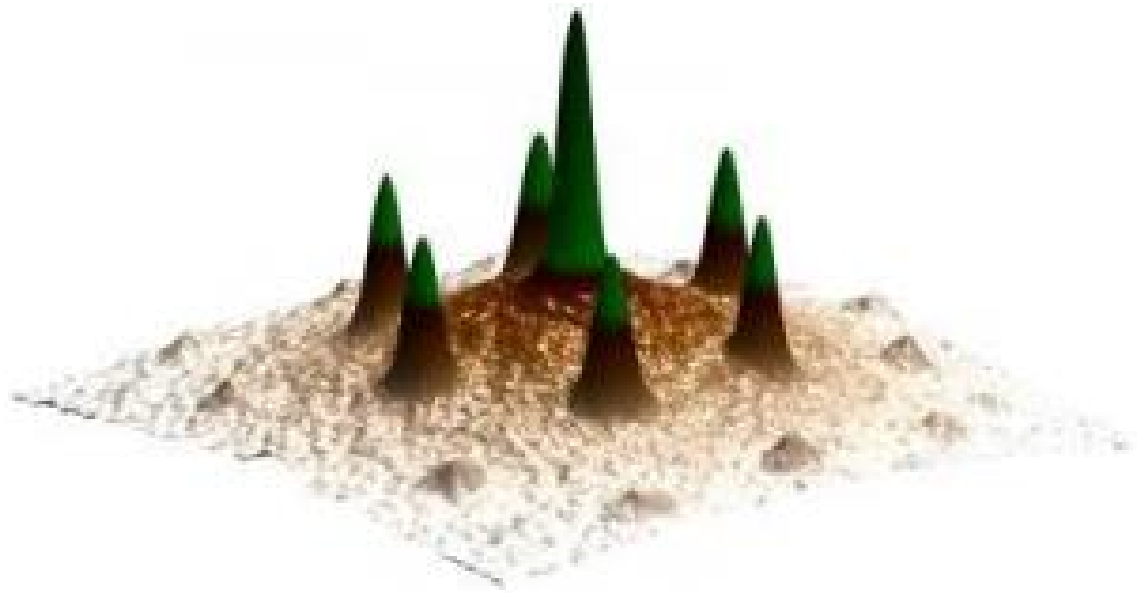
Adapted from materials provided by University of Arizona.

Journal Reference:

1. Thomas W. Swetnam, Christopher H. Baisan, Anthony C. Caprio, Peter M. Brown, Ramzi Touchan, R. Scott Anderson, Douglas J. Hallett. **Multi-Millennial Fire History of the Giant Forest, Sequoia National Park, California, USA**. *Fire Ecology*, 2009; 5 (3): 120 DOI: 10.4996/fireecology.0503120

http://www.sciencedaily.com/releases/2010/03/100318093300.htm

Graphene: What Projections and Humps Can Be Good for



A residual interaction with the SiC substrate causes the formation of the six-fold satellite reflex structure. (Credit: Christoph Tegenkamp, Leibniz University Hanover)

ScienceDaily (Apr. 21, 2010) — At present, graphene probably is the most investigated new material system worldwide. Due to its astonishing mechanical, chemical and electronic properties, it promises manifold future applications -- for example, in microelectronics. The electrons in graphene are particularly movable and could, therefore, replace silicon which is used today as the basic material of fast computer chips.

In a research cooperation, scientists of Leibniz University Hanover and of the Physikalisch-Technische Bundesanstalt (PTB) have now investigated in which way a rough base affects the electronic properties of the graphene layer. Their results suggest that it will soon be possible to control plasmons, i.e. collective oscillations of electrons, purposefully in the graphene, by virtually establishing a lane composed of projections and humps for them.

The results were published in the current edition of the *New Journal of Physics*.

The structure of graphene itself is fascinating: It consists of exactly one single, regular layer of carbon atoms. To manufacture this incredibly thin layer absolutely neatly is a great challenge. A possible method to recipitate graphene extensively on an insulating substrate is epitaxy, i.e. the controlled growth of graphene on insulating silicon carbide. For this purpose, a silicon carbide crystal is heated in vacuum. Starting from a specific temperature, carbon atoms migrate to the surface and form a monoatomic layer on the -- still solid -- silicon carbide. An important question for later applications is, how defects and steps of the silicon carbide surface affect the electronic properties of the graphene grown on it.

Within the scope of a research cooperation between PTB and Leibniz University Hanover, the influence of defects in the graphene on the electronic properties has been investigated. During the investigations, special attention was paid to the influence of the defects on a special electronic excitation, the so-called plasmons.

By different sample preparation, first of all silicon carbide crystals with different surface roughness and, thus, with a different concentration of surface defects were investigated, on which, subsequently,

graphene formed. The influence of the defects on the plasmon excitations was then investigated by means of low-energy electron diffraction (SPA-LEED) and electron loss spectroscopy (EELS).

The process revealed a strong dependence of the lifetime of plasmon on the surface quality. Defects, as they are caused on step edges and grain boundaries, strongly impede the propagation of the plasmons and drastically shorten their lifetime. Here it is remarkable that the other electronic properties of the plasmons, in particular their dispersion, remain largely unaffected.

This opens up interesting possibilities for the future technical application and use of plasmons (the so-called "plasmonics") in graphene. By selective adjustment of the surface roughness, different graphene ranges could be generated in which the plasmons are either strongly dampened or can propagate almost unobstructedly. In this way, the plasmons could be conducted along "plasmon conductors" with low surface roughness specifically from one point of a graphene chip to another.

Story Source:

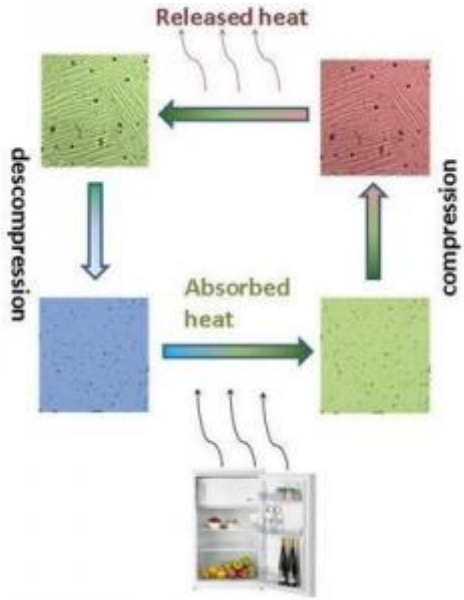
Adapted from materials provided by Physikalisch-Technische Bundesanstalt (PTB), via EurekAlert!, a service of AAAS.

Journal Reference:

1. T Langer, J Baringhaus, H Pfnür, H W Schumacher, C Tegenkamp. **Plasmon damping below the Landau regime: the role of defects in epitaxial graphene**. *New Journal of Physics*, 2010; 12 (3): 033017 DOI: 10.1088/1367-2630/12/3/033017

http://www.sciencedaily.com/releases/2010/04/100419102415.htm

New Material for More Ecological, Efficient and Economic Refrigeration Systems



Schematic representation of a refrigerator system based on the compression of a solid material. During decompression, the solid undergoes a phase transition that lowers its temperature. The cold solid absorbs heat, cooling the refrigerator. In the next stage, the solid is compressed, returning it to its original phase and increasing its temperature. Finally, the solid releases the excess heat into the atmosphere. (Credit: Image courtesy of Universidad de Barcelona)

ScienceDaily (Apr. 21, 2010) — Two teams based at the Barcelona Knowledge Campus, one from the University of Barcelona (UB) and one from the Universitat Politècnica de Catalunya (UPC), have worked with a group from the University of Duisburg-Essen (Germany) to develop a new solid material that produces a caloric effect under hydrostatic pressure (solid-state barocaloric effect). The work was carried out using a high-pressure system developed by the UPC, which is the only one of its type in Spain.

The research is described in an article published in the scientific journal *Nature Materials* and was inspired by guidelines in the Kyoto protocol on renewing current refrigeration systems based on the compression of harmful gases.

Research into materials showing large caloric effects close to room temperature is one of the areas currently being explored to develop new refrigeration systems. Until recently, the most promising materials for applications in this field were *giant magnetocaloric* materials, which change temperature under the influence of an external magnetic field. The authors of this new study show that application of a moderate hydrostatic pressure to a nickel-manganese-indium alloy (Ni-Mn-In) produces results comparable to those achieved with the most effective magnetocaloric materials.

According to Lluís Mañosa, a professor with the Department of Structure and Constituents of Matter at the UB and principal investigator of the study, "the aim of this field of research is to identify materials that are efficient, economic and environmentally respectful, and the advantages of the alloy used in this study is that all of the component materials meet these requirements."

In addition, Antoni Planes, a professor with the same UN department, explains that, "this type of material can produce much greater caloric effects with only slight variations in pressure, which makes it ideal for domestic refrigeration systems (refrigerators, air conditioning, etc.)." When these alloys are submitted to an external field, either magnetic or pressure, the material undergoes a solid-state phase transition, and Lluís Mañosa explains that, "this phase change generates a considerable latent heat exchange." The

physical principle involved is the same as the effect observed when an ice cube is placed into a glass of water: the ice absorbs heat from the water, lowering its temperature.

The experiments were carried out using a unique high-pressure system developed by the Materials Characterization Group at UPC, directed by Josep Lluís Tamarit, a professor with the Department of Nuclear Physics and Engineering. The system was designed to measure the temperatures during state changes according to the pressure and heat exchanged in the process.

According to the researcher Maria Barrio, who works for the same UPC department and co-authored the study, "studying the behaviour of materials under different pressures has a wide range of uses in many fields," and applications include various types of refrigeration systems, such as domestic refrigerators and air-conditioning systems, food storage facilities, industrial machinery and supercomputers. Scientists have understood the magnetocaloric effect for some time, and it has been used extensively in work requiring extremely low temperature, but it was not until the 1990s that experts discovered materials capable of producing a large magnetocaloric effect close to room temperature, or *giant magnetocaloric effect*.

In 2005, an article in *Nature Materials* presented the inverse magnetocaloric effect, under which the temperature of a material submitted to an external magnetic field decreases instead of increasing, which is the standard response of most magnetic materials.

The study, carried out as preparation for the doctoral thesis of Xavier Moya, under the direction of Lluís Mañosa (UB), was awarded the 2009 Ramon Margalef Prize by the UB Board of Trustees.

In addition to the barocaloric effect described above, the Ni-Mn-In alloy also exhibits the inverse magnetocaloric effect. As such, the magnetic field can be combined with exertion of hydrostatic pressure to produce the caloric effect, which can be modulated with a series of parameters to control the temperature. With this new material it is possible to observe the pressure and the magnetic field to control the state change at a desired temperature.

Story Source:

Adapted from materials provided by Universidad de Barcelona, via AlphaGalileo.

Journal Reference:

1. Lluís Mañosa, David González-Alonso, Antoni Planes, Erell Bonnot, Maria Barrio, Josep-Lluís Tamarit, Seda Aksoy, Mehmet Acet. **Giant solid-state barocaloric effect in the Ni-Mn-In magnetic shape-memory alloy**. *Nature Materials*, 2010; DOI: 10.1038/nmat2731

http://www.sciencedaily.com/releases/2010/04/100416193722.htm

How Ancient Flowering Plants Grew: Early Angiosperms Were Weedy, Fast-Growing

Scale bar = 1 cm. The specimen is from the Smithsonian Institution (USNM 222855A). (Credit: Courtesy of Dana Royer, Wesleyan University, Middletown, Conn.)

ScienceDaily (Apr. 20, 2010) — Fossils and their surrounding matrix can provide insights into what our world looked like millions of years ago. Fossils of angiosperms, or flowering plants (which are the most common plants today), first appear in the fossil record about 140 million years ago. Based on the material in which these fossils are deposited, it is thought that early angiosperms must have been weedy, fast-growing shrubs and herbs found in highly disturbed riparian stream channels and crevasses.

Dana Royer from Wesleyan University, Connecticut, and colleagues wanted to see if aspects of a fossil plant's life history, such as its growth strategy, could be determined from its morphology rather than from the matrix in which it was deposited. Could this technique corroborate the idea that these ancient plants were fast-growing species? And, importantly, how common was this life history strategy for plants 100 Ma? The results of their research are published in the March issue of the *American Journal of Botany.*

The authors first needed to assess whether aspects of leaf morphology in living plants today could accurately predict their life-history strategies. In previous research, Royer and colleagues had found that two simple measurements -- petiole width and leaf area -- could tell a lot about the ecophysiology of a plant. They found that the ratio of petiole width (squared) to leaf area is correlated to a leaf's dry mass per area.

"Leaf mass per area is a measure of the density or thickness of leaves, and it is strongly linked to how quickly a plant turns over its nutrient resources," Royer said. "Thin, cheaply built leaves (low leaf mass per area) are typically associated with plants with fast growth rates, and plants like these are usually most competitive in highly disturbed environments such as riparian corridors because their rapid growth allows them to be more opportunistic."

The authors measured the petioles and leaf areas of 93 species of living conifers and 58 species of herbaceous angiosperms and compared the resulting leaf mass per areas to those of previously published woody angiosperms. They found that these three groups could be distinguished based on their leaf mass per areas: for a given petiole width, herbaceous herbs tended to have 43%-75% lower leaf mass per area than woody angiosperms, and conifers had 19%-58% higher leaf mass per area than woody angiosperms.

The beauty of this methodology is that leaf petiole width and leaf area are measurable in many fossil specimens. Royer stated that they then used this methodology to "estimate the leaf mass per area for some of the oldest known angiosperm leaf fossils." They measured 179 fossil specimens representing 30 species from three Albian (110-105 Ma) sites across the United States.

"The majority of the fossils measured in our study have low leaf mass per area," noted Royer, supporting the idea that early angiosperms were fast-growing species similar to the flora found in riparian habitats today. If a similar relationship as today is assumed, then all of the fossil angiosperm species had leaf lifespans of less than 12 months. "This means the unrivalled capacity for fast growth observed today in many angiosperms was in place by no later than the Albian (110 Ma ago)."

"While this doesn't tell us anything directly about the earliest angiosperms -- the oldest angiosperm pollen is around 140 Ma old -- the Albian marks the time when angiosperms begin to be very diverse and important ecologically," Royer concludes. "It is likely that explosive growth is one reason for the success of angiosperms."

Story Source:

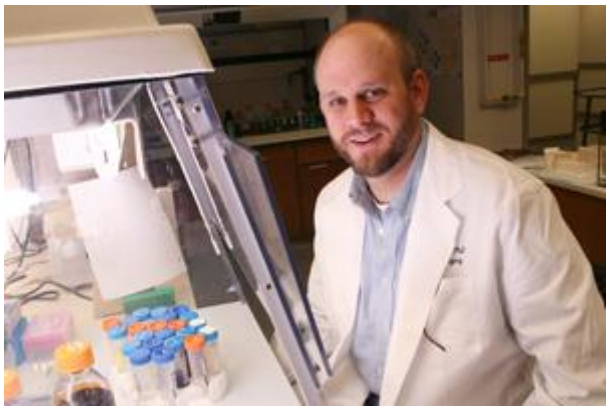
Adapted from materials provided by American Journal of Botany, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Dana L. Royer, Ian M. Miller, Daniel J. Peppe, and Leo J. Hickey. **Leaf economic traits from fossils support a weedy habit for early angiosperms**. *American Journal of Botany*, 2010; 97 (3): 438 DOI: 10.3732/ajb.0900290

http://www.sciencedaily.com/releases/2010/03/100323110101.htm

Chemotherapy Plus Synthetic Compound Provides Potent Anti-Tumor Effect in Pancreatic Cancers



Researchers led by Dr. Rolf Brekken have shown in mice that pancreatic cancer cells dramatically regress when treated with chemotherapy in combination with a synthetic "death-promoting" compound. (Credit: Image courtesy of UT Southwestern Medical Center)

ScienceDaily (Apr. 20, 2010) — Human pancreatic cancer cells dramatically regress when treated with chemotherapy in combination with a synthetic compound that mimics the action of a naturally occurring "death-promoting" protein found in cells, researchers at UT Southwestern Medical Center have found.

The research, conducted in mice, appears in the March 23 issue of *Cancer Research* and could lead to more effective therapies for pancreatic and possibly other cancers, the researchers said.

"This compound enhanced the efficacy of chemotherapy and improved survival in multiple animal models of pancreatic cancer," said Dr. Rolf Brekken, associate professor of surgery and pharmacology and the study's senior author. "We now have multiple lines of evidence in animals showing that this combination is having a potent effect on pancreatic cancer, which is a devastating disease."

In this study, Dr. Brekken and his team transplanted human pancreatic tumors into mice, then allowed the tumors to grow to a significant size. They then administered a synthetic compound called JP1201 in combination with gemcitabine, a chemotherapeutic drug that is considered the standard of care for patients with pancreatic cancer. They found that the drug combination caused regression of the tumors.

"There was a 50 percent regression in tumor size during a two-week treatment of the mice," Dr. Brekken said. "We also looked at survival groups of the animals, which is often depressing in human therapeutic studies for pancreatic cancer because virtually nothing works. We found not only significant decrease in tumor size, but meaningful prolongation of life with the drug combination."

The drug combination was also effective in an aggressive model of spontaneous pancreatic cancer in mice.

The compound JP1201 was created in 2004 by UT Southwestern researchers to mimic the action of a protein called Smac. The researchers discovered Smac in 2000 and found that this protein plays a key role in the normal self-destruction process present in every cell.

Cell death, or apoptosis, is activated when a cell needs to be terminated, such as when a cell is defective or is no longer needed for normal growth and development. In cancer cells, this self-destruct mechanism is faulty and lead to breaks in the cell-death cascade of events. The synthetic Smac, or Smac mimetic, developed at UT Southwestern inhibits these breaks, allowing the cell to die.

"In essence, we're inhibiting an inhibitor," Dr. Brekken said. "And we're allowing the apoptotic cascade to kick off, resulting in the death of cancer cells."

UT Southwestern researchers are using Smac mimetics in breast and lung cancer research, as well. Dr. Brekken said the next step is to develop a compound based on JP1201 that can be tested in humans in clinical trials.

Other UT Southwestern researchers involved in the study included lead author Dr. Sean Dineen, surgery resident; Dr. Christina Roland, surgery resident; Rachel Greer, student research assistant in the Nancy B. and Jake L. Hamon Center for Therapeutic Oncology Research; Juliet Carbon, senior research associate in surgery and in the Hamon Center; Jason Toombs, research assistant in surgery and in the Hamon Center; Dr. Puja Gupta, a pediatric hematology/oncology fellow; Dr. Noelle Williams, associate professor of biochemistry; and Dr. John Minna, director of the W.A. "Tex" and Deborah Moncrief Jr. Center for Cancer Genetics and of the Hamon Center.

The research was supported by Susan G. Komen for the Cure and Joyant Pharmaceuticals, a Dallas-based company and UT Southwestern spinoff that is developing medical applications of Smac-mimetic compounds.

Story Source:

Adapted from materials provided by UT Southwestern Medical Center.

http://www.sciencedaily.com/releases/2010/03/100323133045.htm

A Life Without Fear

by Alix Spiegel

April 26, 2010

Jesse Neider for NPR
April 26, 2010

The drama class had just gotten out, and everybody was standing around talking when Jessica noticed her 9-year-old, Isabelle, making her way over to an elderly woman Jessica had never seen. The woman was neatly dressed, most likely just a well-meaning suburban grandmother who had come to retrieve a grandchild on behalf of an over-extended parent, most likely a perfectly harmless person.

Isabelle, as she usually did, exchanged hellos and struck up a conversation. It was the usual post-drama-class conversation until about two minutes in. Then Isabelle dropped the bomb.

"Will you take me? Can I go home with you?" Jessica heard Isabelle plead.

Driven To Trust

Jessica's daughter, Isabelle, has Williams syndrome, a genetic disorder with a number of symptoms. Children with Williams are often physically small and frequently have developmental delays. But also, kids and adults with Williams love people, and they are literally pathologically trusting. They have no social fear. Researchers theorize that this is probably because of a problem in their limbic system, the part of the brain that regulates emotion. There appears to be a disregulation in one of the chemicals (oxytocin) that signals when to trust and when to distrust.

This means that it is essentially biologically impossible for kids like Isabelle to distrust. (NPR is not using full names in this story for privacy and safety reasons.)

"They don't have that kind of evolutionary thing that other kids have, that little twinge of anxiety like, 'Who is this person? What should I do here?' " Jessica explains. "They just don't have it. She just doesn't have that ... early-warning system."

For Jessica, there are good and bad things about parenting a child with this kind of personality. For instance, when Isabelle was younger, she was chronically happy. She smiled at anything. She loved everyone: family, friends, strangers. She reached for them all, and, in return, everyone loved her. Strangers would stop Jessica to tell about how adorably loving Isabelle was.

In those days, Jessica says, she and her family were more or less tolerant of Isabelle's trusting and loving nature. "We would try to restrain her, but it was somewhat half-heartedly, because we didn't want to embarrass her by calling her on the carpet about how open she was," Jessica says.

The Danger Of Unconditional Trust

But as Isabelle got older, the negative side of her trusting nature began to play a larger role. A typical example happened a couple of years ago, when Jessica and her family were spending the day at the beach. Isabelle had been begging Jessica to go to Dairy Queen, and Jessica had been putting her off. Then Isabelle overheard a lady just down the beach.

"She was telling her kids, 'OK, let's go to the Dairy Queen,' " Jessica says. "And so Isabelle went over and got into the lady's van, got in the back seat, buckled up and was waiting to be taken to Dairy Queen with that family."

Jessica had no idea what had happened to Isabelle and was frantically searching for her when the driver of the van approached her and explained that she had been starting her car when she looked up and saw Isabelle's face in the rearview mirror.

The woman, Jessica says, was incredibly angry.

"She said, 'I am a stranger, you know!' " Jessica says. Essentially, the woman blamed Jessica for not keeping closer watch on her daughter -- for neglecting to teach her the importance of not getting into a car with someone she didn't know. But the reality could not be more different. "It's like, 'My friend, you have no idea,' " Jessica says.

In fact, because of Isabelle, Jessica has had to rethink even the most basic elements of her day-to-day life. She can not take Isabelle to the dog park. She tries not to take Isabelle to the store. And when the doorbell rings, Jessica will leap over a coffee table to intercept her.

It's not just Jessica and her family who must be vigilant. Every teacher at Isabelle's public school has been warned. Isabelle is not allowed to tell them that she loves them. Isabelle is not supposed to tell other schoolchildren that she loves them. And there are other restrictions.

"She's not allowed to go to the bathroom alone at her school, because there have been numerous instances of girls with Williams syndrome being molested at school when they were alone in the hallway," Jessica says. "And these are like middle class type schools. So it's a very real problem. And, you know, I'd rather her be overly safe than be on CNN."

Raising A Child With Williams Syndrome

Jessica spoke with me for over an hour in the family's home in their woodsy, suburban neighborhood while we waited for her three children to come home from school. Then, just after I turned off my recorder to take a break, I felt two small arms circle my neck from behind. It was Isabelle. She had crept in from school and was giving me a hug.

I turned around, and quite suddenly, the room was filled with questions. Who was I? What was I doing here? Which TV show did I like? Did I know the Muppets?

Then Isabelle took my microphone in her hands. She had decided to sing me a song:

"You're my friend ... You're my friend in the whole world," she crooned. "You look so nice and so beautiful and so sweet."

When Isabelle speaks, she has a slight nasal slur. She also has some cognitive issues. Though she goes to a regular school and sits in a regular third-grade class, her attention is very jumpy, and she needs aids to help her.

These cognitive issues make Jessica's job more difficult. Jessica has decided that the most important thing for her to do is to teach Isabelle how to distrust. For years, that has been her life project -- a battle pitched against biology itself.

Jessica and her husband have made Isabelle books about how to behave around strangers. They have rented videos, they have bought educational toys. They have modeled the right behaviors, constructed sticker charts and employed every other trick they could possibly think of. But distrust, it seems, is almost impossible to teach their child. Sometimes Isabelle manages to remember not to tell perfect strangers that she loves them. Mostly, she doesn't.

But Jessica is determined. "We just have to restart every time," she says. "It's just what we have to do."

It's what they have to do, Jessica reasons, because she won't be around to protect her daughter forever. And though Isabelle trusts the world completely, the world is not a place worthy of complete trust.

Even in their current life, Jessica says, there are moments when she realizes that she's just an instant away from something terrible.

"We live a very sheltered life, but I can think of times when we were at the pool and I turn around to talk to someone, and I see her practically sitting on some man's lap at the pool, and he looks very uncomfortable," Jessica says. "And I just think: This is not good."

Unconditional Love, And A Mother's Worry

Fortunately, Jessica says, the experts tell her it will eventually get better. She needs to just keep at it. One day, they tell her, Isabelle will be able to learn not to *feel* distrust, per se, but to master a set of algorithms that will allow her to safely navigate the world. She will learn, for example, not to get into a car with a stranger if she has become lost or disoriented, but to ask some person in a uniform for help instead.

In the meantime, Jessica says there are plenty of rewards to this life -- a life with a child with boundless love and trust. "She'll ask me, 'So how are you today, my darling?' " Jessica says. "And it just makes you smile."

In fact, late in the afternoon on the day I visited, everyone in the family gathered in the kitchen to eat dinner. Isabelle, who loves music, decided to play a CD.

The CD player stuttered then came to life, and Isabelle approached her father.

"Will you dance with me, my sweetie?" she asked.

Her father picked her up in his arms. He spun her round and round.

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Fungal Disease Spreads Through Pacific Northwest

by Richard Knox

April 23, 2010

Jane Greenhalgh/NPR

Bob and Joan Lewis at home in Portland, Ore. In the late fall of 2007, Bob Lewis was diagnosed with a rare fungal infection called Cryptococcus gattii. He recovered after intensive treatment but was left with complications. The disease emerged on Vancouver Island, British Columbia, 11 years ago and has spread south into Washington and Oregon.

Bob and Joan Lewis at home in Portland, Ore. In the late fall of 2007, Bob Lewis was diagnosed with a rare fungal infection called Cryptococcus gattii. He recovered after intensive treatment but was left with complications. The disease emerged on Vancouver Island, British Columbia, 11 years ago and has spread south into Washington and Oregon.

April 23, 2010

A rare and dangerous fungal infection named Cryptococcus gattii has been quietly spreading from British Columbia southward to the U.S. Pacific Northwest. And it's changing as it goes.

Researchers have discovered that a unique strain of the bug has emerged recently in Oregon and already spread widely there, sickening humans and animals.

So far, over the past 11 years there have been about 220 cases reported in British Columbia. Since 2004, doctors in Washington and Oregon have reported about 50 cases. Among the total 270 cases, 40 people have died from overwhelming infections of the lungs and brain.

Public health officials aren't calling it a public health emergency. The fungus can't be spread from person to person, and there doesn't seem to be any prospect of an explosive epidemic. But they do want doctors to be on the lookout for cases, because early diagnosis and proper treatment is vital to prevent deaths.

Tropical Origin

The most striking thing about this fungus is that it's popping up and establishing itself far afield from its usual range -- possibly because of climate change.

"The disease was almost exclusively seen in tropical and subtropical areas of the world," says Dr. Julie Harris, a specialist in fungal diseases at the Centers for Disease Control and Prevention. The hot spots were Australia and Papua New Guinea, along with Egypt and parts of South America.

Tracking The Outbreak

"So it was really surprising in 1999 to find that in this temperate climate of Vancouver Island, people were getting sick with Cryptococcus gattii," says Harris.

It's a cousin of another fungus that is all too familiar to doctors who treat people with AIDS and organ transplants. This other bug, called Cryptococcus neoformans, causes a hard-to-treat brain infection in people with weakened immune systems. Globally it infects almost a million people a year and kills more than 620,000.

Next to that, Cryptococcus gattii is a rare bird. Researchers don't know why people and animals in the Pacific Northwest are getting infected with this tropical fungus, and why only a few who get exposed to it get sick from it.

"This is an airborne infection," Harris says. "These spores are really, really small, and they can be carried in the air. And so hypothetically anyone can inhale them."

The fungus likes to hang out in forests -- on trees and in the surrounding soil. Many of those who have gotten sick have worked in jobs like forestry or construction. But many others haven't had such obvious exposures to lots of Cryptococcus gattii spores.

Early Case

One of the first Vancouver Island cases, back in 2001, was a 45-year-old woman who had gone kayaking in a provincial park on the island's eastern shore. Over a period of months, her symptoms progressed from headaches and night sweats to a fulminant brain infection. By the time she died, in early 2002, she was blind and couldn't walk or speak.

Others have had only casual exposure to the woods -- or none at all. Cases have occurred among city dwellers and suburbanites as well as those who live in forested areas.

Researchers say most cases so far have had one risk factor or another. They have lived near a wooded area or been involved in activities that disturb the soil. They have had underlying diseases of the lung, or cancer. Forty-two percent have been taken a drug that suppresses immunity, such as corticosteroids. But more than one-quarter have had no identifiable risk factor.

So far nearly all cases have been in people ranging in age from 15 to 95. Very few children have gotten the fungus infection.

One of the problems in tracking cases is that the incubation period of a Cryptococcus gattii infection averages six months.

"This makes it very challenging for us to find out what the most important exposure was," Harris says. "Often we'll be able to tell if a patient was exposed, for example, to salmonella.

"They'll get sick the next day, and they can remember what they ate the day before. But with this disease, we're really challenged. It can take from two months up to a year for the disease to manifest itself."

Researchers have also been struck by the array of different animals species getting infected. Domestic cats and dogs lead the list, but there have been confirmed reports in sheep, goats and horses, in elk and llamas, even in porpoises and dolphins whose infected corpses have washed up on beaches.

Symptom Of Climate Change?

Clearly this fungus is getting around. It can survive and spread in a wide range of environments.

It's also changing. Edmond Byrnes and his colleagues at Duke University have discovered a new strain of the fungus unique to Oregon. They've traced it to infections that have occurred in recent years across a swath of the state.

"The new strain has only been around for a few years, and it has already spread throughout much of Oregon," Byrnes says. "So I think it's likely that the organism is going to spread further into northern California."

The Duke researchers' report is in the online journal Public Library of Science Pathogens, published Thursday.

Byrnes says many experts think the spread of Cryptococcus gattii is a symptom of climate change.

"As we know, the climate's changing, and we don't understand how small changes in climate can affect all the organisms in the climate, and could allow certain organisms to start to grow better in that environment," he says.

One thing is certain: These tiny spores can cause devastating illness.

'Something Wrong With My Chest'

Bob Lewis of Portland, Ore., knows about that. He was a hearty outdoors type -- yachtsman, fly fisherman, swimmer -- when he got infected.

"In the spring of 2007, I felt I had something wrong with my chest," Lewis says. "I went to the doctor and they took X-rays and thought it was bronchitis."

Months passed and his infection got worse. Finally Lewis ended up at Oregon Health Sciences University, where infectious disease specialist Sarah West diagnosed him as one of Oregon's first cases of Cryptococcus gattii.

Lewis had never heard of it.

"In fact, I couldn't even say the name of it for a week or so," he says.

His lung infection, indolent for many months, suddenly started growing fast. His wife, Joan, says he was gasping for breath.

"At that point, our primary-care physician took me aside and said, 'Joan, if we can't get him breathing better on his own, he cannot survive more than three days,' " Joan Lewis says. "Of course, that was a tremendous shock."

A course of intravenous antibiotic didn't faze the fungus. Doctors argued about whether to perform surgery. Eventually they found expensive antibiotics that killed the fungus. But ever since, Bob Lewis has had to trail an oxygen tank, and his health has never been the same.

"My heart couldn't do the job it needed to do, so my left ventricle got enlarged," he says. "Then my kidneys developed a critical level of dysfunction. But I'm one of the lucky ones."

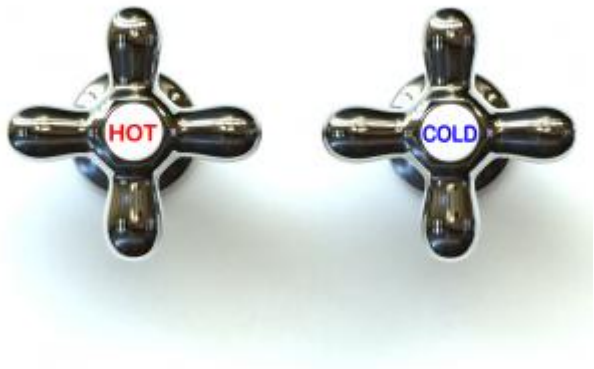
The Lewises weren't aware until this week that 39 cases of the disease have been reported in Oregon.

"That makes me want to cry, to hear those kind of numbers," Joan Lewis says. "This was a tragic and very, very frightening experience and I wouldn't wish it on anybody."

CDC officials say there's nothing individuals can do to minimize their risk. But they want physicians to be alert so patients don't have to wait as long as Bob Lewis did for diagnosis and treatment.

http://www.npr.org/templates/story/story.php?storyId=126198896&sc=nl&cc=hh-20100426

How We Can Sense Temperatures: Discovery Could Lead to Novel Therapies for Acute and Chronic Pain



New research sheds light on the molecular mechanism that enables us to sense temperature, such as the heat from a sizzling stove. The discovery could one day lead to new therapies for conditions such as acute or chronic inflammatory pain. (Credit: iStockphoto/Mark Evans)

ScienceDaily (Apr. 26, 2010) — Scientists at The Scripps Research Institute and the Genomics Institute of the Novartis Research Foundation (GNF) have shed new light on the molecular mechanism that enables us to sense temperature, such as the heat from a sizzling stove. In addition to contributing to our knowledge of basic biology, the findings could one day lead to new therapies for conditions such as acute or chronic inflammatory pain.

The study, which was led by Scripps Research and GNF Professor Ardem Patapoutian, was published in an advance, online edition of the journal *Nature Neuroscience* on April 22, 2010.

To better understand temperature sensation, the team focused on a protein called TRPV1, which is a member of a small family of proteins known to enable temperature sensation, and is involved in inflammation and the communication of pain to the brain. After producing thousands of mutants of this protein, the scientists were able to identify a region of the protein that enabled temperature sensitivity and to detail some of the molecular mechanisms at work in the molecule.

"Ever since the discovery of these proteins, it has been an outstanding question how they can be activated by temperatures," said Research Associate Jörg Grandl, a member of the Patapoutian lab and first author of the paper. "The new study addresses this question."

"Because our ability to sense temperature is closely linked to our ability to sense pain, some of these ion channels are considered targets to treat chronic inflammatory and neuropathic pain indications," said Patapoutian. "Understanding these proteins could be crucial in designing future drugs that can either activate or block them."

Hot and Cold

Humans and other vertebrate animals use specialized sensory neurons to detect temperature, pressure, and other physical stimuli on the skin. These neurons are located in the spinal column and are connected to the skin and organs through long extensions known as axons.

On the surface of these axons are ion channel (pore-forming) proteins, which span the axon's membrane, connecting the inside with the outside. Some of these ion channels act like temperature receptors or "molecular thermometers" by opening and closing according to the temperature. At a particular

temperature, the receptors open. This allows an influx of ions into the neuronal processes, and this electrical signal is relayed through the neuron to the brain.

The existence of specialized hot- and cold-neurons had been known for years, but the molecules that actually sense the temperatures and signal back to the neuron through the axon were a mystery. That changed in 1997 when a group cloned TRPV1, which is a type of transient receptor potential (TRP) channel. TRPV1, an ion channel, opens when it senses hot temperatures -- above 42° C (108° F).

That discovery opened the floodgates for identifying other temperature-detecting proteins. Within a few years, several laboratories -- including Patapoutian's -- had identified additional temperature-detecting proteins and confirmed that mammals used them to detect temperature.

But how the proteins achieved their temperature-sensing ability remained a mystery. While scientists in the field knew in much detail how ion channels were activated by chemicals or voltage signals, the molecular structures required for temperature activation remained unknown.

Two competing theories were advanced to explain the activation of ion channels in response to temperature. Drawing on the proteins' similarity to voltage-gated potassium channels, the first theory posited that TRP channels are generating temperature sensitivity because the energies required for voltage activation are very finely tuned. In contrast, the second theory proposed that these channels have a modular structure and therefore possess a specific domain that enables them to be activated by temperature -- and postulated the existence of a 'temperature-sensor domain'.

Point by Point

To gain insight into how these ion channels achieve their temperature sensitivity, in the new study the scientists conducted studies of TRPV1, which was not only the first TRP to be discovered but is also the best understood. A previous study in the lab had focused on a related, warm-activated ion channel, TPRV3, but since the biophysics of this molecule is complicated, the team was unable to tease apart its mechanisms.

Using mutagenesis techniques, for the new study the scientists first generated some 8,500 mutants of TRPV1. Then, working with the high throughput equipment available at GNF, the team performed an unbiased screen of these compounds to identify mutations of interest.

"We were looking for mutations in these proteins that would only change the temperature sensitivity of these channels, but would not affect any of the other activation mechanisms," said Grandl. "We were looking for single-point mutations [changes of a single amino acid] where the channel still functioned normally in response to capsacin (the active ingredient in chili peppers) or pH, but not to temperature."

Indeed, the team found a number of these mutations that affected the molecule's sensitivity to temperature, but not to other cues. Interestingly, the mutations were clustered in one area of the protein, the outer pore region, which provides further support to the existence of the predicted 'temperature-sensor domain'.

Next, with these mutant versions of TRPV1 in hand, the scientists examined what had changed in the molecule to disrupt temperature sensitivity.

In findings new to the field, the team discovered that TRPV1 has two ways of opening its channel -- for a brief time, opening for only for a millisecond before returning to its closed resting state, and for a relatively long time, opening for about 10 milliseconds. The team found that the mutations disrupting temperature sensitivity interfered with the long channel openings, but not the short ones.

"This study suggests a potential molecular mechanism that generates extreme temperature sensitivity from two mildly temperature sensitive steps," said Grandl. The team postulates that by stabilizing the open state, the pore domain contributes to thermosensitivity of TRPV1. "We now have a novel working model of how Nature could have evolved such exquisite temperature sensitivity, a hypothesis that can be tested in future work."

In addition to Grandl and Patapoutian, the paper was authored by Sung Eun Kim and Valerie Uzzell of Scripps Research, and Badry Bursulaya, Matt Petrus, and Michael Bandell of the Genomics Institute of the Novartis Research Foundation.

The research was supported by the U.S. National Institutes of Health, the Novartis Research Foundation, and fellowships to Grandl from the American Heart Association and the U.S. National Institutes of Health.

Story Source:

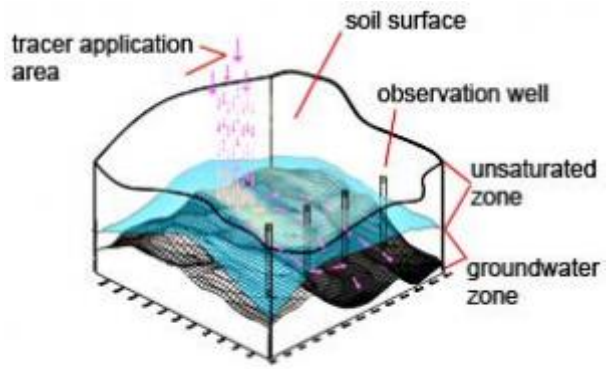
Adapted from materials provided by Scripps Research Institute.

Journal Reference:

1. Jörg Grandl, Sung Eun Kim, Valerie Uzzell, Badry Bursulaya, Matt Petrus, Michael Bandell, Ardem Patapoutian. **Temperature-induced opening of TRPV1 ion channel is stabilized by the pore domain**. *Nature Neuroscience*, 2010; DOI: 10.1038/nn.2552

http://www.sciencedaily.com/releases/2010/04/100423094618.htm

Researchers Model Movement of Radioactive Materials in Soil



ARS scientists are working with the U.S. Nuclear Regulatory Commission to use "tracers" for modeling the movement of contaminants in unsaturated soils and in groundwater. (Credit: Image courtesy of USDA/Agricultural Research Service)

ScienceDaily (Apr. 23, 2010) — Agricultural Research Service (ARS) scientists are helping U.S. Nuclear Regulatory Commission (NRC) experts model the movement of radioactive materials in the soil. Their findings can be used to fine-tune the risk assessment studies that are an essential component in the development of commercial nuclear facilities.

Soil scientists Yakov Pachepsky, Timothy Gish and Andrey Guber all work in the ARS Animal and Natural Resources Institute in Beltsville, Md. The team set up their study at the Optimizing Production Inputs for Economic and Environmental Enhancement (OPE3) study area in Beltsville, which was established in 1998 to study major environmental and economic issues facing U.S. agriculture. It is equipped with remote sensing gear and other instrumentation for monitoring weather, soil, plants and groundwater.

The researchers studied how contaminants move through the vadose zone, which is the area between the soil surface and the groundwater zone. Over a 2-year period, the team added several nontoxic chemical tracers to irrigation water and used 12 site wells to monitor levels of those tracers at three different depths in the soil. Surface runoff, soil moisture profiles, soil water potential, groundwater levels and weather variables were also monitored.

The researchers compared the field data they collected on water flow and tracer concentrations with results from model simulations. Then they ran a range of chemical transport models that varied in complexity to learn more about conditions that could significantly affect the movement of water -- and contaminants -- below the soil surface.

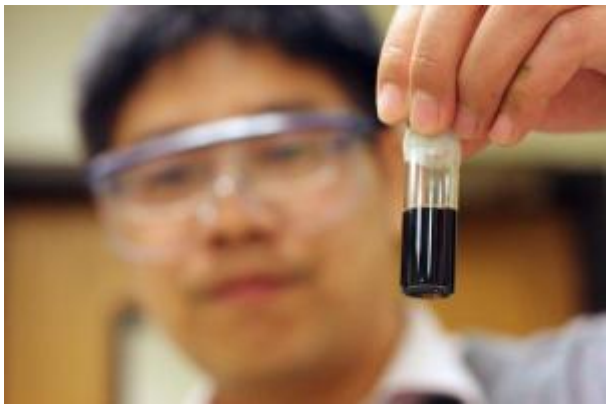
Among other findings, the team concludedthat tracer transport in soils and shallow groundwater could be strongly affected by gaps in the vadose zone's restrictive fine-material layers.

This and other findings from this work can be used to estimate pollutant transport scenarios for risk assessment studies of nuclear facilities. The results were published in a report by the NRC in 2009.

Story Source:

Adapted from materials provided by USDA/Agricultural Research Service. Original article written by Ann Perry.
http://www.sciencedaily.com/releases/2010/04/100423113737.htm

Pressure-Cooking Algae Into a Better Biofuel



Peigao Duan, a graduate student in professor Phillip Savage's lab, holds a vial of biooil. (Credit: Photo by Nicole Casal Moore)

ScienceDaily (Apr. 26, 2010) — Heating and squishing microalgae in a pressure-cooker can fast-forward the crude-oil-making process from millennia to minutes.

University of Michigan professors are working to understand and improve this procedure in an effort to speed up development of affordable biofuels that could replace fossil fuels and power today's engines.

They are also examining the possibility of other new fuel sources such as *E. coli* bacteria that would feed on waste products from previous bio-oil batches.

"The vision is that nothing would leave the refinery except oil. Everything would get reused. That's one of the things that makes this project novel. It's an integrated process. We're combining hydrothermal, catalytic and biological approaches," said Phillip Savage, an Arthur F. Thurnau Professor in the U-M Department of Chemical Engineering and principal investigator on the $2-million National Science Foundation grant that supports this project. The grant is funded under the American Recovery and Reinvestment Act.

"This research could play a major role in the nation's transition toward energy independence and reduced carbon dioxide emissions from the energy sector," Savage said.

Microalgae are microscopic species of algae: simple, floating plants that don't have leaves, roots or stems. They break down more easily than other potential biofuel source plants because they don't have tough cell walls, Savage said.

Unlike fossil fuels, algae-based biofuels are carbon-neutral. The algae feed on carbon dioxide in the air, and this gets released when the biofuel is burned. Fossil fuel combustion puffs additional carbon into the air without ever taking any back.

The pressure-cooker method the U-M researchers are studying bucks the trend in algae-to-fuel processing. The conventional technique involves cultivating special, oily types of algae, drying the algae and then extracting its oil.

The hydrothermal process this project employs allows researchers to start with less-oily types of algae. The process also eliminates the need to dry it, overcoming two major barriers to large-scale conversion of microalgae to liquid fuels.

"We make an algae soup," Savage said. "We heat it to about 300 degrees and keep the water at high enough pressure to keep it liquid as opposed to steam. We cook it for 30 minutes to an hour and we get a crude bio-oil."

The high temperature and pressure allows the algae to react with the water and break down. Not only does the native oil get released, but proteins and carbohydrates also decompose and add to the fuel yield.

"We're trying to do what nature does when it creates oil, but we don't want to wait millions of years," Savage said. "The hard part is taking the tar that comes out of the pressure cooker and turning it into something you could put in your car, changing the properties so it can flow more easily, and doing it in a way that's affordable."

Savage and his colleagues are taking a broad and deep look at this process. They are investigating ways to use catalysts to bump up the energy density of the resulting bio-oil, thin it into a flowing material and also clean it up by reducing its sulfur and nitrogen content.

Furthermore, they're examining the process from a life-cycle perspective, seeking to recycle waste products to grow new source material for future fuel batches. This doesn't have to be algae, Savage said. It could be any "wet biomass." They are working on growing in their experiments' waste products *E. coli* that they could potentially use along with algae.

Other collaborators are: Gregory Keoleian, professor of sustainable systems in the School of Natural Resources and Environment and in the Department of Civil and Environmental Engineering; Adam Matzger professor in the Department of Chemistry; Suljo Linic, assistant professor in the Department of Chemical Engineering; Nina Lin, assistant professor in the departments of Chemical Engineering and Biomedical Engineering; Nancy Love, professor and chair of the Department of Civil and Environmental Engineering; and Henry Wang, professor in the departments of Chemical Engineering and Biomedical Engineering.

Story Source:

Adapted from materials provided by University of Michigan.

http://www.sciencedaily.com/releases/2010/04/100422153943.htm

Bivalves Alert Us to Oil Pollution: Mussel Power to Protect the Environment

Biota Guard. (Credit: Vidar Skålevik)

ScienceDaily (Apr. 26, 2010) — The biological sciences are edging their way into many different areas of society -- including the petroleum industry. Norwegian company Biota Guard is one enterprise whose activities utilise biological processes.

Petroleum activities on the Norwegian continental shelf can pose a major threat to the environment unless operators keep vigilant watch for any accidental emissions. The right people must be notified immediately so they can take decisive action to contain any contamination.

Biota Guard AS is working to ensure that monitoring is a high-quality, efficient process. But rather than develop robots and sensors to monitor for marine discharges from offshore petroleum platforms, the company has focused on a "biological instrument" that senses environmental conditions better than anything else -- the common blue mussel.

Signs of stress in mussels

Biota Guard's system monitors the life signs of individual mussels. These bivalves will close incrementally when exposed to pollutants or when experiencing physical stress due to other threats. The mussel's heart rate is also affected by its immediate surroundings, according to Eirik Sønneland, Project Manager at Biota Guard.

The company is working on linking its mussel-based monitoring system to integrated operations systems in order to incorporate environmental monitoring into the overall management of a petroleum field. Biota Guard's system provides real-time information about potential contamination, even on a small scale.

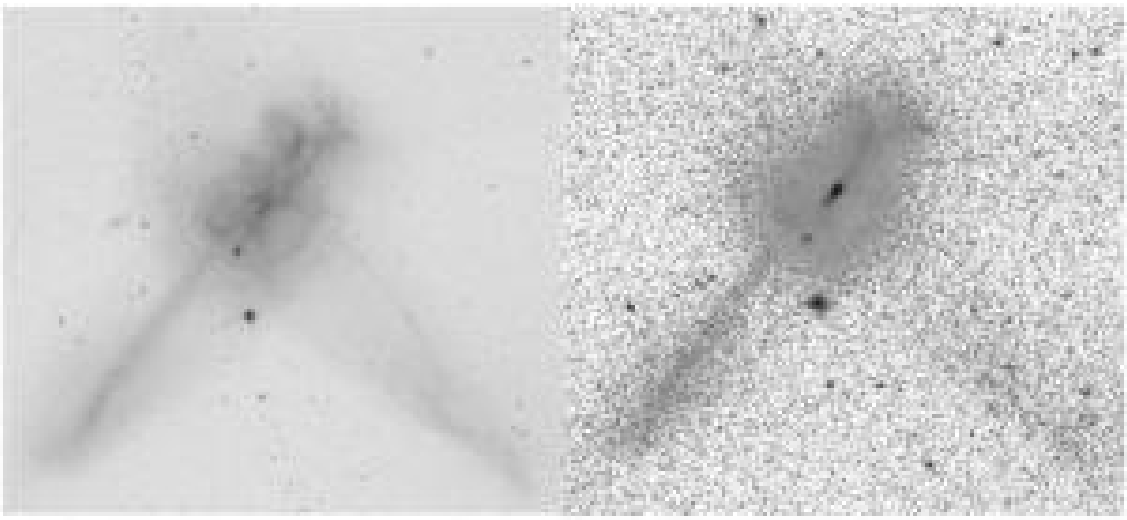
Biota Guard was founded in 2006 by the International Research Institute of Stavanger (IRIS) and Procom Venture. IRIS is a main partner in the project. Funding from the PETROMAKS programme at the Research Council of Norway has been essential to be able to carry out their project.

A primary objective of the PETROMAKS programme is to promote the environmentally sound development of petroleum activities on the Norwegian continental shelf. The authorities have set stringent zero-emissions requirements on petroleum activities in the Arctic region due to its important fisheries resources and the vulnerability of the environment there to external factors.

Story Source:

Adapted from materials provided by The Research Council of Norway, via AlphaGalileo.
http://www.sciencedaily.com/releases/2010/04/100423210008.htm

Galaxy Merger Dilemma Solved



Optical (left) and Infrared (right) image of an IR-bright merging galaxy. The center of the merger is obscured in the left image, but in the infrared (right) the central disk is very bright and easily seen. (Credit: Optical image from the Hubble Space Telescope and infrared image from the University of Hawaii 88" telescope)

ScienceDaily (Apr. 25, 2010) — Scientists at the Naval Research Laboratory have solved a long-standing dilemma about the mass of infrared bright merging galaxies. Because galaxies are the largest directly observable objects in the universe, learning more about their formation is key to understanding how the universe works.

Dr. Barry Rothberg and Dr. Jacqueline Fischer, both of the Infrared-Submillimeter Astrophysics & Techniques Section in the Remote Sensing Division, used new data from the 8-meter Gemini-South telescope in Chile along with earlier results from the W. M. Keck-2 10-meter and University of Hawaii 2.2-meter telescopes in Hawaii and archival data from the Hubble Space Telescope, to solve the problem. They have published a paper on their research findings on galaxy evolution in the *Astrophysical Journa*l.

Galaxies in the Universe generally come in two shapes, spiral, like our own Milky Way, and elliptical, in which the stars move in random orbits, Rothberg explains. The largest galaxies in the Universe are elliptical in shape and how they formed is central to our understanding how the Universe has evolved over the last 15 billion years. The long-standing theory has been that spiral galaxies merge with each other forming most of the elliptical galaxies in the Universe. Spiral galaxies contain significant amounts of cold hydrogen gas. When they merge, the beautiful spiral patterns are destroyed and the gas is converted into new stars. The more gas present in the spiral galaxies, the more stars are formed and with it, large amounts of dust. The dust is heated by the young stars and radiates energy at infrared wavelengths.

Until recently scientists thought that these infrared bright merging galaxies were not massive enough to be the precursors of most elliptical galaxies in the Universe. The problem lay in the method of measuring their mass. The conventional method of measuring mass in dusty IR-bright galaxies uses near-infrared light to measure the random motions of old-stars. The larger the random motions, the more mass is present. Using near-infrared light makes it possible to penetrate the dust and see as many of the old stars as possible.

However, a complication occurs when spiral galaxies merge, because most of their gas is funneled to the gravitational center of the system and forms a rotating disk. This rotating disk of gas is transformed into a rotating disk of young stars that is also very bright at near-infrared wavelengths. The rotating disk of

young stars both outshines the old stars and makes it appear as if the old stars have significantly less random motion. In contrast to this conventional method, Rothberg and Fischer instead observed the random motions of old stars at shorter wavelengths effectively using the dust to their advantage to block the light from the young stars. Their new results showed that the old stars in merging galaxies have large random motions, which means they will eventually become very massive elliptical galaxies.

The next step for NRL researches is to directly observe the stellar disks in IR luminous mergers using three-dimensional spectroscopy. Each pixel is a spectrum, and from this the researchers can make two-dimensional maps of stellar motion and stellar age. This will allow them to measure the size, rotation, luminosity, mass and age of the central disk.

Story Source:

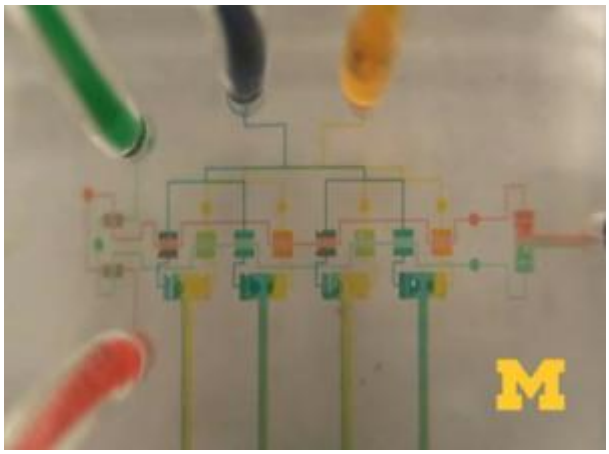
Adapted from materials provided by Naval Research Laboratory.

Journal Reference:

1. Barry Rothberg, Jacqueline Fischer. **Unveiling the σ-discrepancy in infrared-luminous mergers. i. dust and dynamics**. *The Astrophysical Journal*, 2010; 712 (1): 318 DOI: 10.1088/0004-637X/712/1/318

http://www.sciencedaily.com/releases/2010/04/100419173010.htm

Microfluidic Integrated Circuit Could Help Enable Home Diagnostic Tests



Still image from a video showing one circuit is serving as the clocking signal of another circuit so that the branching fluids switch in unison. (Credit: Image courtesy of University of Michigan)

ScienceDaily (Apr. 25, 2010) — As a way to simplify lab-on-a-chip devices that could offer quicker, cheaper and more portable medical tests, University of Michigan researchers have created microfluidic integrated circuits.

Just as electronic circuits intelligently route the flow of electricity on computer chips without external controls, these microfluidic circuits regulate the flow of fluid through their devices without instructions from outside systems.

A paper on the technology is newly published online in *Nature Physics*.

A microfluidic device, or lab-on-a-chip, integrates multiple laboratory functions onto one chip just centimeters in size. The devices allow researchers to experiment on tiny sample sizes, and also to simultaneously perform multiple experiments on the same material. They can be engineered to mimic the human body more closely than the Petri dish does. They could lead to instant home tests for illnesses, food contaminants and toxic gases, among other advances.

"In most microfluidic devices today, there are essentially little fingers or pressure forces that open and close each individual valve to route fluid through the device during experiments. That is, there is an extra layer of control machinery that is required to manipulate the current in the fluidic circuit," said Shu Takayama, the principal investigator on the project. Takayama is an associate professor in the U-M Department of Biomedical Engineering.

That's similar to how electronic circuits were manipulated a century ago. Then, with the development of the integrated circuit, the "thinking" became embedded in the chip itself -- a technological breakthrough that enabled personal computers, Takayama said.

"We have literally made a microfluidic integrated circuit," said Bobak Mosadegh, a doctoral student in Takayama's lab who is first author of the paper.

The external controls that power today's microfluidic devices can be cumbersome. Each valve on a chip (and there could be dozens of them) requires its own electromechanical push from an off-chip actuator or pump. This has made it difficult to shrink microfluidic systems to palm- or fingertip-sized diagnostic devices.

The Takayama lab's innovation is a step in this direction. His research group has devised a strategy to produce the fluidic counterparts of key electrical components including transistors, diodes, resistors and capacitors, and to efficiently network these components to automatically regulate fluid flow within the device.

These components are made using conventional techniques, so they are compatible with all other microfluidic components such as mixers, filters and cell culture chambers, the researchers say.

"We've made a versatile control system," Mosadegh said. "We envision that this technology will become a platform for researchers and companies in the microfluidics field to develop sophisticated self-controlled microfluidic devices that automatically process biofluids such as blood and pharmaceuticals for diagnostics or other applications.

"Just as the integrated circuit brought the digital information processing power of computers to the people, we envision our microfluidic analog will be able to do the same for cellular and biochemical information."

The paper is titled "Integrated Elastomeric Components for Autonomous Regulation of Sequential and Oscillatory Flow Switching in Microfluidic Devices." This research is funded by the National Institutes of Health, the U.S. Department of Education and the National Institute for Dental and Craniofacial Research. Also contributing were researchers from the U-M departments of Biomedical Engineering and Mechanical Engineering as well as the Macromolecular Science and Engineering Center.

The university is pursuing patent protection for the intellectual property, and is seeking commercialization partners to help bring the technology to market.

Story Source:

Adapted from materials provided by University of Michigan.

Journal Reference:

1. Bobak Mosadegh, Chuan-Hsien Kuo, Yi-Chung Tung, Yu-suke Torisawa, Tommaso Bersano-Begey, Hossein Tavana, Shuichi Takayama. **Integrated elastomeric components for autonomous regulation of sequential and oscillatory flow switching in microfluidic devices**. *Nature Physics*, 2010; DOI: 10.1038/nphys1637

http://www.sciencedaily.com/releases/2010/04/100422170149.htm

Particulate Matter from Fires in the Amazon Affects Lightning Patterns

Lightning. Scientists researched data on lightning patterns in the Amazon to show how clouds are affected by particulate matter emitted by the fires used for slash-and-burn foresting practices. Researchers found that while low levels of particulate matter actually help the development of thunderstorms, the reverse is true once a certain concentration is reached -- the particles then inhibit the formation of clouds and thunderstorms. (Credit: iStockphoto/Chee Ming Wong)

ScienceDaily (Apr. 25, 2010) — Native Americans used smoke signals to indicate danger, and a white plume is sent up by the Vatican when a new Pope is chosen. Now, a new research project by Tel Aviv University researchers and their colleagues shows that where there's "smoke" there may be significant consequences for local weather patterns, rainfall and thunderstorms.

In a new study, Prof. Colin Price, head of Tel Aviv University's Department of Geophysics and Planetary Science, researched data on lightning patterns in the Amazon to show how clouds are affected by particulate matter emitted by the fires used for slash-and-burn foresting practices. His findings, recently published in the journal *Geophysical Research Letters*, could be used by climate change researchers trying to understand the impact of pollution on global weather patterns.

Along with colleagues at the Weizmann Institute and the Open University in Israel, Prof. Price demonstrated how pollution's effects on cloud development could negatively impact our environment. While low levels of particulate matter actually help the development of thunderstorms, the reverse is true once a certain concentration is reached -- the particles then inhibit the formation of clouds and thunderstorms.

"The clouds just dry up," he says.

Lightning strikes to the center of the issue

Scientists have known for some time that man-made aerosols affect cloud formation, but specific scientific findings have been inconclusive. How clouds and storms change in response to air pollution is central to the debate about climate change and global warming, since clouds have a general cooling effect on the Earth's climate.

But how man-made pollution impacts clouds, rainfall and weather patterns remains poorly understood, and natural particulates, such as those generated by Iceland's recent volcano eruptions may add to this effect. The thick volcanic ash cloud absorbs solar radiation, heating the upper atmosphere, similar to the forest fire smoke, and can hence also impact the development of clouds and rainfall, Price said.

While studying the climatology of the Amazon forest during its annual dry season, the researchers noticed how thousands of man-made forest fires injected smoke into the atmosphere. Since thunderstorms still

occur during the dry season, it was the perfect opportunity for studying the effects of these particulates on thundercloud development.

Cloud droplets form on small particles called "cloud condensation nuclei" (CCN). As the number of CCN increase due to the fire activity, the lightning activity increased in the storms ingesting the smoke. More CCN implies more small droplets that can be carried aloft into the upper parts of the cloud where lightning is generated. Increased lightning activity generally also implies increasing rainfall over the Amazon. But when particulate matter became too dense, they observed, clouds didn't form, and the lightning activity in thunderstorms diminished dramatically.

Seeking answers to vital questions

These results may have significant implications for polluted regions of the world that rely on rainfall for agriculture and human consumption. "One of the most debated topics related to future climate change is what will happen to clouds, and rainfall, if the earth warms up," says Prof. Price, "and how will clouds react to more air pollution in the atmosphere?"

Clouds deflect the sun's rays, cooling the Earth's climate. If we change the duration of cloud cover, the aerial coverage of clouds, or the brightness of clouds, we can significantly impact the climate, Prof. Price and his colleagues explain. And too many aerosols may have disastrous impacts on rainfall patterns as well.

Air pollution from car exhausts and smokestacks at power plants and factories contribute to increasing particulate matter in our atmosphere. This is the first study of its kind that uses lightning as a quantitative way to measure the impact of air pollution on cloud development over a large area, and across a number of years.

"Lightning is a sensitive index to the inner workings of polluted clouds over the Amazon Basin," concludes Prof. Price.

Story Source:

Adapted from materials provided by American Friends of Tel Aviv University.

Journal Reference:

1. Orit Altaratz, Ilan Koren, Yoav Yair, Colin Price. **Lightning response to smoke from Amazonian fires**. *Geophysical Research Letters*, 2010; 37 (7): L07801 DOI: 10.1029/2010GL042679

http://www.sciencedaily.com/releases/2010/04/100422121702.htm

NASA's Swift Catches 500th Gamma-Ray Burst

Gamma-ray bursts longer than two seconds are caused by the collapse of a rap-idly rotating massive star at the end of its life. As the star collapses, jets of parti-cles and gamma radiation produced by a newborn black hole blast in opposite directions from the stellar core. (Credit: NASA/Swift/Cruz deWilde)

ScienceDaily (Apr. 25, 2010) — In its first five years in orbit, NASA's Swift satellite has given astronomers more than they could have hoped for. Its discoveries range from a nearby nascent supernova to a blast so far away that it happened when our universe was only 5 percent of its present age.

Swift primarily studies gamma-ray bursts (GRBs) -- the biggest and most mysterious explosions in the cosmos. On April 13, the spacecraft's "burst-o-meter" cataloged its 500th GRB.

"On the one hand, it's just a number, but on the other it is a remarkable milestone," said Neil Gehrels, Swift's lead researcher at Goddard Space Flight Center in Greenbelt, Md. "Each burst has turned over a new piece of the puzzle and a clearer picture is emerging."

"Over five years and 500 bursts, Swift has fulfilled every significant promise of its mission and, in addition, brought a wealth of surprises," noted Derek Fox, a Swift team member at Penn State in University Park, Pa.

Burst 500, officially known as GRB 100413B, exploded in constellation Cassiopeia as a long burst, a type usually associated with the death of a massive star. It wasn't detected in on-board analysis of data from the spacecraft's Burst Alert Telescope (BAT), which was interrupted 18 seconds after the burst as Swift slewed to a pre-planned target.

Instead, GRB 100413B came to light when David Palmer, an astrophysicist at Los Alamos National Laboratory in New Mexico, later analyzed the data. "The BAT team regularly digs through the data once it comes to the ground and finds weak bursts like this one that take a bit of special care," said Goddard's Judith Racusin, who coordinated burst observations that day.

Summaries of other notable bursts in Swift's storied career are listed below.

Swift's main job is to quickly localize each gamma-ray burst, report its position so that others can immediately conduct follow-up observations, and then study the burst using its X-ray and Ultraviolet/Optical telescopes. But it does much more, including ultraviolet studies of exploding stars, monitoring black holes and neutron stars for surges of high-energy radiation, and carrying out a long-term X-ray survey of the entire sky.

The spacecraft rocketed into orbit in November 2004. Managed by NASA's Goddard Space Flight Center, Swift was built and is operated in collaboration with Penn State, the Los Alamos National Laboratory in New Mexico, and General Dynamics of Gilbert, Ariz. Other partners include the University of Leicester and Mullard Space Science Laboratory in the United Kingdom, Brera Observatory and the Italian Space Agency in Italy, with additional collaborators in Germany and Japan.

Origins

Because gamma rays are the highest-energy form of light, the brief but brilliant blasts represent a colossal energy release. Gamma-ray bursts were discovered in 1967 by unclassified military satellites designed to look for clandestine nuclear tests. The first observations required extensive analysis to be sure that the bursts were truly originating beyond the solar system, and they weren't published until 1973.

Over the following years, astronomers learned that sufficiently sensitive instruments could detect about two bursts per day, on average, somewhere in the sky. Of those twice-daily GRBs, Swift's Burst Alert Telescope snares about one in eight for detailed study.

According to Lorella Angelini, a Goddard astrophysicist now developing a comprehensive burst database, the number of recorded GRBs is approaching 6,000. Yet if one considers only bursts with measured distances, Swift's share of the total is a whopping 75 percent.

An earlier NASA satellite, the Compton Gamma Ray Observatory, showed that bursts come in long and short varieties, with long bursts (those lasting longer than two seconds) outnumbering short bursts three to one. Compton also showed that bursts occur randomly and evenly over the sky. Maps of GRB distribution bear no hint of our galaxy's structure. This means that they are extremely far away -- and all the more powerful.

Across the universe

A key breakthrough in understanding GRBs came from the Italian-Dutch satellite Beppo-SAX, which in 1997 provided the first precise burst positions. It later discovered lingering X-ray emission -- dubbed "afterglows" -- at burst locations. Observatories on the ground quickly discovered afterglows in visible light, which provided information that confirmed the burst's enormous distances. Astronomers now regularly study afterglows across the electromagnetic spectrum.

Most of the time, the hard task of measuring burst distances falls to ground-based observatories, which can target a burst's location with telescopes far larger than the Ultraviolet/Optical Telescope aboard Swift.

"Getting on the afterglows quickly with large ground-based telescopes remains a key element in understanding GRBs," said Fox, whose research focuses on follow-up observations. "It's this synergy between Swift and ground observatories that has really moved the ball forward, especially for short bursts."

And the farther the burst, the more important rapid ground follow-up becomes. At distances greater than about 12 billion light-years, gas clouds block ultraviolet wavelengths before they can reach Earth, and all optical light becomes shifted into infrared wavelengths only detectable by specially-equipped ground-based telescopes. Astronomers scramble to detect afterglow from new bursts as soon as they can.

"Thanks to such efforts, we know Swift has seen GRBs as close as about 100 million light-years and as far away as 13 billion light-years," adds Gehrels. Put another way, Swift sees gamma-ray bursts over a span of time equivalent to about 95 percent of the universe's age.

The long and the short of GRBs

By the time Swift launched, mounting evidence already pointed to the deaths of massive stars as the source of most long GRBs -- a scenario that still stands. When such a star runs out of fuel, its core collapses and likely forms a black hole surrounded by a dense hot disk of gas called an accretion disk. Somehow, the black hole diverts part of the infalling matter into a pair of high-energy jets that tear through the collapsing star.

The jets move so fast -- upwards of 99.9 percent the speed of light -- that collisions within them produce gamma rays. As the jet breaches the star's surface, a gamma-ray burst is born. The jet continues on, later striking gas beyond the star to produce afterglows.

Short bursts, however, proved much harder to pin down. "We didn't know their most basic properties," notes Ehud Nakar, an astrophysicist at Tel Aviv University in Israel. "We knew so little we weren't even sure that short GRBs were a unique astrophysical phenomenon."

It turns out they are. "Long GRBs originate from the collapse of stars just millions of years old, but the objects that give rise to some short GRBs reach ages of billions of years before exploding," Nakar adds.

The emerging picture is that short GRBs arise when two compact objects -- either a pair of neutron stars or a neutron star and a black hole -- collide and merge. These objects, which are the crushed cores of exploded stars, pack more mass than the sun into volumes just a few miles across. For those bound in a binary system, Einstein's relativity seals their fate.

According to Einstein, massive orbiting objects give off a type of energy called gravitational radiation. Although no one has yet detected these waves, astronomers have observed an effect predicted by this energy loss -- the slowly shrinking orbits of binary neutron stars. Over billions of years, the stellar cinders grow ever closer and finally merge in an event that unleashes titanic energies and creates a short GRB.

But Nakar thinks the full picture still eludes astronomers. "So far, the data favor merging neutron stars, and that is certainly the most popular idea, but other scenarios remain possible. We still do not know the origin of short GRBs."

Thanks mainly to burst identifications from Swift and the afterglow observations they make possible, scientists now have details on dozens of short bursts and their afterglows. "We're now beginning to understand the home galaxies of short GRBs," Fox said.

Over the past five years, Swift has delivered a great deal of revolutionary science. But its career isn't over yet -- and with a little luck, there will be much more to come.

Swift GRB highlights

April 13, 2010: NASA's Swift discovers its 500th burst. GRB 100413B is a long burst in the constellation Cassiopeia.

April 23, 2009: GRB 090423 in Leo holds the record for the farthest burst yet known -- 13.04 billion light-years away. "The burst is beyond the farthest confirmed galaxies and quasars, making it the most distant object we know in the universe today," Fox said. This find validates models suggesting that galaxy

and star formation were well under way in the universe's first billion years and that some early stars died as bursts.

March 19, 2008: GRB 080319B, in Boötes, is truly extraordinary. It produces enough light to be seen briefly with the unaided eye, cresting at visual magnitude 5.3 despite occurring 7.5 billion light-years away -- or more than halfway across the visible universe. Scientists conclude that one of its particle jets appears to have been aimed squarely at Earth.

July 14, 2007: GRB 070714B explodes in Taurus. Afterglow observations indicate a distance of 7.3 billion light-years, making this one of the farthest short bursts to date.

Feb. 18, 2006: GRB 060218 explodes in Aries 450 million light-years away -- in our back yard, cosmically speaking. Although faint, the burst emits detectable gamma rays for more than 40 minutes and detectable optical and X-ray emission lasts more than 10 days. The event is a hybrid, showing characteristics of both a GRB and a supernova, and leads to the best observations yet exploring connections between these phenomena.

Sept. 4, 2005: At a distance of 12.77 billion light-years, GRB 050904, located in Pisces, is the farthest-known GRB at the time, the first of many such Swift records.

May 9, 2005: GRB 050509B, in Coma Berenices, erupts with a flash of gamma-rays that lasts just 0.03 second. Swift turns to the burst fast enough to detect 11 X-ray photons, making this the first short burst with a detected afterglow.

Dec. 17, 2004: Swift's first burst, in Crater, is eight-second-long GRB 041217.

Story Source:

Adapted from materials provided by NASA/Goddard Space Flight Center.

http://www.sciencedaily.com/releases/2010/04/100419173012.htm

Security Expert Finds Security Holes in Passports and 'Smart Cards'

A home-made, extended-range RFID antenna made from cooking gas copper pipes in Prof. Wool's lab. (Credit: Image courtesy of American Friends of Tel Aviv University)

ScienceDaily (Apr. 25, 2010) — Since 2007, every new U.S. passport has been outfitted with a computer chip. Embedded in the back cover of the passport, the "e-passport" contains biometric data, electronic fingerprints and pictures of the holder, and a wireless radio frequency identification (RFID) transmitter.

Although the system was designed to operate at close range, hackers were able to access it from afar -- until research by Prof. Avishai Wool of Tel Aviv University's School of Electrical Engineering helped ensure that the computer chip in American e-passports could be read only when the passport is opened. The research has been cited by organizations including the Electronic Frontier Foundation.

Now, a new study from Prof. Wool finds serious security drawbacks in similar chips that are being embedded in credit, debit and "smart" cards. The vulnerabilities of this electronic approach -- and the vulnerability of the private information contained in the chips -- are becoming more acute. Using simple devices constructed from $20 disposable cameras and copper cooking-gas pipes, Prof. Wool and his students Yossi Oren and Dvir Schirman have demonstrated how easily the cards' radio frequency (RF) signals can be disrupted. The work will be presented at the IEEE RFID conference in Orlando, FL, this month.

More than one way to hack a chip

Prof. Wool's most recent research centers on the new "e-voting" technology being implemented in Israel. "We show how the Israeli government's new system based on the RFID chip is a very risky approach for security reasons. It allows hackers who are not much more than amateurs to break the system," Prof. Wool explains. "One way to catch hackers, criminals and terrorists is by thinking like one."

In his lab, Prof. Wool constructed an attack mechanism -- an RFID "zapper" -- from a disposable camera. Replacing the camera's bulb with an RFID antenna, he showed how the EMP (electro-magnetic pulse) signal produced by the camera could destroy the data on nearby RFID chips such as ballots, credit cards or passports. "In a voting system, this would be the equivalent of burning ballots -- but without the fire and smoke," he says.

Another attack involves jamming the radio frequencies that read the card. Though the card's transmissions are designed to be read by antennae no more than two feet distant, Prof. Wool and his students demonstrated how the transmissions can be jammed by a battery-powered transmitter 20 yards away. This means that an attacker can disable an entire voting station from across the street. Similarly, a terror group could "jam" passport systems at U.S. border controls relatively easily, he suggests.

The most insidious type of attack is the "relay attack." In this scenario, the voting station assumes it is communicating with an RFID ballot near it &#mdash; but it's easy for a hacker or terrorist to make equipment that can trick it. Such an attack can be used to transfer votes from party to party and nullify votes to undesired parties, Prof. Wool demonstrates. A relay attack may also be used to allow a terrorist to cross a border using someone else's e-passport.

How to make "smart cards" smarter

"All the new technologies we have now seem really cool. But when anything like this first comes onto the market, it will be fraught with security holes," Prof. Wool warns. "In America the Federal government poured a lot of money into e-voting, only to discover later that the deployed systems were vulnerable. Over the last few years we've seen a trend back towards systems with paper trails as a result."

But there are some small steps that can be taken to make smart cards smarter, says Prof. Wool. The easiest one is to shield the card with something as simple as aluminium foil to insulate the e-transmission. In the case of e-voting, a ballot box could be made of conductive materials. The State Department has already taken Prof. Wool's advice: since 2007, they've also added conductive fibres to the back of every American passport.

Story Source:

Adapted from materials provided by American Friends of Tel Aviv University.

http://www.sciencedaily.com/releases/2010/04/100415160141.htm

Gene That Allows Worms to Grow New Head and Brain Discovered

Body builders - the worms that point the way to understanding tissue regeneration. (Credit: Image courtesy of University of Nottingham)

ScienceDaily (Apr. 24, 2010) — Scientists at The University of Nottingham have discovered the gene that enables an extraordinary worm to regenerate its own body parts after amputation -- including a whole head and brain.

Their research into the Planarian worm is another piece in the scientific jigsaw that could one day make the regeneration of old or damaged human organs and tissues a real possibility.

The research led by Dr Aziz Aboobaker, a Research Councils UK Fellow in the School of Biology shows for the first time that a gene called 'Smed-prep' is essential for correctly regenerating a head and brain in planarian worms. The study is published on April 22 2010 in the open access journal *PLoS Genetics.*

Planarian worms have an amazing ability to regenerate body parts, including a head and brain, following amputation. These remarkable creatures contain adult stem cells that are constantly dividing and can become all of the missing cell types. They also have the right set of genes working to make this happen exactly as it should so that when they re-grow body parts they end up in the right place and have the correct size, shape and orientation.

Dr Aboobaker said: "These amazing worms offer us the opportunity to observe tissue regeneration in a very simple animal that can regenerate itself to a remarkable extent and does so as a matter of course.

"We want to be able to understand how adult stem cells can work collectively in any animal to form and replace damaged or missing organs and tissues. Any fundamental advances in understanding from other animals can become relevant to humans surprisingly quickly.

"If we know what is happening when tissues are regenerated under normal circumstances, we can begin to formulate how to replace damaged and diseased organs, tissues and cells in an organised and safe way following an injury caused by trauma or disease. This would be desirable for treating Alzheimer's disease, for example. With this knowledge we can also assess the consequences of what happens when stem cells go wrong during the normal processes of renewal -- for example in the blood cell system where rogue stem cells can result in Leukaemia."

Smed-prep is necessary for the correct differentiation and location of the cells that make up a planarian worm's head. It is also sufficient for defining where the head should be located on the worm. The team

have found that although the presence of Smed-prep is vital so that the head and brain are in the right place, the worm stem cells can still be persuaded to form brain cells as a result of the action of other unrelated genes. But even so, without Smed-prep these cells do not organise themselves to form a normal brain.

Daniel Felix, a graduate student who carried out the experimental work said: "The understanding of the molecular basis for tissue remodeling and regeneration is of vital importance for regenerative medicine. Planarians are famous for their immense power of regeneration, being able to regenerate a new head after decapitation. With the homeobox gene Smed-prep, we have characterised the first gene necessary for correct anterior fate and patterning during regeneration. It has been a really exciting project and I feel very lucky to have had this study as the centre piece of my thesis work"

Story Source:

Adapted from materials provided by University of Nottingham.

Journal Reference:

1. Daniel A. Felix, A. Aziz Aboobaker, Susan E. Mango. **The TALE Class Homeobox Gene Smed-prep Defines the Anterior Compartment for Head Regeneration**. *PLoS Genetics*, 2010; 6 (4): e1000915 DOI: 10.1371/journal.pgen.1000915

http://www.sciencedaily.com/releases/2010/04/100423113721.htm

Early Warning System for Rust Developed

The passive sensor-transponder continuously monitors the protective coating of concrete bridges, allowing corrosion damage to be detected at an early stage. (Credit: Image copyrighted/courtesy of Fraunhofer IMS)

ScienceDaily (Apr. 24, 2010) — Concrete bridges have to be strong enough to cope with a wide variety of different impacts: frost, heavy traffic and emissions all take their toll on these structures. And then there are the various types of road salt used in winter to combat icy roads. The most common of these is sodium chloride, which is deployed in large amounts on Germany's roads. When the ice thaws, these salts break down into their ionic components that penetrate the concrete, destroying its five-centimeter thick protective alkaline layer. Any salt that leaches through to the steel rods used to reinforce the concrete pad will cause them to rust, resulting in structural damage. The result is cracks. In a worst-case scenario the bridge itself could collapse.

Until now there have been no effective tests to determine how deep the ions have penetrated the concrete and what damage they have already caused. Current practice is time-consuming and involves construction workers hammering on the reinforced concrete in search of cavities, which are a sure sign of corrosion damage. But experts at the Fraunhofer Institute for Microelectronic Circuits and Systems IMS in Duisburg have now hit upon a more reliable and cost-effective method for detecting rust corrosion at an early stage.

With a new sensor-transponder they can continuously measure and monitor how deep the ions have penetrated the concrete. While the sensor was developed by the building materials testing facility in Braunschweig (MPA Braunschweig), the integrated passive wireless transponder system is the work of IMS researchers. The sensor itself is crisscrossed by very fine iron wires, laid down at even distances. "If the dissolved salts reach the iron wires, these begin to corrode and break. The number of defective iron wires is an indicator of the extent of corrosion and the depth to which the concrete's protective layer has been penetrated. This allows us to determine when the next repair work needs to be carried out," explains Frederic Meyer, a researcher at the IMS. The transponder transmits the measured data by wireless to the reading device carried by the construction workers. "Our transponder does not get the energy it needs to measure the corrosion from a battery, but from a magnetic field. This means it does not need to be replaced and can remain within the concrete structure permanently," says Meyer.

The first field tests are already underway, with the sensor-transponder being integrated and put through its paces in a test bridge constructed by the MPA Braunschweig. The researchers will be exhibiting a prototype at the EURO ID trade fair, to be held in Cologne from May 4 through 6.

Story Source:

Adapted from materials provided by Fraunhofer-Gesellschaft, via EurekAlert!, a service of AAAS.
http://www.sciencedaily.com/releases/2010/04/100421111355.htm

Car Steered With Eyes, Computer Scientists Demonstrate

Scientists in Germany recently demonstrated how they can steer the vehicle that is equipped with complex electronics just by eye. (Credit: Courtesy of Spirit of Berlin / Artificial Intelligence Group / Freie Universität Berlin)

ScienceDaily (Apr. 24, 2010) — "Keep your eyes on the road!" Scientists at Freie Universität working under the computer science professor Raúl Rojas have given a completely new meaning to this standard rule for drivers: Using software they developed, they can steer a car with their eyes.On the site of the former Berlin Tempelhof Airport, the head of the project, Raul Rojas, and his team from the Artificial Intelligence Group recently demonstrated how they can steer the vehicle that is equipped with complex electronics just by eye. More than 60 journalists from around the world were there to watch.

Information about the Software: EyeDriver

The eyeDriver software is a prototype application for steering the research vehicle Spirit of Berlin using eye movements. The software was designed by computer scientists at Freie Universität Berlin in collaboration with the company, SMI (SensoMotoric Instruments). The eye movements of the driver are collected and converted into control signals for the steering wheel. The speed is controlled separately and is not included in eyeDriver. The software shows that you can drive a vehicle alone with eye movements.The HED4 solution by SMI is used for detecting and tracking the eye movements. It is a converted bicycle helmet equipped with two cameras and an infrared LED, as well as a laptop computer with special software. One of the cameras is pointed to the front in the same direction as the person wearing the helmet (scene camera), while the other camera films one eye of the wearer (eye camera). The infrared light supports the eye camera and is pointed to the eye under observation. A transparent mirror that reflects only the infrared light is used to allow a reasonable viewing angle for the eye camera, without limiting the wearer's ability to see. After a brief calibration the software on the laptop of the HED4 is not only able to capture the position of the pupil in the eye camera, but can also calculate the position in the scene camera that the wearer is looking at. These coordinates in the image of the scene camera (viewing position) are transmitted via an ordinary LAN to the onboard computer in the Spirit of Berlin. The eyeDriver software in the onboard computer in the Spirit of Berlin receives the viewing positions at regular intervals over the LAN in the vehicle and uses it to control the steering wheel. The driver can choose between two modes: "free ride" and "routing."In the "free ride" mode the viewing positions are linked directly with the steering wheel motor. That means that the x-coordinates of the viewing position are used to calculate the desired position of the steering wheel. The further the driver looks to the left or

right, the further the steering wheel is turned in that direction. The speed of the vehicle is set in advance and kept constant, as long as the position of the gaze is recognized. In case it is not possible to detect which direction the driver is looking in, for example, if the driver's eyes are closed, the vehicle brakes automatically.

In the "routing" mode, the Spirit of Berlin steers autonomously most of the time. Only where there is a fork in the road, or an intersection, the car stops and asks the driver to select the next route. This requires the wearer of the helmet to look to the left or right for three seconds. If the driver's gaze lingers long enough in one direction, the eyeDriver software confirms acoustically that the choice has been accepted. The decision is communicated to the planner in the vehicle. Then the artificial intelligence in the Spirit of Berlin can plan the route accordingly and continue to run independently.

The Autonomous Vehicle Project

Prof. Dr. Raúl Rojas is a professor of artificial intelligence at the Institute of Computer Science at Freie Universität Berlin. He gained international success with his soccer robots, the "FU-Fighters." They were world champions twice in the small-size league. Since 2006 Prof. Rojas and his team have been designing technologies related to autonomous vehicles. As part of this project, they developed the research vehicle Spirit of Berlin, making it to the semifinals in the DARPA Urban Challenge in California in 2007.

In the fall of 2009, in the innovative vehicle steering series, based on the test vehicle, the computer scientists Tinosch Ganjineh and Miao Wang developed iDriver, with which it is possible to steer the research car using an iPhone. This series is now complemented with the EyeDriver software. It was developed primarily by Miao Wang and David Latotzky in cooperation with the firm SMI. These two developments are simply sub-projects. The core of the research continues to be the autonomous driving.

The AutoNOMOS Project

Since November 2010 the team around Prof. Rojas has been working on the further development of autonomous or semi-autonomous cars in the AutoNOMOS project headed by Tinosch Ganjineh. The project is being funded by the German Ministry of Education and Research (BMBF) in its ForMaT (Forschung für den Markt im Team) program. The funding is for two years. The project will make a significant contribution to the development of accident-free, efficient, and environmentally friendly mobility. AutoNOMOS is a modular system for the operation of autonomous or semi-autonomous cars. Using AutoNomos, it will be possible to detect impending dangers on roads, highways, and crossings (lane change, traffic jams, rights of way) at an early stage and accidents can be prevented. Once the technology is ready, it will be introduced at first on private property and, finally, in public traffic.

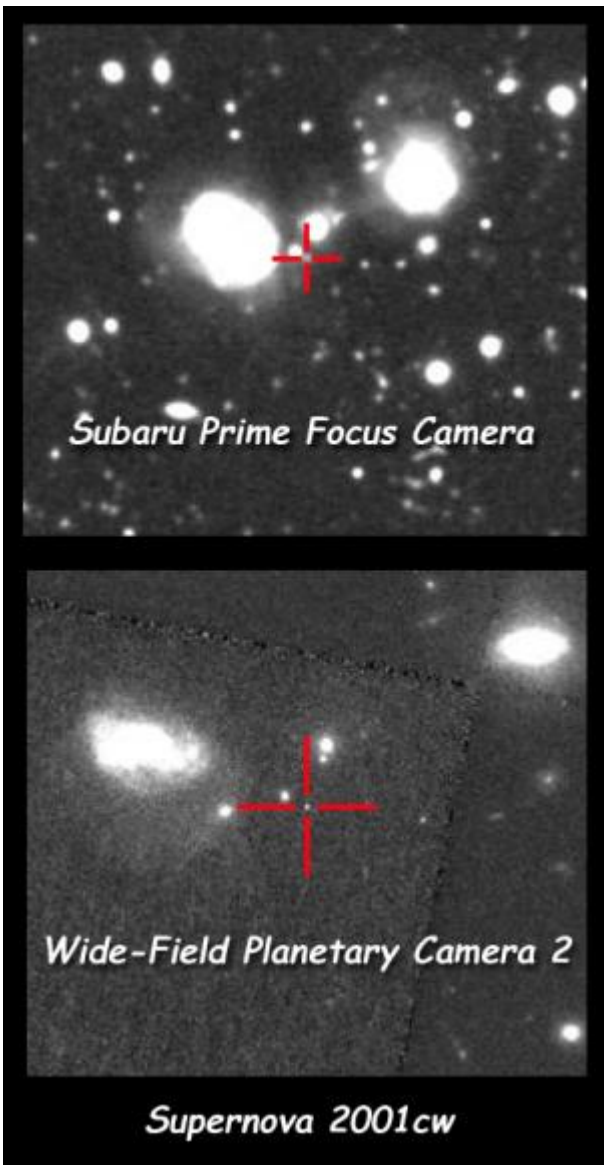
The Spirit of Berlin

The Spirit of Berlin is an autonomous vehicle that was designed and built by the Artificial Intelligence Group at Freie Universität Berlin as of 2007. It is a car that can be driven without a driver. A conventional car (Dodge Grand Caravan, 2000) was equipped with sensors, computers, and actuators. The sensors collect information about the immediate environment. Using this information, the software on the computers selects what to do. The resulting action is then implemented with the help of mechanical actuators.

Story Source:

Adapted from materials provided by Freie Universitaet Berlin, via AlphaGalileo.
http://www.sciencedaily.com/releases/2010/04/100423215028.htm

Searching for Dark Energy With the Whole World's Supernova Dataset



Two views of one of the six new distant supernovae in the Supernova Cosmology Project's just-released Union2 survey, which among other refinements compares ground-based infrared observations (in this case by Japan's Subaru Telescope on Mauna Kea) with follow-up observations by the Hubble Space Telescope. (Credit: Image courtesy of DOE/Lawrence Berkeley National Laboratory)

ScienceDaily (Apr. 24, 2010) — The international Supernova Cosmology Project (SCP), based at the U.S. Department of Energy's Lawrence Berkeley National Laboratory, has announced the Union2 compilation of hundreds of Type Ia supernovae, the largest collection ever of high-quality data from numerous surveys. Analysis of the new compilation significantly narrows the possible values that dark energy might take -- but not enough to decide among fundamentally different theories of its nature.

"We've used the world's best-yet dataset of Type Ia supernovae to determine the world's best-yet constraints on dark energy," says Saul Perlmutter, leader of the SCP. "We've tightened in on dark energy out to redshifts of one" -- when the universe was only about six billion years old, less than half its present age -- "but while at lower redshifts the values are perfectly consistent with a cosmological constant, the most important questions remain."

That's because possible values of dark energy from supernovae data become increasingly uncertain at redshifts greater than one-half, the range where dark energy's effects on the expansion of the universe are most apparent as we look farther back in time. Says Perlmutter of the widening error bars at higher redshifts, "Right now, you could drive a truck through them."

As its name implies, the cosmological constant fills space with constant pressure, counteracting the mutual gravitational attraction of all the matter in the universe; it is often identified with the energy of the vacuum. If indeed dark energy turns out to be the cosmological constant, however, even more questions will arise.

"There is a huge discrepancy between the theoretical prediction for vacuum energy and what we measure as dark energy," says Rahman Amanullah, who led SCP's Union2 analysis; Amanullah is presently with the Oskar Klein Center at Stockholm University and was a postdoctoral fellow in Berkeley Lab's Physics Division from 2006 to 2008. "If it turns out in the future that dark energy is consistent with a

cosmological constant also at early times of the universe, it will be an enormous challenge to explain this at a fundamental theoretical level."

A major group of competing theories posit a dynamical form of dark energy that varies in time. Choosing among theories means comparing what they predict about the dark energy equation of state, a value written *w*. While the new analysis has detected no change in *w*, there is much room for possibly significant differences in *w* with increasing redshift (written z).

"Most dark-energy theories are not far from the cosmological constant at z less than one," Perlmutter says. "We're looking for deviations in *w* at high z, but there the values are very poorly constrained."

In their new analysis to be published in the *Astrophysical Journal*, the Supernova Cosmology Project reports on the addition of several well-measured, very distant supernovae to the Union2 compilation.

Dark energy fills the universe, but what is it?

Dark energy was discovered in the late 1990s by the Supernova Cosmology Project and the competing High-Z Supernova Search Team, both using distant Type Ia supernovae as "standard candles" to measure the expansion history of the universe. To their surprise, both teams found that expansion is not slowing due to gravity but accelerating.

Other methods for measuring the history of cosmic expansion have been developed, including baryon acoustic oscillation and weak gravitational lensing, but supernovae remain the most advanced technique. Indeed, in the years since dark energy was discovered using only a few dozen Type Ia supernovae, many new searches have been mounted with ground-based telescopes and the Hubble Space Telescope; many hundreds of Type Ia's have been discovered; techniques for measuring and comparing them have continually improved.

In 2008 the SCP, led by the work of team member Marek Kowalski of the Humboldt University of Berlin, created a way to cross-correlate and analyze datasets from different surveys made with different instruments, resulting in the SCP's first Union compilation. In 2009 a number of new surveys were added.

The inclusion of six new high-redshift supernovae found by the SCP in 2001, including two with z greater than one, is the first in a series of very high-redshift additions to the Union2 compilation now being announced, and brings the current number of supernovae in the whole compilation to 557.

"Even with the world's premier astronomical observatories, obtaining good quality, time-critical data of supernovae that are beyond a redshift of one is a difficult task," says SCP member Chris Lidman of the Anglo-Australian Observatory near Sydney, a major contributor to the analysis. "It requires close collaboration between astronomers who are spread over several continents and several time zones. Good team work is essential."

Union2 has not only added many new supernovae to the Union compilation but has refined the methods of analysis and in some cases improved the observations. The latest high-z supernovae in Union2 include the most distant supernovae for which ground-based near-infrared observations are available, a valuable opportunity to compare ground-based and Hubble Space Telescope observations of very distant supernovae.

Type Ia supernovae are the best standard candles ever found for measuring cosmic distances because the great majority are so bright and so similar in brightness. Light-curve fitting is the basic method for standardizing what variations in brightness remain: supernova light curves (their rising and falling brightness over time) are compared and uniformly adjusted to yield comparative intrinsic brightness. The light curves of all the hundreds of supernova in the Union2 collection have been consistently reanalyzed.

The upshot of these efforts is improved handling of systematic errors and improved constraints on the value of the dark energy equation of state with increasing redshift, although with greater uncertainty at very high redshifts. When combined with data from cosmic microwave background and baryon oscillation surveys, the "best fit cosmology" remains the so-called Lambda Cold Dark Matter model, or ΛCDM.

ΛCDM has become the standard model of our universe, which began with a big bang, underwent a brief period of inflation, and has continued to expand, although at first retarded by the mutual gravitational attraction of matter. As matter spread and grew less dense, dark energy overcame gravity, and expansion has been accelerating ever since.

To learn just what dark energy is, however, will first require scientists to capture many more supernovae at high redshifts and thoroughly study their light curves and spectra. This can't be done with telescopes on the ground or even by heavily subscribed space telescopes. Learning the nature of what makes up three-quarters of the density of our universe will require a dedicated observatory in space.

This work was supported in part by the U.S. Department of Energy's Office of Science.

Story Source:

Adapted from materials provided by DOE/Lawrence Berkeley National Laboratory.

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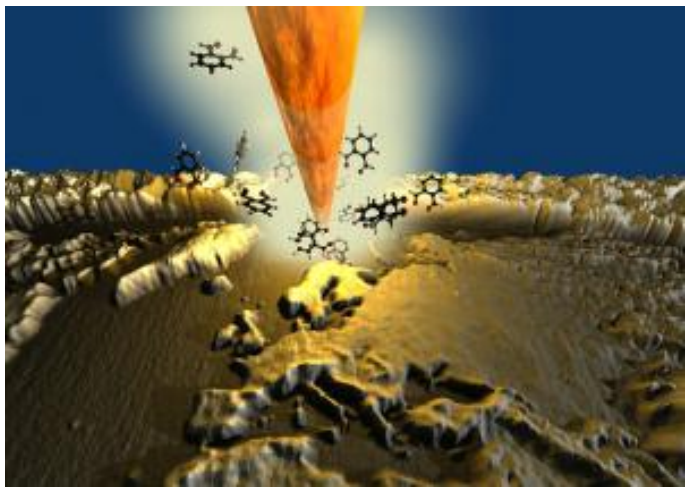
http://www.sciencedaily.com/releases/2010/04/100421133120.htm

IBM Research Creates World's Smallest 3D Map; Brings Low-Cost, Ease of Use to Creation of Nanoscale Objects



3D rendered image showing a heated nanoscale silicon tip, borrowed from atomic force microscopy that is chiselling away material from a substrate to create a nanoscale 3D map of the world. As reported in the scientific journal Advanced Materials, IBM Researchers used this new nanopatterning technique to create the smallest map of the world in 3D, measuring only 22 by 11 micrometers was "written" – on a polymer - at this size 1000 world maps could fit on a grain of salt. In the relief, one thousand meters of altitude correspond to roughly eight nanometers (nm). It is composed of 500,000 pixels, each measuring 20 nm2 and was created in only 2 minutes and 23 seconds. (Credit: Image courtesy of Advanced Materials)

ScienceDaily (Apr. 24, 2010) — IBM scientists have created a 3D map of the earth so small that 1,000 of them could fit on one grain of salt.* The scientists accomplished this through a new, breakthrough technique that uses a tiny, silicon tip with a sharp apex -- 100,000 times smaller than a sharpened pencil -- to create patterns and structures as small as 15 nanometers at greatly reduced cost and complexity. This patterning technique opens new prospects for developing nanosized objects in fields such as electronics, future chip technology, medicine, life sciences, and optoelectronics.

To demonstrate the technique's unique capability, the team created several 3D and 2D patterns, using different materials for each one as reported in the scientific journals Science and Advanced Materials:

- A 25-nanometer-high 3D replica of the Matterhorn, a famous Alpine mountain that soars 4,478 m (14,692 ft) high, was created in molecular glass, representing a scale of 1:5 billion.**
- Complete 3D map of the world measuring only 22 by 11 micrometers was "written" on a polymer. At this size, 1,000 world maps could fit on a grain of salt. In the relief, one thousand meters of altitude correspond to roughly eight nanometers (nm). It is composed of 500,000 pixels, each measuring 20 nm2, and was created in only 2 minutes and 23 seconds.
- 2D nano-sized IBM logo was etched 400-nm-deep into silicon, demonstrating the viability of the technique for typical nanofabrication applications.
- 2D high-resolution 15-nm dense line patterning.

The science behind the technique

The core component of the new technique, which was developed by a team of IBM scientists, is a tiny, very sharp silicon tip measuring 500 nanometers in length and only a few nanometers at its apex.

"Advances in nanotechnology are intimately linked to the existence of high-quality methods and tools for producing nanoscale patterns and objects on surfaces," explains physicist Dr. Armin Knoll of IBM Research -- Zurich. "With its broad functionality and unique 3D patterning capability, this nanotip-based patterning methodology is a powerful tool for generating very small structures."

The tip, similar to the kind used in atomic force microscopes, is attached to a bendable cantilever that controllably scans the surface of the substrate material with the accuracy of one nanometer -- a millionth of a millimeter. By applying heat and force, the nano-sized tip can remove substrate material based on predefined patterns, thus operating like a "nanomilling" machine with ultra-high precision.Similar to using a milling machine, more material can be removed to create complex 3D structures with nanometer precision by modulating the force or by readdressing individual spots. To create the 3D replica of the Matterhorn, for example, 120 individual layers of material were successively removed from the molecular glass substrate.

Comparing to e-beam lithography

The new IBM technique achieves resolutions as high as 15 nanometers -- with a potential of going even smaller. Using existing methods such as e-beam lithography,*** it is becoming increasingly challenging to fabricate patterns at resolutions below 30 nanometers, where the technical limitations of that method are reached.

What's more, compared to expensive e-beam-lithography tools that require several processing steps and equipment that can easily fill a laboratory, the tool created by IBM scientists -- which can sit on a tabletop -- promises improved and extended capabilities at very high resolutions, but at one-fifth to one tenth of the cost and with far less complexity.

Yet another advantage of the nanotip-based technique is the ability to assess the pattern directly by using the same tip to create an image of the written structures, as the IBM scientists demonstrated in their experiments.

Potential applications range from the fast prototyping of nano-sized devices for future computer chips to the production of well defined micron-sized optical elements like aspheric lenses and lens-arrays for optoelectronics and on-chip optical communication.

Materials breakthrough

In the two publications, the scientists describe their novel 3D-nanopatterning methodology for two very distinct and promising types of substrate materials: a polymer called polyphthalaldehyde and a molecular glass similar to substrate materials used in conventional nanofabrication techniques, so-called resists. Identifying these two materials was a key factor for the breakthrough performance and reliability of the technique.In their search for suitable and efficient substrate materials, the scientists concentrated on organic materials that could be used as resists, thereby following the same philosophy as used for today's semiconductor technology, which is important for further integration.

"The material was a 'make it or break it' issue," explains Jim Hedrick, scientist at IBM Research -- Almaden. "We had to find and synthesize materials which form mechanically tough glasses and yet can be easily thermally decomposed into non-reactive volatile units."

The molecular glass that was used in the Matterhorn experiment consists of snow-flake-like molecules, measuring about one nanometer and having an almost spherical shape. At a tip temperature above 330 degrees C (626 degrees F), the hydrogen bonds that hold the molecules together break, allowing the molecular parts to become mobile and to escape from the surface. A particular strength of the material is that the patterned molecular glass can be transferred by means of conventional etching techniques to, for example, silicon, which is common in the semiconductor industry. Molecular glass was first proposed in the late 1990s by Mitsuru Ueda of Yamagata University, Japan, for use as high-resolution photoresists and was thereafter developed by Chris Ober of Cornell University.

The nanosized 3D world map was created in a polymer called polyphthalaldehyde, a polymer originally developed by IBM Fellow Hiroshi Ito in the 1980s. Exposed to substantially elevated temperatures, the

components of this chain-like organic molecule unzip and fall into volatile pieces. A self-amplified reaction causes the molecule to decompose and then accelerates the entire patterning process by being even faster than the mechanical motion of the tip.

IBM and nanotechnology

IBM has been a pioneer in nanoscience and nanotechnology ever since the development of the scanning tunneling microscope (STM) in 1981 by IBM Fellows Gerd Binnig and Heinrich Rohrer. For this invention, which made it possible to image individual atoms and later on to manipulate them, Binnig and Rohrer were awarded the Nobel Prize in Physics in 1986. The atomic force microscope, an offspring of the STM, was invented by Binnig in 1986. The STM is widely regarded as the instrument that opened the door to the nanoworld.

In fact it was 20 years ago this month that IBM Fellow Don Eigler reported the first controlled movement of individual atoms, famously using a scanning tunneling microscope to spell out the letters "I B M" with 35 xenon atoms.

These historic breakthroughs laid a solid foundation for IBM's continued research in nanoscience.

Contributing to this rich history for years to come, a new world-class collaborative nanoscale research lab is currently under construction on the campus of IBM Research -- Zurich. This state-of-the-art nanotech center, which will open next year, is part of a strategic partnership in nanotechnology between IBM Research and ETH Zurich, one of Europe's leading technical universities.

Notes

* Taking 0.3 mm as the average size of a grain of salt, 1000 maps would span the diameter.

** One nanometer in the vertical pattern corresponds to 57 altitude meters.

*** This method selectively exposes a surface to a beam of electrons, thereby creating patterns in a film, called a resist. The resist serves as a template for transferring the pattern to various materials, for example silicon, by means of etching. It is one of the most versatile and mature methods used today, but it is very costly and complex.

Story Source:

Adapted from materials provided by IBM.

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http://www.sciencedaily.com/releases/2010/04/100423220607.htm

Machine-Learning Revolutionizes Software Development

ScienceDaily (Apr. 24, 2010) — Automation technology has revolutionised the fine-tuning needed to maximise software performance on devices such asmobile phones.

Application developers for software on mobile phones and other embedded devices can achieve acceptable performance levels ten times faster thanks to a breakthrough by European researchers.

Human-readable software code needs to be translated into binary code by a compiler if it is to run on hardware. When hardware is upgraded the software's compiler usually needs to be tweaked or 'tuned' to optimise its performance. If compilers are not optimised for the hardware, doubling the processor size or increasing processor speed can actually result in a loss of software performance, not an improvement.

But hardware is changing so quickly compiler developers can't keep up and compiler optimisation has become a bottleneck in the development process.

Using machine-learning technology, researchers on the Milepost project have developed an automatic way to optimise compilers for re-configurable embedded processors. Whether it is mobile phones, laptop computers or entire systems, the technology automatically learns how to get the best performance from the hardware and the software will run faster and use less energy.

Industry revolution

"All the compiler teams at the big companies are rethinking the way they do things as a result of this," says Professor Michael O'Boyle, from the University of Edinburgh, and project coordinator for Milepost (http://www.milepost.eu/).

"Automation provides compiler developers with leverage to be more experimental. They can try new ideas, new analyses and new optimisations. The machine-learning technology analyses whether it works and when it works. It opens up a whole new area of research and a whole area of performance gains that we couldn't try before. For instance, we were able to deliver a portable compiler that can work across any future architecture configuration."

The Milepost GCC technology learns to predict the optimal compiler solution for any new program by analysing the execution time of various compiler options and the amount of code in their training programs.

The key technical challenge for the Milepost team was to describe programs and hardware in ways that machine-learning technology could use. That also meant completely redesigning compilers to enable them to use the new machine-learning technology.

Better software performance can open up new opportunities for product suppliers, explains O'Boyle. "If you can run things faster and more energy efficiently, you may be able to choose a different piece of hardware than before -- perhaps a cheaper option for the same performance. Alternatively, you could add more functionality without increasing energy usage. You get more for your money."

French company CAPS Enterprise SAS, one of the participants in the EU-funded Milepost project, planned to include Milepost technologies in its new set of tools. Other participants, including IBM, are using Milepost GCC to get better performance from their processors, making their products more attractive to customers.

Open source auto-tuner

The Milepost team has launched a code tuning website for the compiler development community. Developers can upload their software code to the site and automatically get input on how to tune their code so it works faster.

"This is one of the most successful projects I have been involved in," says Michael O'Boyle. He and his fellow researchers are now seeking to apply the lessons of Milepost to help solve the challenges of next - generation computer technologies.

"We can use machine-learning technologies to look at multi-core and heterogeneous platforms and we will be looking at dynamic online adaptation," he says.

But as workloads change, can we reconfigure hardware and software to make it adaptable to the fine grain and big scalability challenges we will have when we move from 2, 4 or 8 cores to thousands of cores on a chip?

This is the big question facing developers of the future. And the smart money will be on the Milepost researchers to answer it.

The Milepost project received funding from the ICT strand of the Sixth Framework Programme for research.

Story Source:

Adapted from materials provided by ICT Results.
http://www.sciencedaily.com/releases/2010/04/100420161222.htm

Science enthusiasts chase dream

By Michelle Martin
BBC Radio Science Unit

From clouds to crowds - four amateur scientists have been chosen by BBC Radio 4 to turn their ideas into real-life experiments.

The finalists were revealed this week on Material World, the station's weekly science programme.

The ideas include testing whether there is more room at the front of music gigs than further back and looking at how people present themselves on Facebook.

The amateurs will be mentored by leading scientists in their fields.

The four finalists are:

- Ruth Brooks, 59, a retired home tutor from Devon, who wants to discover the homing distance of the garden snail so she can stop them from eating her petunias
- Sam O'kell, 35, a croupier from Cheshire; he will test his theory that there is more room at the front of music gigs than further back
- Nina Jones, 17, a student from Buckinghamshire, who will look at how people of different ages present themselves online through their Facebook photos
- John Rowlands, 41, an amateur astronomer from North Wales; he wants to research the frequency of noctilucent clouds, luminous layers of ice crystals that form high in the atmosphere.

The talent search So You Want to Be a Scientist? was launched in January, and more than 1,300 ideas were sent in.

" **It's really tough getting the methodology right so you can get to an answer that's reliable** "
Trevor Cox

The four finalists were chosen by a panel of judges chaired by Professor Lord Robert May, former chief science advisor to the government.

He was joined by clinical psychologist Professor Tanya Byron, acoustics engineer Professor Trevor Cox, and Mark Henderson, science editor of the London Times newspaper.

"The shortlist was amazing, I was overwhelmed," said Professor Byron.

"They were so creative and diverse, so it was really hard to make a decision."

Scientific statement

After agreeing on the first three finalists, the judges almost reached a stalemate on the final place.

It was a close call between John Rowlands' study of noctilucent clouds, and an entry by art gallery owner Shane Record from Kent.

Shane wanted to test his observation that more people come into his gallery when he puts a mannequin by the artwork.

Giving the illusion that they will not be alone in the gallery, says Shane, makes visitors far more likely to enter.

In the end, they chose John Rowlands' amateur astronomy experiment, which had wider implications for research fields such as climate change.

It is thought that the increase in brightness and frequency of noctilucent clouds over past decades may be linked to global warming.

The amateurs will be mentored by leading scientists in their chosen field, who will advise them on how to turn their ideas into rigorous experiments.

From anecdote to experiment

Professor Cox said the finalists had a difficult task ahead of them.

"I think the devil is in the detail with science, it's really tough getting the methodology right so you can get to an answer that's reliable."

The four finalists will present their results at the British Science Festival in Birmingham in September, where the judges will pick a winner.

They will then write their results into a research paper and submit it to an academic journal.

Mark Henderson said that watching the finalists' progress would give people a new insight into the world of science.

"Science is about having ideas, then gathering the evidence to support your hypothesis.

"I really hope that by following these experiments people will be able to see how science is really done."

To hear more about the finalists and the judges' meeting, readers in the UK can listen again to Material World on

You can also follow the progress of the four finalists on

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8641165.stm

Published: 2010/04/24 18:19:31 GMT

Geothermal energy summit in Bali

By Karishma Vaswani
BBC News, Jakarta

Indonesia is hosting what is being called the world's biggest geothermal energy conference.

The congress in Bali is an attempt to look at how to better develop geothermal power as an environmentally friendly fuel for the future.

Geothermal power is energy extracted from the heat stored in the Earth, and environmentalists say it could be the key to using cleaner forms of fuel.

Representatives from 80 countries are attending the talks.

Expensive endeavour

It is often dubbed volcano power but the correct scientific explanation for geothermal energy is power extracted from the heat stored in the Earth's core.

Indonesia has ambitious plans to tap geothermal power and in particular the energy created by its volcanoes.

The archipelago of more than 17,000 islands sits on the Pacific "Ring of Fire" - one of the most active regions in the world for volcanic activity.

Indonesia does not have the resources to be able to provide a consistent supply of electricity to all of its population, so finding an alternative source of energy is critical for south-east Asia's largest economy as it rapidly expands.

This will be one of the major talking points at the world geothermal congress in Bali this week.

Scientists say that in theory the planet's geothermal power is enough to supply mankind's energy needs and could certainly help to solve Indonesia's fuel problems.

But the issue is cost. While environmentally friendly, the harnessing of geothermal power is also a very expensive endeavour.

Indonesia currently uses mostly coal as a source of power, which is cheap but is also considered harmful to the environment.

It is thought that a geothermal plant could cost about twice as much as a coal one and take many more years to build.

It is being reported that Indonesia is keen to raise more than $1bn (£650m) in investment as a result of this conference so that it can develop geothermal energy as a source of power for its future.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8643326.stm

Published: 2010/04/25 21:58:32 GMT

Call to cut child heart op units

By Jane Hughes
Health correspondent, BBC News

Several children's heart surgery units across England should be closed with operations done by fewer, specialised centres, according to an expert review.

It was launched after the 1990s Bristol heart babies scandal when children having heart surgery died needlessly.

The BBC has learned that all 11 paediatric heart centres are being assessed to decide which to keep open.

The intention is to improve care, but patients' groups say long journeys could put pressure on families.

There are currently 31 surgeons in 11 centres across England carrying out heart operations on children.

" **Some people have friends and family they can call on for support, but not everybody does** "
Katherine Murphy, Patients Association

Their work first came under the spotlight after it emerged that children had died unnecessarily following heart surgery at the Bristol Royal Infirmary between 1991 and 1995.

Experts have already advised that fewer, larger centres of excellence would provide better care for children needing heart surgery.

The NHS National Specialised Commissioning Group is now assessing which centres should stop doing surgery, and which should be expanded to provide the best, most specialised care.

Balance

A report by the group says a balance has to be struck between services that are close to home and services that provide enough specialist skills to provide the highest standards of care.

At the moment, four children's heart surgery centres have only one or two paediatric surgeons. The report says this means there are times when a surgeon is not available to deal with routine cases or emergencies, and that they may have more limited expertise.

There are no plans to cut the overall number of surgeons, but it is likely some would have to move to different centres.

Each would have a minimum of four surgeons. The centres that stopped doing surgery could continue doing non-surgical treatments like diagnostics out-patient care.

Long journeys

NHS medical director Sir Bruce Keogh said the proposals put the interests of children first.

"If we don't address this issue we will put some of the most critically ill children at risk and fail in our duty to ensure these NHS services are fit for the future," he said.

The Patients Association said it was not opposed to reorganisations of specialist services when there were good clinical reasons, but it said if surgical units were closed, patients and their families could face long journeys for treatment.

"Some people have friends and family they can call on for support, but not everybody does," said spokeswoman Katherine Murphy.

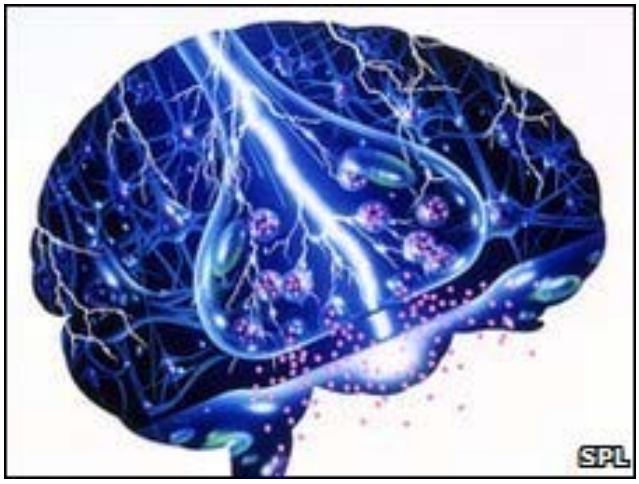
"If the NHS is to be a truly comprehensive health service it needs to be mindful of these needs and help families and carers cope with the very real difficulties that can be created."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8641105.stm

Published: 2010/04/25 23:53:33 GMT

New culprit emerges in epilepsy

Researchers have shed new light on the mechanism behind epilepsy attacks in the brain, revealing a potential new target for drug treatment.



Around half a million people in the UK have some form of epilepsy.

Until recently the focus of research has been on cells called neurons, but a US study points to a completely different cell.

Nature Neuroscience journal reports its behaviour may be key to uncontrolled brain activity behind the condition.

Epilepsy attacks, which can manifest as fits in some people, or "absences" in others, are caused by too much electrical signalling from the brain's neurons.

However, in many cases, the reason for this over-activity is poorly understood.

" **By better understanding the detailed events that occur in epilepsy, we are gaining knowledge that could ultimately lead to better treatments** "
Dr Douglas Coulter, Children's Hospital of Philadelphia

Scientists now believe that, in some cases, although the problem happens at the neuron the underlying reason may be the failure of surrounding cells to help control this activity.

The latest study, from the Tuft University School of Medicine and the Children's Hospital of Philadelphia, provides the strongest evidence yet that a cell called an astrocyte is the culprit.

The astrocyte is known to have a wide range of functions, including supplying nutrients to other brain cells, and even helping the brain cope with damaged nerve cells.

In some brain diseases, the astrocytes swell up and behave differently, and it is this condition which the researchers believe is linked to epilepsy.

No inhibition

They induced this swelling in brain samples from mice, then tested whether this made a difference to the ability of the brain cells to "turn down", or inhibit, the brain signals from specific neurons.

They found that the enlarged astrocytes led to reduced levels of a brain chemical known to inhibit electrical signalling from the neurons.

Dr Douglas Coulter, one of the researchers, said: "We already know that inhibition is a powerful force in the brain.

"In epilepsy, inhibition is not working properly, and uncontrolled signalling leads to epileptic seizures.

"By better understanding the detailed events that occur in epilepsy, we are gaining knowledge that could ultimately lead to better treatments for epilepsy, and possibly for other neurological diseases."

Professor Vincenzo Crunelli, a neuroscientist from the University of Cardiff, said other research, including his own, now pointed towards a role for astrocytes in various different types of epilepsy.

He said the finding might be particularly relevant in a form of epilepsy called temporal lobe epilepsy, which can be resistant to treatment.

He said: "This certainly suggests that the astrocytes may be involved in maintaining this over-excitation of the neurons.

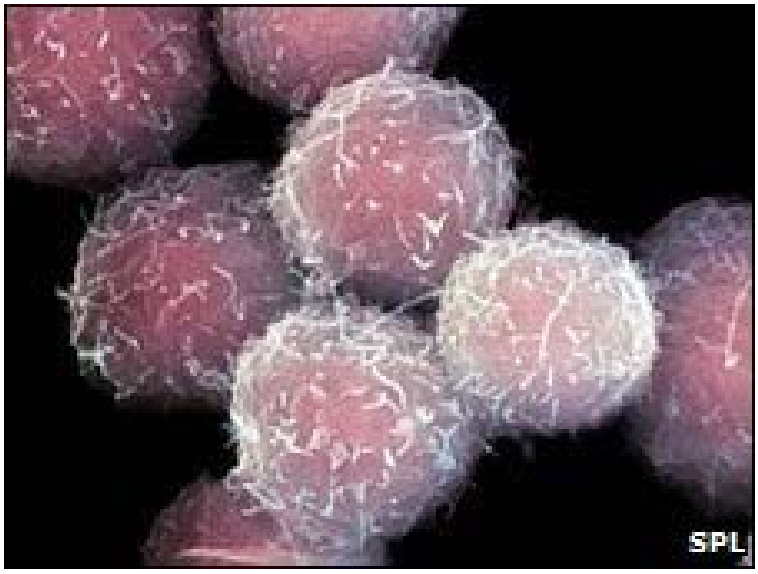
"If this is the case, it offers the chance of a new therapeutic target."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8639527.stm

Published: 2010/04/25 23:16:57 GMT

'Leftover' veins yield stem cells

Human veins left over from lifesaving bypass surgery could be a source of "master" cells to help treat future heart problems, say scientists.



A University of Bristol team extracted stem cells from the veins, then used them to stimulate new blood vessel growth in mice, Circulation reports.

The researchers say their findings could bring treatments to repair damaged heart muscle one step closer.

However, a stem cell expert warned that they remained some years away.

Stem cells are attractive to medical researchers because they have the ability to produce many different types of human cell, opening up the possibility of repair or renewal for tissues ravaged by disease or injury.

While human embryos were originally seen as the prime source of "pluripotent" cells, with the potential to form virtually any tissue type, scientists are increasingly finding ways to isolate cells from adults which have some of these properties, and encourage them to multiply into useful numbers.

The latest discovery uses a "waste" product from thousands of operations carried out on heart patients each year.

Patients with heart disease often have blocked or narrowed arteries supplying the heart muscle.

" **Repairing a damaged heart is the holy grail for heart patients** "
Professor Peter Weissberg, British Heart Foundation

The lack of blood leaves the muscle damaged, and this can cause chest pain or even a heart attack.

A heart bypass operation takes a section of vein, usually from the patient's leg, and uses it to replace a blocked or narrowed section of heart artery.

The surgeon normally takes a slightly longer section than is actually required.

In this study, the Bristol team took the leftover piece and, in the laboratory, they managed to extract "progenitor" cells from the veins and persuade them to increase in number.

Mouse muscle

When the stem cells were injected into the leg muscle of a mouse which had been deprived of blood to simulate conditions in a damaged heart, the cells appeared to trigger the development of new blood vessels and improve blood flow.

Professor Paolo Madeddu, who led the research, said: "This is the first time that anyone has been able to extract stem cells from sections of vein left over from heart bypass operations.

"These cells might make it possible for a person having a bypass to also receive a heart treatment using their body's own stem cells."

However, other experts said much more work would be needed before such cells could be used widely in humans.

Professor Qingbo Xu, from King's College London, said the mechanisms by which the cells worked needed to be more fully understood.

"It's possible this could be a future treatment, although not at the same time as the heart bypass surgery, as it takes some time to extract and grow these cells in the laboratory.

"But there is a long way to go before we can have a clinical application for this."

Professor Peter Weissberg, the medical director of the British Heart Foundation, which funded the research, said the prospect of repairing heart damage was the "holy grail" for heart patients.

He said: "It brings the possibility of 'cell therapy' for damaged hearts one step closer, and, importantly, if the chemical messages produced by the cells can be identified, it is possible that drugs could be developed to achieve the same end."

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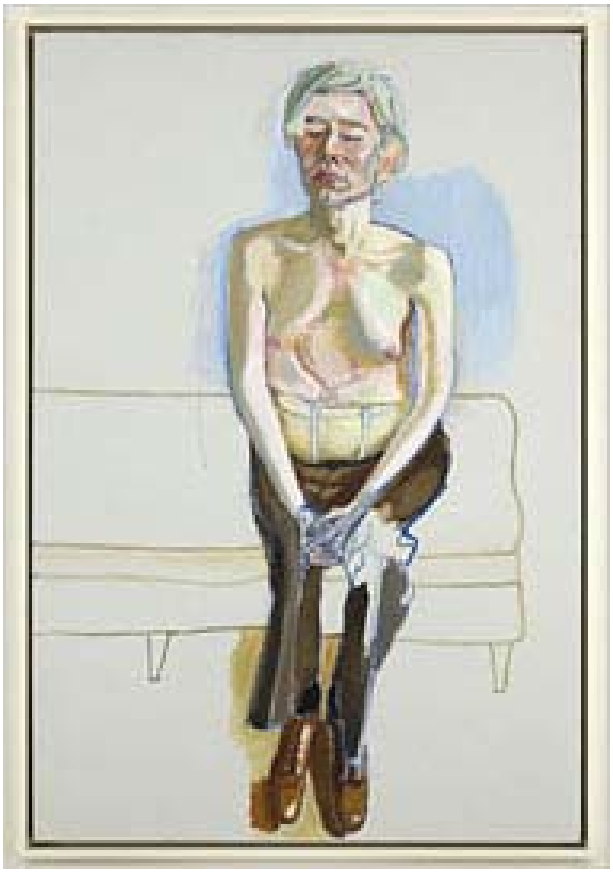
Portraits: Alice Neel's Legacy of Realism
By PHOEBE HOBAN



ALICE NEEL'S art is unmistakable, from her startling images of 20th-century art-world figures to her signature pregnant nudes. One of the first artists in the Works Progress Administration program of the Great Depression, Neel started out as a Social Realist and then defiantly painted figurative work during the height of Abstract Expressionism. She focused on the least fashionable of realist genres, portraiture, which had long since been declared dead, bringing to it an electrifying verve.

Now the subject of a major retrospective at the Museum of Fine Arts, Houston, Neel emerged from near obscurity in the 1960's and '70's, buoyed by feminism and a return to the figure. By the time she died at 84, in 1984, she had become a bona fide art star, painting Andy Warhol, being feted at Gracie Mansion and twice appearing with Johnny Carson.

Since her death Neel has continued to loom large, and her influence is apparent (if not always immediately obvious) in the work of many contemporary figurative painters. Take the atmosphere of innuendo in Eric Fischl's suggestive, sexually fraught narratives. Like Neel he is a master of depicting that which is palpable but unspoken. Neel's often-stated goal of capturing "the Zeitgeist" is shared in different ways by both Elizabeth Peyton, who chronicles contemporary culture in her deadpan portraits, and Marlene Dumas, whose imagery frequently refers to hot-button political and social issues, and who is — as Neel said of herself — "attracted by the morbid and excessive." As did Neel, these artists memorably document their time.

Marlene Dumas, the South African-born painter whose latest solo show at the David Zwirner Gallery ended on Saturday, has written that "The Painter," her striking 1994 portrait of her daughter with paintstained hands, was unconsciously "indebted to and an homage to" Neel's haunting "Andy Warhol" (1970), which she described as "one of the most beautiful paintings of the 20th century."

The paintings share an extreme spareness and ethereal palette, tinted in hues more typical of dead than living bodies.

"The dark side is what makes it so good," Ms. Dumas said of Neel's work by telephone from her studio in Amsterdam.

"I can relate there, but it isn't only the horror and darkness, because there is the humor. It's this mixture. That's why I can relate also to her children and nakedness."

Ms. Dumas said that what she liked most about Neel's "And Warhol" was the way she had condensed the complexity of her subject. "He looks a bit like a woman, male and female in one," she said. "Warhol was

also enigmatic; there is a total fake, artificial aspect, then there is the lonely aspect of an alienated character."

"There is this economy of means," she added "There is almost nothing redundant in this painting, It's very difficult to do a complicated subject in a simple image."

Ms. Dumas said that both paintings are, in a sense, self-portraits. "You could call the painting of Warhol and also the portrait of my daughter, 'the portrait of the artist,'" she said. "My daughter was an alter ego for me." And Neel's painting, she continued, is "very much Alice Neel but also very much Andy Warhol."

"I use the body, and Neel uses the body, to get to the spirit, because the spirit has some form," Ms. Dumas said. "It's not about flesh or about materiality, it's about trying to capture the spirit."

Elizabeth Peyton, like Neel, has recorded her era in portraits of the cultural elite (Kurt Cobain), people in her immediate milieu, and those who are both. (She even did a nude image of Neel.)
Ms. Peyton's portrait of her friend Jonathan Horowitz, a fellow artist and frequent model, was done from life in her studio. Its pensive pose and warm tones communicate Ms. Peyton's bond with her subject, just as Neel's sensitive 1963 portrait of her oldest son, Richard, then a student at Columbia Law School, reflects the level of their connection. (The Neel family quippingly called this portrait, done while he was in the midst of exams, "The Black Prince.") Both portraits also convey a specific moment in time, through clothing, posture and facial expression.

"I was most interested in people, and that seemed like the most important thing — humans, humanity," Ms. Peyton said in an e-mail message. "I feel pictures of people contain their time in an important way that communicates to other times."

Ms. Peyton said she was impressed by Neel's powerful ability "to connect with all kinds of people."

"You could say she took on the whole thing of people, and all that encompasses, in a fearless way," Ms. Peyton said. "I love that she doesn't try to 'get it right,' that the gesture or feeling is always more important in her work than an exact description of the sitter." This is especially true of Neel's faces, she added: "They are really their own universe, created by her."

Eric Fischl became known in the early 1980s for his provocative bedroom scenes and louche nudes, which often look like painterly freeze frames. "The thing that I love about Neel's work and feel close to," Mr. Fischl said recently, "is that she is one of those artists where you remember every painting of hers that you see: it burns in the back of your brain."

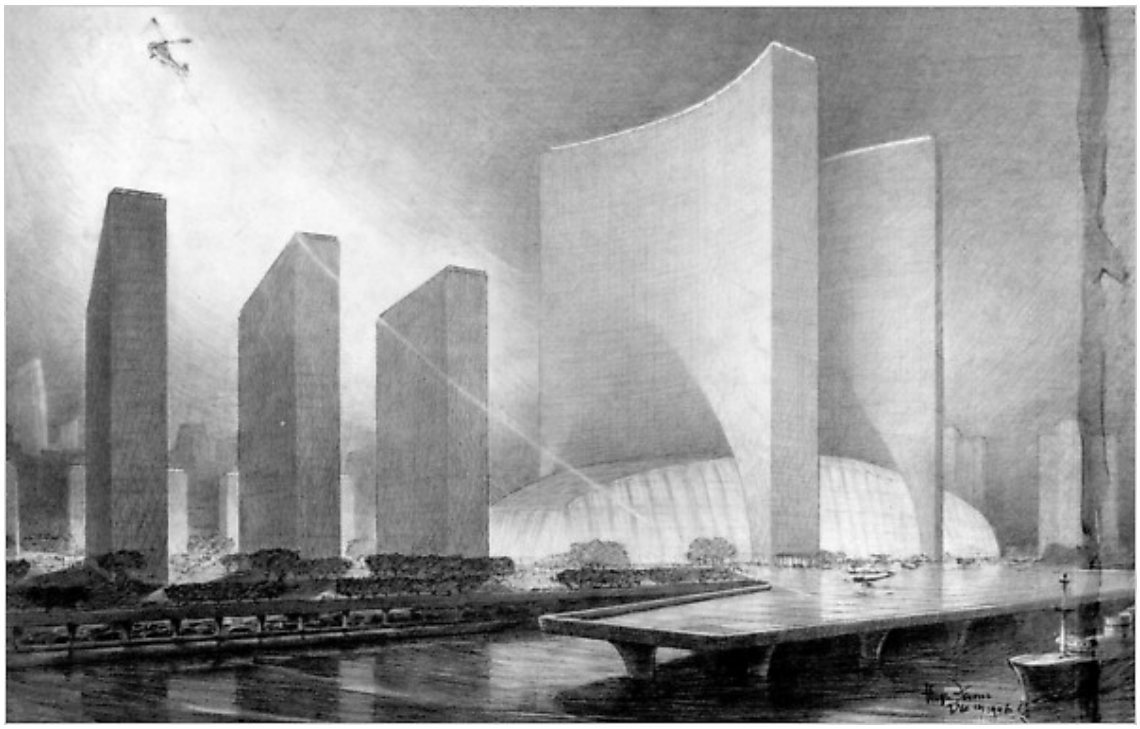
"That's something I try to do in my work," he added "give people a sort of monumentalized moment."
"Willie and Liz," Mr. Fischl's 2003 portrait of the actor Willem Dafoe and the theater director Elizabeth LeCompte, then partners in life and work, echoes Neel in its use of body language to telegraph tension.
"There is a kind of focus on the expressiveness of the hands," Mr. Fischl said. "The slightly disproportioned bodies is something Neel does a lot," he added, as is "the abstraction and simplification of the background."

But Neel's work, Mr. Fischl said, is both more expressionistic and explicitly psychological. "I'm more repressed than that," he explained. Neel had a particular knack for capturing moments of extreme detachment between couples. Although their hands are clasped, her "Red Grooms and Mimi Gross" (1967), scarcely appear to inhabit the same room. Grooms's gaze is trapped between befuddled and beumused, while Gross, shown in profile, glances severely away. (The two artists later divorced, but both have said they were unaware of being particularly estranged at the time.)

http://www.nytimes.com/2010/04/25/arts/design/25neel.html?ref=design

One Among Many Ideas for the U.N. Site

By CHRISTOPHER GRAY



THE United Nations is starting the long-awaited restoration of its 1951 headquarters building to the way it was when it was fresh and new. The project, costing almost $2 billion, will empty the main building and take until 2013.

It is hard to imagine the city without this iconic glassy slab, but it was only one of a dozen postwar proposals for replacing the old slaughterhouse district. Suggestions ranged from a heliport to a concert hall.

Like other low areas along the East River, the site of the United Nations was at first prized for industry. By the 1910s it was the home of slaughterhouses, the Eberhard Faber pencil factory, and, right at 42nd Street, the New Amsterdam Gas Company.

In the 1920s, elite development along the East River overtook Beekman and Sutton Places, and in 1925 the architects Sloan & Robertson published a plan for a blocklong development with a residential tower and yacht club landing, apparently on part of what became the United Nations site. But in that period, such a wide swath was too difficult for a single developer to undertake.

Then, in 1946 the ebullient, big-thinking developer William Zeckendorf came along, and in a burst of postwar enthusiasm, assembled most of the land between First Avenue and the East River from 42nd to 49th Street. Mr. Zeckendorf never made little plans, and for this site he envisioned X-City, a megaproject unlike anything that had yet been seen in Manhattan's private sector.

Along the river he placed a complicated arrangement of 40-story office buildings, 30-story apartments, and paired 57-story structures, one an office tower and the other a hotel. Between the tallest pair of buildings was a spherical concert and opera complex; renderings make it look like a basketball between seven-foot players.

To highlight the project at night, an array of spotlights were to be beamed heavenward, great glowing shafts disappearing into the sky — an eerie prefiguration of the annual Tribute in Light memorial near the site of the World Trade Center. Mr. Zeckendorf's architect was Wallace K. Harrison, one of the key architects of Rockefeller Center; the developer may well have considered the Rockefeller connection one of his qualifications. Larger even than Rockefeller Center, the project was a too-tall order for financing in postwar New York, or perhaps for any time in the history of the city. Mr. Zeckendorf had a wonderful plot of land, but no means to build on it.

At the same time that Mr. Zeckendorf was buying land and commissioning futuristic drawings, the new United Nations was casting about for a headquarters site somewhere in the United States. However logical a choice it might now seem, New York was also crowded, expensive and distracting; the United Nations would wind up being a big fish in a pond of bigger fish. Philadelphia seemed likely, but in late 1946 John D. Rockefeller Jr. stepped in and took an option on Mr. Zeckendorf's site for $8.5 million, intending to donate it to the United Nations.

To inspire the site selection board to think East River instead of Schuylkill, Mr. Zeckendorf had Mr. Harrison tweak his X-City plans to include a low curved assembly hall straddled by both towers at ground level. It resembled two men riding a turtle. The United Nations board, persuaded by the free land and a strong New York faction, decided in the city's favor, although it discarded Zeckendorf's design: Even for a world body, his plan was too big. Mr. Harrison supervised a committee of invited architects from various countries who contributed ideas for the essential assignment, an office building with an assembly hall.

For the assembly building a Soviet designer, Nikolai Bassov, presented an ominous, boxy shape worthy of Lenin's tomb. Perhaps anticipating diplomats from other universes, the French architect Le Corbusier developed a design for a central open-air entrance covered by a curving hangarlike roof that looked like the landing bay of a giant space station. The Brazilian Oscar Niemeyer envisioned a Spartan collection of shapes, not unlike his utopian design for Brasilia, built in the next decade. In the end Mr. Harrison deftly oversaw the synthesis of many ideas without great rancor, although the testy Corbu went away mad that his genius had been underrecognized. While Mr. Harrison's group of architects were uniting, others sought to integrate the United Nations into the larger city. Mr. Zeckendorf had the idea of ripping out six square blocks between Third and First Avenues, from 46th to 49th Street, to create a magnificent approach to the new complex. The wide boulevard, flanked by a procession of 12 slabs of varying sizes for offices, concert halls and apartments, would lead to the river and, at the end, a cable-stayed steel tower, perhaps 600 feet high.

The American Institute of Architects proposed something similar, but all the way over to Lexington. These projects would have rivaled or exceeded both the United Nations and Lincoln Center in scope. But each also was a vision too far, requiring acquisition by eminent domain and the eviction of thousands of voters. In the end, only the south side of 47th Street, from Second to First, was cleared for a cold, lumpy porridge of a park, much better than nothing but still a leftover. The many alternative designs for the United Nations site read like a lost history of midcentury architecture

In 1950 the United Nations began moving in, with the optimism of a fresh white shirt, a vision of how both the city and the world could look. But in the last half century much of that has worn off. The fortified aspect of the place is emblematic, its high civic ideals lost in the menacing character of high fences, metal detectors and concrete bollards. Too, there is nothing left of the ambitions of William Zeckendorf; without his implausible visions, it seems likely the United Nations would not be here — noble goals, scofflaw diplomats and all.

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http://www.nytimes.com/2010/04/25/realestate/25streets.html?ref=design

Heroes and Villains in the Pantheon of Design

By ALICE RAWSTHORN

LONDON — One of the most famous men in 16th century Japan was the Buddhist priest, Sen no Rikyu, who had reinvented the traditional tea ceremony as the apogee of simplicity and purity. He was summoned to see the mighty warlord, Toyotomi Hideyoshi, but arrived late. When asked why, Rikyu explained calmly that he had been drinking tea.

Hideyoshi responded by grabbing his bamboo tea ladle, and smashing it in two. The modest ladle seemed like an affront to a man whose power was vested in bombastic displays of wealth and military prowess. He insisted that Rikyu change the style of the tea ceremony by making it more ornate. When the priest refused, Hideyoshi ordered him to commit suicide. Rather than compromise, Rikyu obeyed.

Many designers face similar dilemmas to Rikyu, albeit with less tragic consequences, according to Robert Grudin, the American writer and philosopher, in his new book, "Design and Truth." "However grand their aspirations, they wait upon the will of people in power," he writes. "And power, which can ratify the truth of good design, can, conversely, debase design into a fabric of lies."

The moral of Mr. Grudin's book is that designers should be true to themselves, as Rikyu was, and never compromise. "Good design enables honest and effective engagement with the world," as he puts it. "Poor design is symptomatic either of inadequate insight or of a fraudulent and exploitative strategy of production. If good design tells the truth, poor design tells a lie, a lie usually related, in one way or another, to the getting or abuse of power."

One designer who did compromise, according to Mr. Grudin, is Minoru Yamasaki, the architect of the World Trade Center in New York. As Mr. Grudin tells it, his original proposal was to build two 80-story towers at the center, only for the developers to demand that they be higher, ideally 110 stories high. They wanted to: a) rent out more office space; and b) charge more for it, which they could do if it was in the world's tallest buildings.

The book describes how the architect complied, and agreed to create yet more space by reducing the number of escape routes for each tower from six to three, and clustering them in the center, rather than spreading them around. Those Twin Towers were indeed the world's tallest buildings, if only briefly from 1972 to 1973. They were unloved by New Yorkers — too big, too brutal, too vulgar — and were eventually destroyed in the 9/11 terrorist attacks.

Mr. Grudin argues that had the Twin Towers been less conspicuous, they may not have been targeted by Al Qaeda. He also suggests that more people might have survived if there had been more escape routes, placed further apart. He describes Mr. Yamasaki as a "tragic hero" who was "caught within the wheels of power, lost perspective and compromised his own artistic integrity."

At a time when ethics and integrity are increasingly important in design, Mr. Grudin's perspective is particularly interesting because he writes, not as a designer, but as a philosopher whose chief concerns are liberty and determinism. Seeing design in the widest possible sense, he regards it as being as important to literature, politics, music and philosophy as to hatching yet another iPhone app or chair. To him, design is — or should be — joyous, inclusive and empowering, "an erotic pragmatism" which is "fundamental to the survival of our humanity."

Mr. Grudin traces its history from Ancient Rome, when the Latin word "designare" had many meanings including mark, trace, describe, designate, plan and perpetrate. He moves on to 16th century Florence, where the writer Giorgio Vasari applied the word "disegno" to all of Leonardo da Vinci's work in art, architecture, philosophy and engineering. Vasari's vision survived until the early 1900s, when design was redefined again, this time with a focus on industry.

Along the way, Mr. Grudin finds examples of honest design in everything from Monteverdi's opera "Orfeo," Haydn's symphonies, the Emperor Augustus's public works, and Thomas Jefferson's Declaration of Independence, to his beloved 1956 Norton Dominator 99 motorbike. He also spots dishonest design in Heidegger's philosophy, Sherman tanks and an over-sized fridge that fell on — and nearly crushed — a handyman named Les, while he was hauling it out of the Grudins' kitchen.

Lessons are learnt from each example. Take the Ford Edsel, the monstrous 1958 "mass-market battleship," as Mr. Grudin describes it, whose bulk evoked "an adolescent dream of material excess and arrogant power: you will never be able to afford a palace, but you can drive around in one."

Another victim of "over-design" is St. Peter's Basilica in Rome. The villain of that story is Pope Paul V, who insisted that the elegant architectural scheme designed by Donato Bramante and Michelangelo be inflated into a "baroque barn whose sole symbolic purpose was to proclaim the centralized and overwhelming power of Rome and the pope." Which architect visited St. Peter's before starting work on his biggest commission? None other than Hitler's favorite, Albert Speer, while planning the (unbuilt) Hall of the People in Berlin.

Then there are the good guys. Federico Gonzaga, a 16th century ruler of Mantua, gave the artist, Giulio Romano, complete freedom to design the Palazzo Te as "a brilliantly decorated architectural tribute to pagan antiquity and sensual indulgence." And Charles Eames is cast as a champion of design humanism for striving to give the seat of his 1956 Lounge Chair "the warm receptive look of a well-used first baseman's mitt."

Mr. Grudin's take on design is enjoyable and eclectic, if a tad old-fashioned. He fails to mention new(ish) concepts like social design, service design and design thinking, yet makes repeated references to "form follows function," a modernist design dictum, which was made redundant when the microchip destroyed the old link between the size and style of an object, and its power. It's a shame, because his "outing" of the heroes and villains in the new age of digital design and service design would have been just as much fun.

http://www.nytimes.com/2010/04/26/arts/26iht-design26.html?ref=design

A Cacophony of Musical Playthings in the Desert
By EDWARD ROTHSTEIN

PHOENIX — There are complete skins of animals, dried, tied and knotted, their orifices fitted with hollow canes and reeds. Other hides are stretched taut over enormous gourds. Strings, spun from intestines, are pulled and pegged into the ends of long necks. Antlers, bones and horns are cut, carved and drilled. Elephant, goat, antelope, lizard, gazelle — the skins of all are used.

It isn't the scrapheap of an abattoir, but it can seem like one.

Music is noble, ethereal, seductive, thrilling, but spend time gazing at some of the 12,000 instruments that the new Musical Instrument Museum has collected in time for its Saturday opening — about 3,000 are on display in a new 190,000-square-foot building on 20 acres in northern Phoenix — and you are overwhelmed by something else. These instruments from around the world are haunted by the animal world and its natural setting.

It is so easy today to think of instruments as the products of manufacture that you can be unprepared for their primal invocations. They boast of the rawness of their natural origins, sometimes displaying it in furs or skins, sometimes merely evoking it with inchoate cries of the inhuman. Skins and bone are wrested into shape — stretched, pulled, hammered, pressed — until these instruments are prepared to sing, shout or pulse.

We often think about musical culture from the other end of its life, from the sounds being produced. At this museum, though, you are faced again and again with music's origins — with its means, not its ends.

Those origins may not always be obvious, particularly when you walk into the museum's collection of mechanical instruments and watch the 27-foot-wide Decap mechanical jazz orchestra (built in the 1930s in Antwerp, Belgium) play two saxophones, two accordions, a xylophone and a drum kit as it reads signals off reams of programmed, punctured paper. But in general, instruments anticipate the transformational work of the music they play: they take elements of the instinctive, animal, irrational world and shape it. They transform nature into culture. There may be no more important civilizing work. We like to think of it as play.

Think of instruments, too, as a kind of raw material that you are confronted with as you walk through the expansive exhibit spaces of this $250 million museum. It is material that the institution celebrates,

promotes and sometimes illuminates, and it makes the museum of immediate interest. But the possibilities, for now, are more compelling than the achievements.

Though I saw the museum before its exhibits were fully mounted (and obtained images, text and plans for what was missing), the impact of this institution is in its size, nerve and astonishing quality and character of parts of its collection. But it seems unfinished in ways that should be examined.

There may be no other museum in the world that has set itself so ambitious a goal — trying to present so many of the globe's instruments while becoming a center for ethnographic musical study — all while starting from scratch. The sprawling new building contains a 299-seat concert hall that will offer wide-ranging programming. It is equipped with a state-of-the-art video and audio recording studio.

The museum also has a conservation lab and an "experience gallery," in which instruments can be played by visitors. And its Artist Gallery displays loans of celebrity instruments (like one of John Lennon's pianos). The institution has also attracted an accomplished staff of ethnomusicologists and organologists (as instrumental specialists are called), along with liberal mandates to go out and collect.

Most museums begin with a great collection; this one began with an idea. It was the brainchild of Robert J. Ulrich, the chairman emeritus of the Target Corporation; in 2007 Billie R. DeWalt, a cultural anthropologist and former professor of Latin American studies at the University of Pittsburgh, became the museum's founding president and director, and guided its development.

Two years ago the institution purchased a major collection of 1,200 instruments from the Fiske Museum at the Claremont Colleges in California: American, European and world instruments dating from the 17th through the 20th centuries. They are accompanied here by new purchases, many of which, it seems, have never even been played. The museum is a megalopolis of musical instrumentation, with wide aisles and spacious displays (created by Gallagher & Associates), and room enough for the half-million hoped-for annual visitors.

The department store metaphor is tempting, and not just because the building's main architect, Rich Varda, oversees Target's team of store designers (he worked here with RSP Architects). The presentation is not particularly imaginative; the overall design is fairly static; the feel is almost utilitarian. But there's something here for nearly every taste, with most of the instruments branded by nationality rather than by type.

The five major galleries are almost continental, devoted to Africa and the Middle East, Asia and Oceania, Europe, Latin America and the Caribbean, and the United States and Canada. The displays are organized by country and no land — whether Brunei, Togo or Kyrgyzstan — seems left out. Every nation is judged to have a musical culture important enough to justify a panel or two of text, displays of some distinctive instruments and a video showing them being played in native surroundings.

There are electronic instruments as well, but Sennheiser audio players distributed to visitors are the most essential high-tech aspect of the experience. The audio players pick up transmissions that allow you to hear the videos at each display: the Peruvian raft flute players dressed in full regalia, Leonard Bernstein conducting the Vienna Philharmonic, or the elaborate drumming in traditional Central African ceremonies.

After a while, though, it becomes apparent that we remain on the surface of things. In most cases, we don't really learn why these particular instruments are used, where a nation's traditions came from, how they are changing or how the music itself works. One panel explains: "The Bisa people of the Mandé Region play the kone lamellaphone; in the Sahei, the Fulani play the filen bamboo flute."

It is difficult to map all this out conceptually. And the principle of national organization is distracting. Why every country? Some are crucial, others irrelevant. Some have had immense influence; with others, neglect does not seem undeserved.

And why, within a nation, is there so little organization and, among nations, so much repetition? Guitars, often with only slight differentiation, appear in Malta, New Zealand, Argentina and the American Southwest. Plucked lutes are displayed in Turkmenistan, Mongolia, Nigeria and Australia. What does this tell us, apart from the fact that certain forms of instruments have spread all over the world?

The collection is more socially than musically determined. Instruments appear in a display not necessarily because they best reflect native cultures, but because they are the instruments people happen to be playing: a British pennywhistle appears in the Barbados display, an American trumpet in Cuba's. There is some value in this, but the approach also creates a jumble of instruments, genres and traditions. People do all kinds of things, but to understand their significance, we need to make additional distinctions.

This problem is aggravated because musical instrument companies that became museum supporters ended up with extensive displays here. The Fender guitar exhibit is possibly the largest one in the entire United States-Canada gallery, and the text is unabashedly promotional. "Contemporary musical artists," we read, " have consistently turned to Fender for inspiration."

They've also, apparently, turned to Martin guitars and Steinway pianos ("the standard by which all others are measured").

Otherwise, the organizing principles seem to favor random sampling. This is particularly a problem in the United States gallery, the only place the museum puts aside its preoccupations with national boundaries and organizes displays by style. There are exhibits devoted to klezmer, Appalachian music, Sousa bands, country and western, Japanese-American drumming, conjunto, jazz, bluegrass and hip-hop. You can piece together some of the ways black American music evolved, but the museum's miscellaneous approach turns American music into a conglomeration of small, unrelated islands of sound. There is something remarkable about the history of diverse musics in the United States, but we can't make sense of it here. At a time when most museums want to shape their exhibitions into narratives, this one seems strenuously to avoid any semblance of a narrative or evaluative thread. The musical tradition that suffers most through this approach is the "classical" — the tradition of art music in the United States. We don't find anything about the development of American orchestras, or the growth of the world's finest musical conservatories, or the evolution of American musical experimentation. Nor, in the Asian galleries, do we learn of the explosion of interest in Western classical music in the last half-century, and the growth of Japanese and South Korean piano manufacturers.

Generally, the curatorial approach favors representation and sampling rather than assessment and distinction. Its point is diversity, and its method is quantity. Is that really the approach, though, taken by members of the museum's distinguished curatorial council — a list of consultants who are representatives of the world's major instrument collections and museums? But the aspect missed the most here, strangely, is the music itself. We see the instruments, we listen to them being played, but we don't learn how they are used to explore musical space and time, how a culture's sense of musical scales and relations might affect the construction of its instruments, or how its beliefs about the world might affect both its instruments and its music. Perhaps, over time, that will come.

In the meantime, what we are left with — and, admittedly, this is no minor thing — is a sense of the scale of the human musical enterprise and its centrality in every culture's attempts to tame the ever untamable natural world.The Musical Instrument Museum opens on Saturday at 4725 East Mayo Boulevard, Phoenix; (480) 478-6000; themim.org.

http://www.nytimes.com/2010/04/24/arts/design/24museum.html?ref=design

A Jungle of Bamboo Is Growing Atop the Met

By CAROL VOGEL

ON a recent summerlike morning, men in T-shirts and women in bikini tops were busily working to the loud strains of Michael Jackson, Led Zeppelin and Jimi Hendrix. Some looked like tightrope walkers, delicately balancing on horizontal poles in bare feet; others could be seen shinnying up vertical poles like monkeys, securing intersections with colored nylon ropes; and still others were building teepeelike configurations on the ground.

But this wasn't a circus tent-raising; it was the scene on the rooftop of the Metropolitan Museum of Art. Supervised by artists and built by about a dozen rock climbers, an installation in the form of a labyrinthine jungle of bamboo was rising some 25 feet in the air.

The Met has long been a place where the flowerings of different centuries and cultures quietly coexist, an orderly home of Apollonian calm. But the installation, "Big Bambú: You Can't, You Don't, and You Won't Stop," is a startling departure. Where once there were uninterrupted vistas of the city's skyline and Central Park, there are now thickets and elevated walkways winding through them.

It's the creation of Doug and Mike Starn, the 48-year-old identical-twin artists perhaps better known for painterly photographs than installations. And while "Big Bambú" may seem liked a finished installation when it opens on Tuesday, it is a perpetual work in progress. Throughout the summer the public will be able to witness its metamorphosis as the rock climbers — sans music — continually add to the work until it forms a cresting wave covering an area 100 by 50 feet and soaring 50 feet above the roof.

Museum officials estimate that some 400,000 people (depending on weather) will see "Big Bambú" before it is dismantled at the end of October. All visitors will be able to stroll the roof's main level. The paths above, however, will be limited to guided groups of 10 to 15 people, twice an hour. Those visitors will need timed tickets and a sturdy pair of rubber-soled shoes. Navigating the bamboo heights does present challenges, so the Met has trained its guides carefully for all kinds of eventualities, including a sudden attack of acrophobia.

In the center of the construction the other day were the Starns, cameras around their necks, recording the progress. The artists, who grew up in New Jersey, have worked together all their lives and been around

the art world since the 1980s. They come across as laid-back hippies, with their shoulder-length manes and scruffy bluejeans, but they are a well-practiced team and finish each other's sentences.

Both were afraid of heights when they first conceived the project.

"Just looking up at the ceiling in our studio gave us vertigo," Mike said. "But we got over it as we started building."

Last year they unveiled a permanent installation in the South Ferry subway station in Lower Manhattan: a 250-foot-long work featuring their signature photographs of trees. Also about nature, "Big Bambú" is far more complex: part performance, part architecture and part sculpture.

The idea grew out of their project "Sphere of Influence," which was first shown in Berlin in 1991 and consisted of a rotating globe about 14 feet in diameter made of metal pipe clamps juxtaposed against sheets of transparent photographs. But for "Big Bambú" pipe was too heavy.

"It didn't have the right qualities," Doug Starn said. "This piece is organic. It's about all the things in your life, including those that aren't planned."

It isn't the artists' first bamboo adventure. The Met project is a more ambitious variation of one they did in 2008 in an old foundry that serves as their studio in Beacon, N.Y. That installation is still on view and will continue growing this summer as well. (Many of the rock climbers at the Met worked with the Starns on the Beacon project.)

They chose bamboo, they said, because it is light yet incredibly strong and can withstand all kinds of weather. And like the work itself, it constantly changes, its colors deepening and fading depending on the light and the weather. (The title of the installation is a play on the brothers' nicknames in high school, Cheech and Chong, whose albums included "Big Bambú." "It became the default name" of the work, Mike Starn said. "We liked the vibe.")

For the Met, staging "Big Bambú" is a daring feat. There have been sculpture exhibitions by artists like Jeff Koons, Ellsworth Kelly and Roy Lichtenstein on the roof, but this is by far the most ambitious.

Always on the lookout for rooftop projects, Anne L. Strauss, associate curator of modern and contemporary art at the Met, went to see "Big Bambú" in Beacon in the fall. "Because the Starns' piece is its own microcosm with all its inherent complexities set against Manhattan with its own complexities, I thought it would be a fascinating dialogue," she said.

The layout has been carefully planned, but the sight of the bamboo poles lashed together feels chaotic, a sensibility both artists say they embrace. Mike Starn compared the construction itself to "the arteries in your body or in the city subway system," and added, "We're also talking about Western civilization, the interconnected dependency we all have on each other but which is changing all the time."

The project will evolve in three phases: first the basic structure will be completed by next week's opening; then the eastern part will be built to about 50 feet up by the beginning of June; finally the west side will rise to about 40 feet by mid-July.

Months of intricate planning went into making sure the project would proceed without a hitch. They hired an architect to transcribe their drawings for submission to the city's Building Department. "Fortunately the commissioner grew up in Hong Kong, where bamboo is used for scaffolding," Doug Starn said referring to Derek Lee, the department's borough commissioner for Manhattan.

Also informed of the plans were the mayor's office, the Cultural Affairs Department and the Fire Department. A structural engineer had to be consulted, too.

More than 5,000 poles from a bamboo farm in Georgia and a century-old plantation in South Carolina have gone into the project along with 50 miles of nylon cord in three widths and about 20 colors. The rock climbers are using a variety of knots to lash the poles together, some they learned from climbing or sailing, others improvised.

The artists said they deliberately chose colorful nylon, rather than a more transparent material because "it was important for us to point out the connective tissue," Mike Starn said. "That's something we always do in our work. Our photographs are often Scotch-taped together."

Last week, after a main portion of the first phase of construction was completed, the installation was subjected to load testing, which involved scattering 350 sandbags weighing 50 pounds each and leaving them there for 24 hours. (The project passed with flying colors, Met officials said.)

What will happen to all the bamboo once its over?

"We might take some of it to Beacon, or we might save a cube or a section of it as a complete artwork," Doug Starn said. "We really haven't decided yet."

Care to Climb?

All visitors will be allowed on the main level of the roof, but walking the elevated pathways of "Big Bambú" is more complicated. For that you will need to know about:

TIMED TICKETS One per person, available only first come first served, with museum admission, in the Uris Center for Education, at the 81st Street entrance. Morning tour tickets are released at 9:30 a.m.; afternoon tours at noon. On Fridays and Saturdays, evening tours are available, and tickets will be released at 3:30 p.m. Bring a photo ID and be prepared to sign a waiver.

THE WEATHER Because the bamboo can be slippery, the installation may be closed because of rain (or even rain the night before). Call (212) 396-5300 on the day you plan to attend to check.

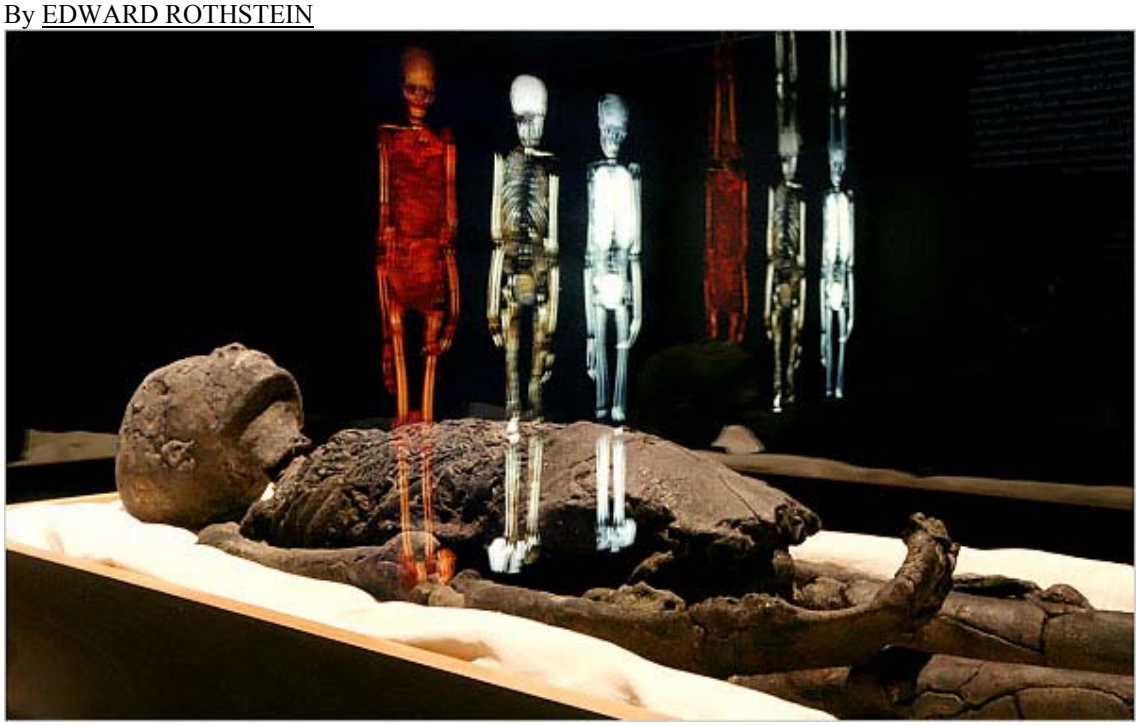
THE RULES Visitors have to wear closed, rubber-soled shoes and be able to walk unassisted. (No wheelchairs, walkers or canes, unless the canes have a wrist strap and are used to aid the visually impaired.) Children must be at least 10 and over four feet tall; adults must accompany those younger than 13. Also, no personal items (including handbags, cellphones and cameras) will be allowed; lockers will be provided.

The Met has other rules as well. For a complete list, go to metmuseum.org/special/big_bambu/guidelines.asp.

http://www.nytimes.com/2010/04/23/arts/design/23bambu.html?ref=design

Mystique of Tut, Increasing With Age

By EDWARD ROTHSTEIN



There has always been something a little disorienting, almost out of proportion, about King Tut. Is there any Egyptian pharaoh now more widely known, any more celebrated? The extraordinary objects found in his tomb have been viewed by millions, and the more objects from that horde are seen, the larger Tut looms. Yet the more we know, the less imposing he becomes, and the more puzzling the contrast seems.

Visit "Tutankhamun and the Golden Age of the Pharaohs," which opens on Friday at the Discovery Times Square Exposition, and if you have ever been astonished by the objects found in the king's tomb — whether from seeing Tut's first museum tour in the 1970s, or this more wide-ranging show in one of its six preceding locations — you will be amazed again. (New York is its last stop before the artifacts return to Egypt in January.)

This show expands the historical horizon of the ground-breaking blockbuster that was Tut I by linking the king to his ancestors (and, incidentally, enshrining the now dominant spelling of his name). It also breaks with the museological origins of that first tour, which took shape under the oversight of Thomas Hoving, then director of the Metropolitan Museum of Art. This one is being managed by Egypt's Council of Antiquities, with more explicitly commercial partners and more extensive financial demands, which is one reason the Met declined to house the show. (Discovery is charging $27.50 for adult admission.)

Here are gathered some 130 objects from Egypt's 18th dynasty (from the middle of the 16th century to the beginning of the 13th century B.C.). And the gilded eloquence of the objects discovered in Tut's tomb in 1922 — fewer than half of the objects here are from that cache — can almost be overshadowed by earlier, more earthen artistry: the sensuously carved swimming woman from the 14th century B.C., serving as the handle of a spoon for unguents; the poised balance of a black panther from a century earlier; or the shapely wooden paws on which a 15th-century B.C. princess's chair is mounted.

This is the world out of which King Tutankhamun grew. These anonymous artists combined the most formal artifice, in which animal-like gods reigned coolly over their realms, with the most vivid sculptural naturalism, which brought those beastlike divinities vividly into the human world.

And then there is King Tutankhamun himself. A final gallery, designed for New York's show, reports on the latest results of DNA analysis and CT scans of 11 royal Egyptian mummies, including Tut. That research was directed by Zahi Hawass, who leads the Supreme Council of Antiquities in Cairo; he also chose the objects and wrote the catalog for this exhibition (which was shaped by its curator, the Egyptologist David P. Silverman).

The study's conclusions, announced in February in The Journal of the American Medical Association, confirmed the identities of Tut's great-grandparents and grandparents. Moreover, two mummified infants found near Tut, the show suggests, may have been his own stillborn daughters.

The study also provided grounds for identifying another mummy as Akhenaten, Tut's father, whose sandstone visage grandly overlooks the entrance to one gallery. Akhenaten was a revolutionary leader, who attempted to overturn Egypt's traditional gods; his monumental head casts considerable authoritative power here, which the images of Tut can only answer with elegant delicacy.

In fact, the same research also suggests that Tut, who came to power at 9 (perhaps 1332 B.C.) and died before he was 20, was more frail than had been imagined. Far from being murdered in a court intrigue, as one hypothesis has it, he may have died from malaria, whose parasite left its genetic traces behind. Tut also suffered from a bone disorder known as Köhler's disease II, along with a bone necrosis that weakened his left foot (which may have been one reason 130 sticks and canes, some well worn, were entombed with him).

An editorial in the medical journal said that Tut's "inherited conditions" led to "an inflammatory, immunosuppressive and constitutionally weakened condition." This could have been a result of inbreeding in Egypt's ruling dynasty; a family tree on display states that Tut's own parents were brother and sister, though no exhibition text explores that idea. Actually, the show seems reluctant to cast too many shadows over its celebrations.

But before you become aware of Tut's history in the exhibition, you already sense a difference between Akhenaten's power and Tut's. When the child-king is shown striding as King of Lower Egypt, beautifully gilded and crowned and carrying a royal crook and flail, he looks proud but gentle, even a bit uncertain.

Four game boards were also found in the tomb; one, made of ivory, is displayed here: was this his more favored activity? If so, who made the decision to overturn his father's religious revolution, restore the priesthood and the empire's old capital, as happened during Tut's reign? It hardly seems that the young king would have had the will or strength without the help (or machinations) of others. Perhaps I am judging only by surfaces, but we can't avoid the impression here of a figure propped up by gorgeous paraphernalia.

They served the same function in Tut's afterlife. Mummies don't just overcome death with their impermeable agelessness and unchanging masks; they also hide all the weaknesses and flaws of life. It almost becomes a shock to see this, too, at the exhibition's end: the unwrapped, mummified body of Tut, little more than a black-boned skeleton — a facsimile precisely sculptured from the detailed medical scans. It is, in its way, more sensational than the gold death mask that was a feature of the Tut I show; Tut II gives us a literal death mask, and it haunts as much as the decorous cover once did.

The show doesn't really want us to become too aware of how diminished Tut's stature becomes when we see him stripped of the tomb's bountiful trappings: Tut is a commodity, not just a pharaoh. Mr. Hawass makes it clear that this exhibition also had an important purpose: it was to raise money for the restoration and construction of Egyptian museums. He took on the National Geographic Society as a collaborator, and, for the tour, contracted with Arts and Exhibitions International and AEG Exhibitions — both companies experienced with large-scale entertainment and marketing.

In 2005, when this show first began its tour, The Los Angeles Times reported that a $5 million fee was required from each site, along with additional large bonus sums for high attendance; half of all other revenue is also paid to Egypt. (Exhibition representatives would not discuss fees and income.)

By now some seven million people have seen the show in Los Angeles; Fort Lauderdale, Fla.; Chicago; Philadelphia; London; Dallas; and San Francisco; New York will probably boost the total attendance over the eight million level reached by the American tour of Tut I. This week Mr. Hawass announced that Egypt had earned $100 million so far (while also expressing dismay that Tut had not returned to the Met).

So Tut is a commercial enterprise, which is one reason it never really challenges you to go too deeply into things, not the least of which is the strange contrast between Tut as a slight historical figure and as the guardian of these immense riches.

But the skewed proportions are also a result of historical accident. This tomb was not plundered after ancient times partly because it was unimposing and unexpected. Was this because of the suddenness of Tut's death? It meant using a tight burial space prepared for a far less regal personage. Photographs of the 1922 discovery make the tomb look more like an attic packed with worn memorabilia than a place welcoming you into the afterlife. Peculiarly, this tomb may have been atypical in many respects, which is what led to its preservation — and thus to the temptation to treat it as typical.

As an antidote to Tuttish temptations, go to the Met, where items from its collection and background material have been temporarily placed in a single gallery-size exhibition, "Tutankhamun's Funeral." It isn't exactly "The Return of Tut," for here we see not the artifacts of the tomb, but items found in a nearby pit by the amateur archaeologist Theodore M. Davis in 1907-8, about 15 years before the tomb was even discovered.

Mr. Davis didn't know what to make of his finds (he was even known to take pieces of papyrus he found and rip them to show visitors their strength), which is why it so readily found its way to the Met, where its value was later recognized by the man who became the museum's chief Egyptologist and then director, Herbert E. Winlock.

This stash was, Mr. Winlock decided, a repository of funeral equipment and preparatory material from Tut's entombment: sand bags used to fill up body cavities, strips of bandage and linen, even packets of a white sand called natron, naturally found in Egypt, which was used as a desiccant in mummification. These are not objects of great beauty; they are objects of purpose, meant to be permanently interred, having been intimately connected with the deceased.

And in the midst of this utilitarian last-aid kit were also found floral collars, broad necklaces woven from colorful herbs, flowers, berries and leaves. The Met identifies the various plants; the show's curator, Dorothea Arnold, suggests that these collars were used to adorn Tut's body, or else were prepared but never used.

These fragile, dry collars are as amazing as Tut's gold death mask: they show the swift passage of time, just as the tomb finds defy it. Seeing short-lived botanica arrayed in a display case some 3,300 years after they were delicately put together is a gift of historical accident. But it seems to emphasize not only how transient human life is, but, as we see with Tut and his tomb, also how long its traces might be felt.

"Tutankhamun and the Golden Age of the Pharaohs" is on view through Jan. 2 at Discovery Times Square Exposition, 226 West 44th Street, Manhattan; discoverytsx.com. "Tutankhamun's Funeral" is on view through Sept. 6 at the Metropolitan Museum of Art; metmuseum.org.

http://www.nytimes.com/2010/04/23/arts/design/23tut.html?ref=design

The Streets, Frozen in Neon
By CAROL KINO

ON a recent Sunday afternoon, Mark Faurer, a New York City cab driver, led a museum curator and a reporter on a tour of historic Times Square. Strolling down Broadway, Mr. Faurer pointed out the sites of onetime attractions like the Planters store near 47th Street, which sold fresh-roasted peanuts; the Camel billboard at 44th Street that used to puff steam "smoke rings" over passers-by; Hubert's Dime Museum, home of a freak show and flea circus on 42nd Street, west of Seventh Avenue; and the strip of movie theaters that lined and lighted up that same block, where you could see B movies and first-run films at cut-rate prices.

Mr. Faurer, 67, has come to know the city inside out in his 33 years as a cabby, but his memories of this long-gone version of Times Square go back even farther. His father, the photographer Louis Faurer, who died in 2001, was an ardent chronicler of New York street life in the 1940s and '50s, particularly in this neighborhood, and often took Mark on his rounds as a child. In the 1960s the elder Faurer sometimes asked his son to join him as he shot a silent film called "Time Capsule," again mainly on the streets of Times Square.

The area was "much brighter then," Mark Faurer said, when it was illuminated by an unfathomable number of incandescent bulbs.

The curator, Lisa Hostetler, observed that for midcentury photographers, that was part of the allure. "You could take pictures without drawing as much attention to yourself, because the flash wasn't going off," she said. "You could get really caught up in the crowd and the energy and the commotion."

Ms. Hostetler, who oversees photography at the Milwaukee Art Museum, is in a position to know. She wrote her doctoral dissertation on Louis Faurer and first met Mark while researching it in 1996, when she tracked him down at his home in Brooklyn. It is largely thanks to their combined efforts that Louis's work is now enjoying renewed public attention.

Seen together, the two suggest the kind of incongruous couple that Faurer's camera might have picked out of the crowd: Mark, tall, gaunt and shy, is the spitting image of his dour-looking father, while Ms. Hostetler, 38, is tiny and vivacious and resembles a ballerina, which she trained to be in her teens. Over the last 14 years they have spent many hours puzzling together the pieces of Faurer's oeuvre.

Most recently they discovered and preserved "Time Capsule," which had been lost in Faurer's archives for decades. The film features prominently in a major show on midcentury street photography organized by Ms. Hostetler at the Milwaukee Museum, through April 25 and is also being shown in New York, at the International Center of Photography (through May 9) and through Saturday at the Howard Greenberg Gallery on East 57th Street in Manhattan, which represents the Faurer estate.

Faurer is sometimes credited with having pushed American street photography away from a more objective, documentary style toward a subjective, psychologically complex vision. His pictures, seemingly made on the fly, captured New Yorkers looking like "vivid characters in a sort of fictive drama," as Walter Hopps, the founding director of the Menil Collection in Houston, wrote in 1995. He went so far as to say, "midcentury American photography belonged to Louis Faurer."

But although his work was included in Edward Steichen's two landmark photography shows at the Museum of Modern Art, "In and Out of Focus" (1948) and "The Family of Man" (1955), and was the subject of a well received retrospective at the Museum of Fine Arts, Houston, in 2002, he is much less known today than photographers like William Klein, Robert Frank and Diane Arbus, who credited him as an influence.

"He is just one of those hidden geniuses who other photographers know about," said Brian Wallis, chief curator at the International Center of Photography, "but he never really rose to a level of recognition among the general public like some of his colleagues."

Ms. Hostetler's show, "Street Seen: The Psychological Gesture in American Photography, 1940-59," focuses on Faurer and other photographers known for their gritty, rough-and-tumble images of urban life, including Lisette Model, Klein and Frank. Ms. Hostetler maintains that this group has much in common with the other artistic styles and movements of the day.

"They were striving to stay in the present moment," she said, "to work in the warp and weave and texture of time, just like the Abstract Expressionists, Beat poets, and jazz musicians."

Though "Time Capsule" was shot just after her show's official time frame, Ms. Hostetler argues that "there is this retrospective quality to it that gives a sense of Times Square as it was through the decades." The film begins and ends with close-up shots of shadowy figures seen passing before the light-bulb-studded marquees of West 42nd Street. In between comes a dizzying montage that seems to race through the decade, from pompadoured teenagers to spaced-out hippies.

Some extraordinary vignettes flash by, like a shot of a bored-looking movie cashier who gazes into space like a melancholy girl in a Hopper painting. There is also a climactic moment: the 1968 assassination of Robert F. Kennedy. People are seen sitting dazed in the streets amid memorial displays; then the light bulbs spell out "This era is over."

"Originally he was going to have that as the title of the film," Mark Faurer said. "I think it meant the end of a certain political era."

Ms. Hostetler said, "I wonder if it's also the end of an era for Times Square."

The film went undiscovered for so long largely because of Faurer's chaotic life. Raised in South Philadelphia, he bought his first camera at 21 and taught himself photography. By the 1940s he had started a family in Philadelphia but was spending several nights a week in New York, prowling with his

camera until the wee hours. Like many photographers of the day — an era when the medium wasn't widely considered fine art — Faurer also worked for fashion magazines, primarily Flair and Harper's Bazaar, where he met Robert Frank, one of the few friends he retained throughout his life. (Endlessly irascible, he burned many bridges.)

That's also where he lost the thread of his personal work. After leaving his wife in 1956, he was seduced by the fashion world and its lifestyle, and clearly by fashion models too, including Susan Hoffmann (later the Warhol star Viva) and the supermodel Agneta Freiberg, his companion for some years, who appears briefly in "Time Capsule." By the 1960s he had virtually stopped making personal photographs. But then he became interested in film. "Underground film was popular," Mark Faurer said, and other photographers were making films, including Robert Frank. Once again Faurer began to prowl Times Square, this time with two 16-millimeter movie cameras. Mark, then training as a film editor at ABC, often went through the footage with him. After filming the movie theaters on 42nd Street, Mark recalled, his father would say, "I want to get this, because I know they're going to do away with this soon."

Because of Louis's obsessive perfectionism he continued editing the film for almost a decade, and Mark sat through many different versions. "I got annoyed," he said, "because he changed it so many times." In late 1968, plagued by tax problems, Louis sold off his film equipment and decamped to Europe; soon after, Mark left for California. "I figured he just took the film with him," he said. By the time both had returned to New York — Louis without work and Mark with his own young family, which he supported as a cab driver — they were both too preoccupied to pursue it.

Louis Faurer did have a late-career resurgence, helped by Viva, who introduced him to Walter Hopps. But after Louis was hit by a bus in 1984 — an accident that left him brain-damaged — his career was over, and his prints and negatives were scattered around New York. "He was very sloppy about caring for his own work," said David I. Ferber, Louis's lawyer and a business adviser for the estate. He would let friends carry away chunks of his work, in hopes that they would care for it better than he could. Over the years much of it disappeared, and what remained was in chaos. When he died, his Westbeth apartment was littered with negatives and work prints, as well as piles of film cans that Mark couldn't bear to examine closely.

Some of Louis's work also ended up with Mr. Ferber who, a year or so after his client's death, came across an old video cassette and gave it to Mark. Realizing it was the long-lost film, he shared the discovery with Ms. Hostetler, then working at the Metropolitan Museum. Although the images were blurry and faded, Ms. Hostetler said: "I was really excited. That's the moment when I was like, 'When I do my big show, that's going in it!' "

Last year, in advance of that big show — "Street Seen" — Mark tackled the film cans and immediately found the final edited version of the film, which was surprisingly well preserved. "On the leader of the film, it had the title 'Time Capsule,' " he said.

Will the film's discovery change Louis Faurer's standing in today's art world?"It's a piece of film art, it's a piece of history, it's a piece of the puzzle of Lou Faurer," said his dealer, Howard Greenberg, who saw it for the first time a couple of weeks ago. "But I don't think it's going to change his market in any significant way."

If nothing else, though, Ms. Hostetler said, "It really establishes Lou as a poet of Times Square."

http://www.nytimes.com/2010/04/23/arts/design/23faurer.html?ref=design

Little-Known Disorder Can Take a Toll on Learning

By TARA PARKER-POPE

Nicole Bengiveno/The New York Times **ADVOCATE** Rosie O'Donnell, right, at home with her son Blake, who has an auditory processing disorder. Ms. O'Donnell's quest to help her son led her to Lois Kam Heymann, left, an auditory therapist, whom Blake now works with.

Parents and teachers often tell children to pay attention — to be a "good listener." But what if your child's brain doesn't know how to listen?

That's the challenge for children with auditory processing disorder, a poorly understood syndrome that interferes with the brain's ability to recognize and interpret sounds. It's been estimated that 2 to 5 percent of children have the disorder, said Gail D. Chermak, an expert on speech and hearing sciences at Washington State University, and it's likely that many cases have gone undiagnosed or misdiagnosed.

The symptoms of A.P.D. — trouble paying attention and following directions, low academic performance, behavior problems and poor reading and vocabulary — are often mistaken for attention problems or even autism.

But now the disorder is getting some overdue attention, thanks in part to the talk-show host Rosie O'Donnell and her 10-year-old son, Blake, who has A.P.D.

In the foreword to a new book, "The Sound of Hope" (Ballantine) — by Lois Kam Heymann, the speech pathologist and auditory therapist who helped Blake — Ms. O'Donnell recounts how she learned something was amiss.

It began with a haircut before her son started first grade. Blake had already been working with a speech therapist on his vague responses and other difficulties, so when he asked for a "little haircut" and she pressed him on his meaning, she told the barber he wanted short hair like his brother's. But in the car later, Blake erupted in tears, and Ms. O'Donnell realized her mistake. By "little haircut," Blake meant little hair should be cut. He wanted a trim.

"I pulled off on the freeway and hugged him," Ms. O'Donnell said. "I said: 'Blakey, I'm really sorry. I didn't understand you. I'll do better.' "

That was a turning point. Ms. O'Donnell's quest to do better led her to Ms. Heymann, who determined that while Blake could hear perfectly well, he had trouble distinguishing between sounds. To him, words like "tangerine" and "tambourine," "bed" and "dead," may sound the same.

"The child hears 'And the girl went to dead,' and they know it doesn't make sense," Ms. Heymann told me. "But while they try to figure it out, the teacher continues talking and now they're behind. Those sounds are being distorted or misinterpreted, and it affects how the child is going to learn speech and language."

Blake's brain struggled to retain the words he heard, resulting in a limited vocabulary and trouble with reading and spelling. Abstract language, metaphors like "cover third base," even "knock-knock" jokes, were confusing and frustrating.

Children with auditory processing problems often can't filter out other sounds. The teacher's voice, a chair scraping the floor and crinkling paper are all heard at the same level. "The normal reaction by the parent is 'Why don't you listen?' " Ms. Heymann said. "They were listening, but they weren't hearing the right thing."

The solution is often a comprehensive approach, at school and at home. To dampen unwanted noise, strips of felt or tennis balls may be placed on the legs of chairs and desks. Parents work to simplify language and avoid metaphors and abstract references.

The O'Donnell household cut back on large, noisy gatherings that were upsetting to Blake. Twice-weekly sessions focusing on sounds and words, using rhyme and body gestures, helped him catch up on the learning he had missed.

Help inside the classroom is essential. One family in Westchester County, who asked not to be named to protect their son's privacy, met with his teachers and agreed on an array of adaptations — including having his teacher wear a small microphone that directed her voice more clearly to a speaker on the student's desk so he could better distinguish her voice from competing sounds.

Nobody knows exactly why auditory processing skills don't fully develop in every child, according to the National Institute on Deafness and Other Communication Disorders. Scientists are conducting brain-imaging studies to better understand the neural basis of the condition and find out if there are different forms.

Reassuringly, the disorder seems to have little or nothing to do with intelligence. Blake has an encyclopedic knowledge of animals — he once corrected his mother for referring to a puma as a mountain lion. The Westchester child is now a 17-year-old high school student being recruited by top colleges.

"He's in accelerated Latin, honors science classes," said his mother. "I remember I used to dream of the day he would be able to wake up in the morning and just say, 'Mommy.' "

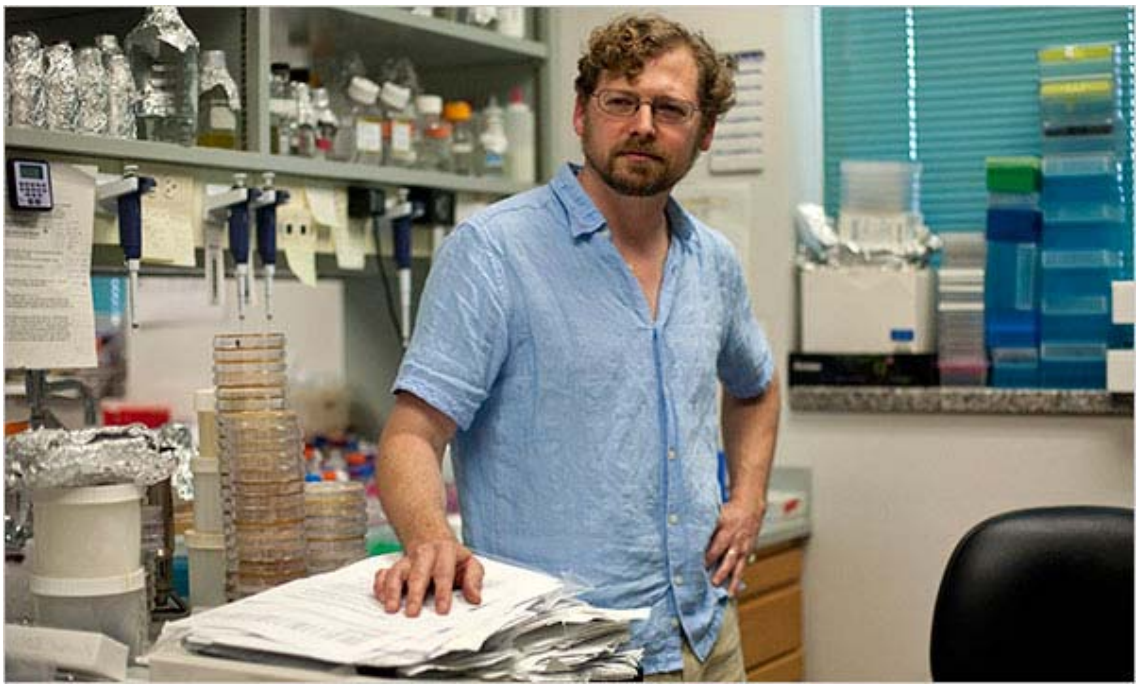
Not every child does so well, and some children with A.P.D. have other developmental and social problems. But Ms. O'Donnell says that treatment is not just about better grades.

"It definitely affected his whole world," she said of her son. "Not just learning. It cuts them off from society, from interactions. To see the difference in who he is today versus who he was two years ago, and then to contemplate what would have happened had we not been able to catch it — I think he would have been lost."

http://well.blogs.nytimes.com/2010/04/26/little-known-disorder-can-take-a-toll-on-learning/?ref=health

The Search for Genes Leads to Unexpected Places

By CARL ZIMMER



Edward M. Marcotte is looking for drugs that can kill tumors by stopping blood vessel growth, and he and his colleagues at the University of Texas at Austin recently found some good targets — five human genes that are essential for that growth. Now they're hunting for drugs that can stop those genes from working. Strangely, though, Dr. Marcotte did not discover the new genes in the human genome, nor in lab mice or even fruit flies. He and his colleagues found the genes in yeast.

"On the face of it, it's just crazy," Dr. Marcotte said. After all, these single-cell fungi don't make blood vessels. They don't even make blood. In yeast, it turns out, these five genes work together on a completely unrelated task: fixing cell walls.

Crazier still, Dr. Marcotte and his colleagues have discovered hundreds of other genes involved in human disorders by looking at distantly related species. They have found genes associated with deafness in plants, for example, and genes associated with breast cancer in nematode worms. The researchers reported their results recently in The Proceedings of the National Academy of Sciences.

The scientists took advantage of a peculiar feature of our evolutionary history. In our distant, amoeba-like ancestors, clusters of genes were already forming to work together on building cell walls and on other very basic tasks essential to life. Many of those genes still work together in those same clusters, over a billion years later, but on different tasks in different organisms.

Studies like this offer a new twist on Charles Darwin's original ideas about evolution. Anatomists in the mid-1800s were fascinated by the underlying similarities of traits in different species — the fact that a bat's wing, for example, has all the same parts as a human hand. Darwin argued that this kind of similarity — known as homology — was just a matter of genealogy. Bats and humans share a common ancestor, and thus they inherited limbs with five digits.

Some 150 years of research have amply confirmed Darwin's insight. Paleontologists, for example, have brought ambiguous homologies into sharp focus with the discovery of transitional fossils. A case in point

is the connection between the blowholes of whales and dolphins and the nostrils of humans. Fossils show how the nostrils of ancestral whales moved from the tip of the snout to the top of the head.

In the 1950s, the study of homology entered a new phase. Scientists began to discover similarities in the structure of proteins. Different species have different forms of hemoglobin, for example. Each form is adapted to a particular way of life, but all descended from one ancestral molecule.

When scientists started sequencing DNA, they were able to find homologies between genes as well. From generation to generation, genes sometimes get accidentally copied. Each copy goes on to pick up unique mutations. But their sequence remains similar enough to reveal their shared ancestry.

A trait like an arm is encoded in many genes, which cooperate with one another to build it. Some genes produce proteins that physically join together to do a job. In other cases, a protein encoded by one gene is required to switch on other genes.

It turns out that clusters of these genes — sometimes called modules — tend to keep working together over the course of millions of years. But they get rewired along the way. They respond to new signals, and act to help build new traits.

In an influential 1997 paper, Sean B. Carroll of the University of Wisconsin, Neil Shubin of the University of Chicago and Cliff Tabin of Harvard Medical School coined a term for these borrowed modules: “deep homology.”

Since then, scientists have gotten a far more detailed look at many examples of deep homology. Dr. Carroll and his colleagues, for example, recently figured out how the spots on a fly’s wing evolved through rewiring modules. A tiny fly called Drosophila guttifera sports a distinctive pattern of 16 polka dots on its wings. Dr. Carroll and his colleagues discovered that the module of genes that sets the location of the spots is the same module that lays out the veins and sensory organs in the wings of many fly species. The module was later borrowed in Drosophila guttifera to lay down dots, too.

Our own eyes are also the product of deep homology. The light-sensing organs of jellyfish seem very different from our eyes, for example, but both use the same module of genes to build light-catching molecules.

Scientists are also discovering that our nervous system shares an even deeper homology with single-celled organisms. Neurons communicate with each other by forming connections called synapses. The neurons use a network of genes to build a complete scaffolding to support the synapse. In February, Alexandre Alié and Michael Manuel of the National Center for Scientific Research in France reported finding 13 of these scaffold-building genes in single-celled relatives of animals known as choanoflagellates.

No one is sure what choanoflagellates use these neuron-building genes for. The one thing that is certain is that they don’t build neurons with them.

Until now, scientists have simply stumbled across examples of deep homology. Dr. Marcotte wondered if it was possible to speed up the pace of discovery.

The evidence for deep homologies, he reasoned, might already be waiting to be found in the scientific literature — specifically, in the hundreds of thousands of studies scientists have conducted on how various genes worked in various species.

Scientists have identified thousands of genes that can give rise to diseases in humans when they mutate. Other researchers have systematically mutated each of the 6,600 genes in yeast and observed how the

mutant yeast fare under different conditions. If Dr. Marcotte could analyze data like these, he reasoned, he might find gene modules doing different things in distantly related species.

Dr. Marcotte and his colleagues amassed a database of 1,923 associations between genes and diseases in humans. They added more than 100,000 additional associations between genes and traits in species including mice, yeast and nematode worms.

The scientists then searched for related genes that produced different traits in different species. They discovered, for example, that five genes known to help build blood vessels were closely related to five genes that yeast cells use to fix their cell walls.

Discovering these shared genes then allowed Dr. Marcotte and his colleagues to make new discoveries. Their database had a total of 67 genes that fix cell walls in yeast. If yeast and humans inherited an ancient gene module, we might use related versions of other yeast genes to build blood vessels.

The scientists studied the 62 other wall-fixing yeast genes. To do so, they found related versions in frogs and watched how each one behaved in the developing frog embryo. The scientists discovered that five of the additional yeast genes also made proteins found in developing blood vessels. To see how important these proteins were for building blood vessels, the scientists shut down, one by one, the genes that carried the instructions for each protein, and observed how frog embryos developed.

"We ended up with a dramatic loss of blood vessels," said John Wallingford, a University of Texas developmental biologist and co-author of the study. Dr. Marcotte wondered if humans might also share modules with much more distantly related organisms: plants. He and his colleagues expanded their database with 22,921 associations between genes and traits scientists have found in the mustard plant Arabidopsis thaliana.

To their surprise, the scientists discovered 48 modules shared by plants and people. "There was a lot of screaming in the halls for that one," Dr. Marcotte said.

The scientists picked out one particularly strange module shared by plants and people for closer study. In humans, the genes have been linked to a rare genetic disorder called Waardenburg syndrome. It is caused by a disturbance in a group of cells in embryos called neural crest cells. Normally, the neural crest cells crawl through the embryo and form a strip running along the back. They then give rise to nerve cells, pigment-producing cells and some bones of the skull. People with Waardenburg syndrome have symptoms scattered across the parts of the body produced by neural crest cells. They may include deafness; widely spaced eyes; a white forelock of hair; and white patches on their face.

The scientists discovered that two Waardenburg-linked genes matched mustard plant genes for sensing gravity. If these genes are disabled by a mutation, a plant can't grow upright. Dr. Marcotte and his colleagues found three more gravity-sensing plant genes in their database. They decided to see if any of the three also played a role in Waardenburg syndrome.

The scientists found that one of the gravity-sensing plant genes became active in the neural crest cells of frog embryos. When they silenced the gene in those neural crest cells, the embryos became deformed. Dr. Carroll (who also writes a science column for The New York Times) saw the new research as a logical progression from early studies. "It warms our hearts that deep homology is gaining traction like this," he said.

"This is a very effective way to find human disease genes," said David Platchetzski of the University of California, Davis, who was not involved in the study. "You can move forward much more quickly."

http://www.nytimes.com/2010/04/27/science/27gene.html?ref=science

Reef Offers Model for Conservation

By ERIK OLSEN

GLOVER'S REEF, Belize — As Alex Tilley powers his 15-foot skiff over the turquoise surface, a dark form slips across the white sand floor below. "Sting ray," Mr. Tilley says.

For the next half mile, en route to the Wildlife Conservation Society research station here at Glover's Reef in Belize, at least half a dozen rays are spotted moving beneath the surface. To Mr. Tilley, the presence of so many rays says a lot about the state of the reef here.

"The fish populations at Glover's are still very robust," he said. "This is definitely one of the healthiest reefs in the region."

Mr. Tilley is the station manager and resident scientist here on Middle Caye, one of six small islands within the Glover's Reef atoll. A Ph.D. candidate in marine biology from Bangor University in North Wales, Mr. Tilley leads a reef monitoring program sponsored by the Wildlife Conservation Society, a Bronx-based organization that helped establish the reserve here in 1993.

While his British accent betrays his national origins, Mr. Tilley now lives here year-round managing the research station and conducting studies on the local sharks and rays. With its lush tropical setting and thriving reef, the caye is a kind of tropical paradise. "It beats working in a lab," he said.

Glover's Reef, about 28 miles from the coast of Belize, is one of the only true atolls in the Atlantic Ocean. It is also the site of Belize's largest "no-take" marine reserve, a 17,500-acre zone where all types of fishing are prohibited. The no-take zone makes up about 20 percent of the wider 87,000-acre Marine Protected Area here. Within 75 percent of the reserve, some types of fishing are allowed, although there are restrictions on the type of gear that can be used.

According to scientists here, the marine reserve at Glover's Reef offers a test case for the viability of similar reserves around the world. They are now hoping to apply some of the conservation strategies here to make other places succeed.

"I think Glover's Reef is a model of hope," says Ellen K. Pikitch, a marine biologist at the Stony Brook University School of Marine and Atmospheric Sciences. Dr. Pikitch runs the Institute for Ocean Conservation Science, an organization seeking wider protection for sharks worldwide. She said that the effort at Glover's "shows that marine reserves, even small marine reserves, can work. I think it's very transportable this concept."

Dr. Pikitch, a self-professed "shark fanatic," has other reasons to be hopeful. She leads the largest shark population study in the Caribbean here at Glover's Reef, now in its 10th year. Shark populations here have remained stable, while others around the world are in severe decline.

The sharks are an integral part of a healthy reef. Along with other top predators they help keep barracuda populations in check, which is important because barracuda consume algae grazers like Parrotfish that prevent runaway algae growth from choking the corals. Other research has shown that over the long term, protected areas can even have a restorative effect on coral populations.

John Bruno, a marine ecologist at the University of North Carolina at Chapel Hill, and Elizabeth Selig, a marine scientist with Conservation International, analyzed a global database of 8,534 live coral cover surveys conducted from 1969 to 2006. They reported their findings in February in the Proceedings of the National Academy of Sciences.

"We found that marine protected areas have an indirect effect that seems to benefit corals," Dr. Bruno said. But, he said, it takes time for these effects to be realized. "People put these parks out there and then run out to see them in five years, but the benefits show up later, sometimes it takes decades," he said.

Dr. Pikitch credits the success of Glover's Reef to the design of the protected area. The no-take zone helps fish stocks recover, and those fish then repopulate the nearby fisheries outside the zone. She calls this doing "double duty" and says that these strategies are of particular importance in places like Belize where fishing has been a key means of subsistence since Mayan times.

There are still significant challenges. Enforcement remains a problem. The Wildlife Conservation Society shares its home on Middle Caye with an outpost of the Belize Fisheries Department. The department employs four rangers here whose job is to patrol the reef and catch fishermen who violate the fishing ban or who poach undersized conch and spiny lobster outside the no-take zone.

Recent improvements have made enforcement somewhat easier. Last July, a 40-foot high observation tower was built at the station allowing for a 360-degree panoramic view of the atoll.

Further, the wider Belize reef system is considered one of the most endangered in the world. The effects of pollution, overfishing and global warming, which can lead to coral bleaching, have all conspired to reduce coral cover here. One analysis rated 63 percent of Belize's reefs as being threatened by human activities. Natural disasters have had a major impact as well. Still, because of what they see at places like Glover's Reef, scientists like Dr. Pikitch have been pushing the government to expand the protected areas.

Dr. Pikitch acknowledges that the problems facing reefs here are significant, but she remains optimistic that new information, including data from her shark study, will increase awareness and prompt action to protect reefs. "We are losing coral reefs at an astounding rate," she said. "It's like death by a thousand cuts. So when you have a success like this in a coral ecosystem you say, 'Wow this is great.'"

http://www.nytimes.com/2010/04/27/science/earth/27reef.html?ref=science

For Earth Day, 7 New Rules to Live By

By JOHN TIERNEY

On the 40th anniversary of Earth Day, is the middle-aged green movement ready to be revived by some iconoclastic young Turqs?

No, that's not a misspelling. The word is derived from Turquoise, which is Stewart Brand's term for a new breed of environmentalist combining traditional green with a shade of blue, as in blue-sky open-minded thinking. A Turq, he hopes, will be an environmentalist guided by science, not nostalgia or technophobia.

Ordinarily I'd be skeptical of either the word or the concept catching on, but I believe in never ignoring any trend spotted by Mr. Brand, especially on this topic. He was the one, after all, who helped inspire Earth Day by putting the first picture of the planet on the cover of his "Whole Earth Catalog" in 1968.

Now he has another book, "Whole Earth Discipline," in which he urges greens to "question convenient fables." In that spirit, let me offer a few suggestions gleaned from the four decades since Earth Day. Here are seven lessons for Turqs of all ages:

1. It's the climate, stupid. The orators at the first Earth Day didn't deliver speeches on global warming. That was partly because there weren't yet good climate models predicting warming in the 21st century and partly because the orators weren't sure civilization would survive that long anyway.

They figured that the "overpopulated" world was about to be decimated by famine, the exhaustion of fossil fuels, global shortages of vital minerals, pollution, pesticides, cancer epidemics, nuclear-reactor meltdowns, and assorted technological disasters. Who had time to worry about a distant danger from a natural substance like carbon dioxide?

Well, the expected apocalypses never occurred, and it's the unexpected problem of greenhouse gases that concerns scientists today. Greens say they've shifted their priorities, too, but by how much?

*2. You can never **not** do just one thing.* Environmentalists of the 1970s liked to justify their resistance to new technologies by warning that you could never do just one thing. It was a nice mantra and also quite accurate. New technologies do indeed come with unexpected side effects.

But resisting new technology produces its own unpleasant surprises. The "No Nukes" movement effectively led to more reliance on electricity generated by coal plants spewing carbon. The opposition to "industrial agriculture" led to the lower-yield farms that require more acreage, leaving less woodland to protect wildlife and absorb carbon.

3. "Let them eat organic" is not a global option. For affluent humans in industrialized countries, organic food is pretty much a harmless luxury. Although there's no convincing evidence that the food is any healthier or more nutritious than other food, if that label makes you feel healthier and more virtuous, then you can justify the extra cost.

But most people in the world are not affluent, and their food budgets are limited. If they're convinced by green marketers that they need to choose higher-priced organic produce, they and their children are liable to end up eating fewer fruits and vegetables — and sometimes nothing at all, as occurred when Zambia rejected emergency food for starving citizens because the grain had been genetically engineered.

In "Denialism," a book about the spread of unscientific beliefs, Michael Specter criticizes the "organic fetish" as a "pernicious kind of denialism" being exported to poor countries.

"Total reliance on organic farming would force African countries to devote twice as much land per crop as we do in the United States," he writes. "An organic universe sounds delightful, but it could consign millions of people in Africa and throughout much of Asia to malnutrition and death."

4. Frankenfood, like Frankenstein, is fiction. The imagined horrors of "frankenfoods" have kept genetically engineered foods out of Europe and poor countries whose farmers want to export food to Europe. Americans, meanwhile, have been fearlessly growing and eating them for more than a decade — and the scare stories seem more unreal than ever.

Last week, the National Academy of Sciences reported that genetically engineered foods had helped consumers, farmers and the environment by lowering costs, reducing the use of pesticide and herbicide, and encouraging tillage techniques that reduce soil erosion and water pollution.

"I daresay the environmental movement has done more harm with its opposition to genetic engineering than with any other thing we've been wrong about," Mr. Brand writes in "Whole Earth Discipline." "We've starved people, hindered science, hurt the natural environment, and denied our own practitioners a crucial tool."

5. "Green" energy hasn't done much for greenery — or anything else. Since the first Earth Day, wind and solar energy have been fashionable by a variety of names: alternative, appropriate, renewable, sustainable. But today, despite decades of subsidies and mandates, it provides less than 1 percent of the electrical power in the world, and people still shun it once they discover how much it costs and how much land it requires.

6. "New Nukes" is the new "No Nukes." In the 1980s, Gwyneth Cravens joined the greens who successfully prevented the Shoreham nuclear reactor from opening on Long Island. Then, after learning about global warming, she discovered that the reactor would have prevented the annual emission of three million tons of carbon dioxide. She wrote a book on the nuclear industry titled, "Power to Save the World."

Mr. Brand has also renounced his opposition to nuclear power and now promotes it as green energy because of its low-carbon emissions and its small footprint on the landscape. He wants to see the

development of small modular reactors, and he quotes a warning from the climate scientist James Hansen, "One of the greatest dangers the world faces is the possibility that a vocal minority of antinuclear activists could prevent phase-out of coal emissions."

Some groups, like the Natural Resources Defense Council, are still resisting nuclear power, just as groups like Greenpeace are fighting genetically engineered crops. But if Mr. Brand is right, maybe some greens will rediscover the enthusiasm for technology expressed in his famous line at the start of "The Whole Earth Catalog:" "We are as gods and might as well get good at it."

Technological progress, not nostalgia or asceticism, is the only reliable way for greens' visions of "sustainability" to be sustained. Wilderness and wildlife can be preserved only if the world's farmers have the best tools to feed everyone on the least amount of land. Solar power will be widely adopted only if there are breakthroughs that make it more efficient.

Greenhouse gases will keep accumulating unless engineers build economical sources of low-carbon energy or develop techniques for sequestering carbon. And if those advances aren't enough to stop global warming, we'll want new tools for directly engineering the climate. Given the seriousness of the danger, Mr. Brand supports climate-engineering research, and he has updated his famous line from four decades ago. The update makes a good concluding lesson for Turqs:

*7. We are as gods and **have** to get good at it.*

http://www.nytimes.com/2010/04/20/science/20tier.html?ref=science

Poor 'get less prostate surgery'

By Clare Murphy
Health reporter, BBC News

Men living in deprived areas are less likely to receive radiotherapy or surgery for prostate cancer than their richer counterparts, a study suggests.

Writing in the British Medical Journal, researchers who studied 35,000 men described "substantial" differences between what rich and poor received.

They said it was unclear what impact this could have on survival.

But previous studies have suggested a gap as high as 7% in survival rates between the least and most deprived.

If the cancer is localised and deemed low risk, most men are regularly monitored, but if it has started to develop doctors offer surgery or radiotherapy.

The Cambridge University team noted that the use of surgery more than doubled between 1995 and 2006. But their study showed it was more likely to be taken up by the most affluent - with 8.4% of this group receiving treatment to remove the prostate gland compared with 4% of the worst-off patients.

With radiotherapy, nearly 29% of the wealthiest received this form of treatment, compared with 21% of the poorest.

The pattern of discrepancies continued even when age, stage of the disease and hospital were taken into account.

Interaction

Prostate cancer accounts for about 12% of male deaths from cancer in the UK and is the second most common cause of cancer death in men. In older men aged 85 and over, the disease is the most common cause of all deaths from cancer.

" **It is vital that further research is carried out to explore the reasons behind these results** "
Dr Sarah Cant Prostate Cancer Charity

Incidence has been rising among the wealthiest groups, but this is thought to be down to the more affluent being more likely to take up testing - which at present is not routinely offered on the NHS.

The study authors noted that there may be a number of reasons why they observed these patterns in treatment, including differences in the interactions between patient and doctor or the risks different patients with varying educational backgrounds were prepared to take with their treatment.

While discrepancies between survival rates have been recorded, a wealthier patient who opts for surgery on a low risk tumour may not gain much advantage over a poorer patient with the disease at a similar stage who is merely monitored.

"Given these uncertainties, the observed differences cannot be assumed to indicate differences in treatment quality," said Georgios Lyratzopoulos, who led the research.

Dr Sarah Cant of the Prostate Cancer Charity said it was "vital that further research is carried out to explore the reasons behind these results".

But she added that, since 2006, measures have been put in place to ensure that anyone diagnosed with cancer is given clear information about the treatment options open to them.

"It is important that all men receive accurate and comprehensive information and have the opportunity to discuss their treatment options fully with their doctor. If men do not receive the information they need or do not feel able to discuss this with their doctor they may be less likely to be able to participate in decisions about how they should be treated."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8637584.stm

Published: 2010/04/23 02:05:22 GMT

Dreams 'can help with learning'

Napping after learning something new could help you commit it to memory - as long as you dream, scientists say.

They found people who dream about a new task perform it better on waking than those who do not sleep or do not dream.

Volunteers were asked to learn the layout of a 3D computer maze so they could find their way within the virtual space several hours later.

Those allowed to take a nap and who also remembered dreaming of the task, found their way to a landmark quicker.

The researchers think the dreams are a sign that unconscious parts of the brain are working hard to process information about the task.

Dr Robert Stickgold of Harvard Medical School, one of the authors of the paper, said dreams may be a marker that the brain is working on the same problem at many levels.

He said: "The dreams might reflect the brain's attempt to find associations for the memories that could make them more useful in the future."

Study tips

Co-author Dr Erin Wamsley said the study suggests our non-conscious brain works on the things that it deems are most important.

"Every day we are gathering and encountering tremendous amounts of information and new experiences," she said.

"It would seem that our dreams are asking the question, 'How do I use this information to inform my life?"

The research, published in the academic journal Cell Biology, could have practical implications.

The scientists say there may be ways to take advantage of this phenomenon for improving learning and memory.

For example, students might be better studying hard before bedtime, or taking a nap after a period of afternoon study.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8638551.stm

Published: 2010/04/23 01:57:22 GMT

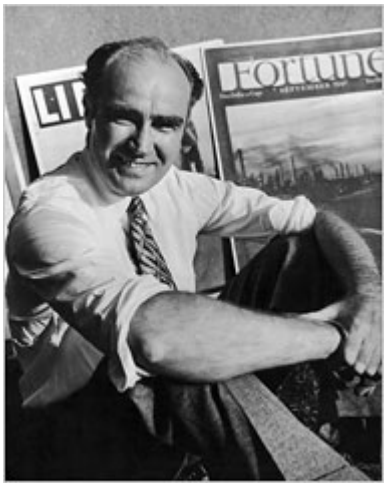
Henry Luce, the Editor in Chief
By BILL KELLER
Skip to next paragraph

THE PUBLISHER

Henry Luce and His American Century

By Alan Brinkley

Illustrated. 531 pp. Alfred A. Knopf. $35



Of all the arguments under way these days at the noisy crossroads of the news business, none is quite so basic as the debate over journalistic authority — who has it, and what it is worth.

On one side, to oversimplify just a little, is a view that the democratizing power of the Internet has rendered traditional forms and values of journalism obsolete, and with them, not incidentally, the idea that people should pay for news. Alan Rusbridger, the editor of The Guardian of London, observed recently that the old world in which journalists were trusted to filter and prioritize the news is now in tension with "a world in which many (but not all) readers want to have the ability to make their own judgments; express their own priorities; create their own content; articulate their own views; learn from peers as much as from traditional sources of authority." Among the more utopian partisans of this wisdom-of-the-crowd view, the reliance on professional journalists is seen as elitist and stifling.

On the other side is a conviction that a significant population of serious people feel the need for someone with training, experience and standards — reporters and editors — to help them dig up and sort through the news, identify what's important and make sense of it. That in no way precludes enlisting the audience as commentators, as contributors and as collaborators. (Witness the splendid hybrid of professional and amateur journalism that has kept alive the stream of news from Iran.) But in this view — which I share — the authority of professional journalists is both a valuable convenience for readers without the time or inclination to manage a tsunami of information on their own, and a civic good, in that a democracy needs a shared base of trustworthy information upon which to make its judgments.

Henry R. Luce can be considered a founding father of the authority school — for better and for worse.

Luce, the creator of Time, Life, Fortune and later of Sports Illustrated, was a media tycoon at a time when, as A. J. Liebling put it, freedom of the press belonged to the man who owned one (rather than, as now, to anyone with an Internet service provider), a time when a lone publisher could aspire to influence the course of world events. Luce used his mighty megaphone to promote leaders he admired, to paint a generally uplifting portrait of middle-class America and to advance the cause of American intervention in the world, up to and including an unrelenting passion for the misadventure in Vietnam. What he called "journalism of information with a purpose" was sometimes hard to distinguish from propaganda, and it won him the scorn of liberal intellectuals.

Alan Brinkley, a scholar of the New Deal and a frequent reviewer in these pages, has a gift for restoring missing dimensions to figures who have been flattened into caricature. "Voices of Protest," for which he won a National Book Award, revisited the cartoon demagogues Huey Long and Father Charles Coughlin

and established their important role in forcing President Franklin D. Roosevelt to pay attention to the economic miseries of the Great Depression.

In "The Publisher: Henry Luce and His American Century," Brinkley performs a similar service. His Luce is a complicated figure, more tragic than malign. That is not to say this is a particularly flattering profile. The book does full justice to Luce's outsider insecurity, his blind affinity for men of power and his defects as a family man. But it is a humanizing portrayal, and it credits the role his magazines, Time and Life especially, played in a country growing uneasily into the dominant geopolitical force in the world. Luce's publications served as a kind of cultural adhesive that bound the middle class to a shared understanding of the world and ushered it through periods of war and economic hardship. It's hard to imagine any outlet playing such a role in today's disaggregated media environment.

For those, like me, whose previous image of Luce came largely from David Halberstam's book "The Powers That Be," Brinkley's biography is not especially revelatory, but it is subtler and, in the end, more sympathetic.

"The Powers That Be" depended on many scores of interviews, and it is a propulsive read (or an exhausting one, depending on how you feel about Halberstam's methamphetamine prose). Brinkley's book, written 30 years later, when most of Halberstam's interview subjects were no longer around, relies instead on voluminous letters and diaries. This is largely successful because his subjects, in the days before Twitter and instant messaging, were prolific and literate correspondents.

The man who would, in his most famous essay for Life, proclaim the 1900s "the American century" was born and raised 6,000 miles from American shores. His father was a Presbyterian missionary in China, a Yale-educated and enlightened man who saw his task as not merely converting the Chinese to his faith, but raising them to Western standards of education and prosperity so they would gravitate to Christianity on their own. What the boy took from his father was both an ambition to greatness — a missionary sense of his own — and a deep fear that he could never measure up.

As a student at Hotchkiss and Yale, Luce was an outstanding scholar but painfully aware that he did not come from money; his resentful envy of those born to privilege would inform his and his magazines' ideal of a contented, inclusive middle class. At Hotchkiss, Luce also met one of the two people who would loom largest in his adult life — both of them simultaneously rivals and partners. Briton Hadden was as iconoclastic as Luce was earnest, as untamed as Luce was disciplined, as charismatic as Luce was socially inept. They competed for honors and attention through prep school and university, and a few years after graduation became collaborators in an audacious journalistic start-up.

Luce and Hadden shared a contempt for what is now called the mainstream media, both the sensational tabloids and the serious dailies, which they regarded as dull and bloated. Brimming with precocious self-confidence, they conceived a weekly digest of news and analysis culled from other publications. The journal that was initially to be called Facts (but morphed into Time before its debut in 1923) promised to scour close to 90 periodicals and amalgamate news from every sphere of life. Its declared mission was to serve "the illiterate upper classes, the busy businessman, the tired debutante, to prepare them at least once a week for a table conversation."

"They were nothing if not presumptuous — two 24-year-olds, with almost no money and less than two years of professional journalism experience between them, setting out to start a magazine at the tail end of a severe recession," Brinkley writes.

The new magazine had the qualities we associate now with blogs. It was concise and informal, with plenty of political topspin, rendered in a prose that inspired much satire. ("Backward ran sentences until reeled the mind," went a parody in The New Yorker.)

By the time the self-destructive Hadden had caroused himself to death at age 31, Time was a tremendous success, and a new business magazine, Fortune, was on the launching pad. A few years later, Luce was planning a "picture magazine" that would be the immensely popular Life. Time, which had begun as an abstract of other publications, and Life and Fortune all became showcases for original work by some of the best writers and photojournalists ever loosed on the world. A number of them — James Agee, Theodore White, Archibald MacLeish, Margaret Bourke-White — have memorable walk-ons in this book.

The most important supporting character in the narrative, though, aside from Hadden, is Clare Boothe Luce, the media mogul's second wife — playwright, congresswoman, ambassador to Italy and certifiable fruitcake. Her exploits would have supplied abundant copy for the popular magazine that Time Inc. begat after Luce's death: People. Theirs was a tempestuous, competitive, heartbreaking relationship, featuring explosive fights, romantic detours, a stunted sex life, experiments with LSD (she loved it; he didn't), and luridly melodramatic letters that Brinkley puts to good use.

From the beginning, Luce's magazines did not shy away from opinion, and Luce labored, not always successfully, to assure that those opinions were his own. He insisted on the title editor in chief rather than the one Brinkley has chosen, reflecting a role in the content that was aggressively hands-on.

Halberstam described Luce as part hick, noting that "our best editors have always been at least partly hick, everything is new and fresh and possible for them, they take nothing for granted." Luce's almost childish curiosity and wonder was the redeeming genius of his magazines.

But his publications were also characterized by an infatuation with power — for a long time, Brinkley says, Mussolini was treated with a fascination "often indistinguishable from admiration" — and a full-throated, mostly Republican partisanship. Luce urged his magazines to promote politicians he loved. He wrote campaign speeches for Wendell Willkie, adored Eisenhower, paid lavishly for excerpts from Winston Churchill's memoirs and was a little dazzled by Kennedy's Camelot. Luce was so myopically devoted to the Chinese Nationalist autocrat Chiang Kai-shek that he overrode his own skeptical correspondents and minimized the surging strength of the Chinese Communists. He called for the United States to "free" China, using nuclear weapons if necessary. Luce despised Roosevelt — in part because Roosevelt failed to flatter him, but mostly because he saw Roosevelt as too passive in world affairs — and he used Time to wage a feud with the president.

Fortune, too, had its agenda, as Brinkley writes, "to legitimize modernism, to reward those who contributed to the rationalization of industry and commerce, and to celebrate the sleek new aesthetic that accompanied it." And Life's role was to promote an idealized, harmonious middle-class America:

"In an era blighted by Depression, prejudice, social turmoil and the shadow of war, Life offered the comforting image of a nation united behind a shared, if contrived, vision of the 'American dream.' "

Luce's abiding cause, forged by World War II and fueled by his loathing of Communism, centered on his activist, paternalistic view of America's role in the world, and on his disdain for those he saw as isolationists and appeasers. It was articulated in his essay "The American Century" and permeated his publications. At one point he actually contemplated transforming Fortune from a business magazine into the "Magazine of America as a World Power."

Halberstam pronounced Luce "the most powerful conservative publisher in America, and in the '50s at least as influential as the secretary of state."

Brinkley leans a bit more heavily than other biographers on the frustration of Luce's power — not only his inability to move presidents where they didn't want to go, but the difficulty he had getting his own editors and writers to follow his line. His hatred of F.D.R. did not seriously dent Roosevelt's political popularity or distort his policies. His belief that the United States should liberate China got no traction.

By the time Luce wrote "The American Century," the fact that America had emerged from the shadow of Europe to become the most powerful nation on earth was both conventional wisdom and plain truth.

"His magazines were mostly reflections of the middle-class world, not often shapers of it," Brinkley concludes. "Where Luce was most influential was in promoting ideas that were already emerging among a broad segment of the American population — most notably in the early 1940s."

Nor was Luce all that conservative. He supported the growth of government power, including the welfare state. He championed civil rights for minorities and was less chauvinistic than his peers on the subject of women's freedom. He favored trade unions. Though zealously anti-Communist, he was scornful of Joseph McCarthy's excesses.

"Luce always described himself as a liberal — not a liberal of the left, but a liberal in his openness to new ideas and his embrace of progressive change," Brinkley says.

And there was a high-mindedness about his endeavors that deserves admiration. Whatever else you think of Luce, he never dived down-market. Whenever his publications flagged, Luce insisted that the way to invigorate them was to make them better, not dumber, more populist, more sensational or more cynical. His objective was never just the expansion of his audience or the demolition of his rivals, but the advancement of what he saw as the greatness of his nation.

In Brinkley's view, the legacy of Luce lies not in any great influence over American politics or policy, but in the creation of new forms of media that — in their day, before their eclipse by television and then the Internet — "helped transform the way many people experienced news and culture."

What does that mean, exactly? Luce's magazines, and later the comforting network news broadcasts in the era of Uncle Walter Cronkite, provided Americans with a shared knowledge, a unifying sense of the world. Brinkley writes:

"The construction of Luce's publishing empire is part of a much larger phenomenon of the middle years of the 20th century: the birth of a national mass culture designed primarily to serve a new and rapidly expanding middle class. . . . Part of his considerable achievement was his ability to provide an image of American life that helped a generation of readers believe in an alluring, consensual image of the nation's culture."

By the time of his death, in 1967, that consensus had been torn asunder, and today there is no vehicle, no voice with the coherent power of Luce's magazines in their heyday. The last of his breed of media tycoon is a 79-year-old Australian billionaire whose impact has been more corrosive than cohesive.

It would be a mistake to sentimentalize the previous century's version of journalistic authority. But it is probably fair to say that the cacophony of today's media — in which rumor and invective often outpace truth-testing, in which shouting heads drown out sober reflection, in which it is possible for people to feel fully informed without ever encountering an opinion that contradicts their prejudices — plays some role in the polarizing of our politics, the dysfunction of our political system and the increased cynicism of the American electorate.

Bill Keller is the executive editor of The Times.

http://www.nytimes.com/2010/04/25/books/review/Keller-t.html?nl=books&emc=booksupdateema1

Assessing Jewish Identity of Author Killed by Nazis

By PATRICIA COHEN

The first novel of Irène Némirovsky's that most people read was the last one she wrote. Némirovsky, the Russian Jewish author, died at Auschwitz in 1942 at 39 after completing two parts of a five-part novel titled "Suite Française." Secreted away in a trunk carried by Némirovsky's daughters, Denise and Elizabeth, as they escaped from German-occupied France, the manuscript was not published for more than 60 years. It received stunning reviews that simultaneously announced the discovery and loss of an enormous talent.

Némirovsky's personal story contains plenty of drama, including the desperate, heart-rending attempts by her husband, Michel Epstein, to save her. He too died at Auschwitz. But along with the belated publication came charges from a handful of critics that Némirovsky, killed because she was a Jew, was herself an anti-Semite who courted extreme right-wing friends and wrote ugly caricatured portraits of Jews.

Next month a new biography, "The Life of Irène Némirovsky: Author of Suite Française," and a collection of her short stories are being published for the first time in English in the United States, giving Americans another opportunity to assess Némirovsky's life and work.

The biographers, Olivier Philipponnat and Patrick Lienhardt, who are French and have already received enthusiastic reviews in France and Britain, had access to a trove of untapped letters, journals, archives and personal remembrances that fill in gaps about Némirovsky's life. They even unearthed an unknown short story and said they believe there is more unpublished work yet to come, including a radio play discovered just weeks ago.

As for the most incendiary charges, they unequivocally reject them. "The one word I refuse to hear is 'anti-Semitism,' " Mr. Philipponnat said, speaking in English by phone from Paris.

What motivated Némirovsky, Mr. Philipponnat and Mr. Lienhardt argue, were deep and complex feelings about her Russian-Jewish bourgeois background, shtetl Jews and, in particular, an overwhelming loathing for her mother, Anna. Vain and snobbish, Anna Némirovsky had numerous affairs and saw her daughter as an albatross, obstructing her seductions and attempts to conceal her real age. "It seems clear that this child had not been wanted," they write.

More shocking was Denise Némirovsky's tale, reported in The Sunday Times of London in 2007, that when she and her sister showed up at her grandmother's door after the war, she refused to open it, shouting "If you're orphans, go to the orphanage."

Charges of anti-Semitism first surfaced in 1929 after Némirovsky's novel "David Golder" was published. Némirovsky, who said she was repeatedly playing out the relationship with her mother in her fiction, based the characters loosely on her family. She was 26 at time — the same age as Philip Roth when he wrote "Goodbye, Columbus," a book that also earned its author the label of a "self-hating Jew."

David Golder is a greedy and crude Jewish banker with a long hooked nose and a grasping wife. The novel, tagged as both a "masterpiece" and anti-Semitic, aroused fierce sentiments from people on the left and right, from Jews and non-Jews in France, which Némirovsky, who wrote in French, considered her true spiritual home since settling there in 1919. Némirovsky rejected the accusations. When a reporter from a Zionist newspaper showed up at her home, she said: "I'm accused of anti-Semitism? Come now, that's absurd! For I'm Jewish myself and say so to anyone prepared to listen!"

But Jewish enemies were making use of her characters, the reporter persisted.

"Nevertheless, that's the way I saw them," she replied.

To Mr. Philipponnat and Mr. Lienhardt critics then and now have given the book a myopic reading. Calling it a depiction of a social milieu, they ask, "Had 'David Golder' been written in 2009 by Bernard Madoff's daughter, who would dream of accusing her of anti-Semitic views?"

In 1935 Némirovsky pointed out how different the political climate was when she wrote the novel. "It is absolutely certain that had there been Hitler, I would have greatly softened 'David Golder,' and I would not have written it in the same way," she said. "And yet I would have been wrong, it would have been a weakness unworthy of a real writer!"

The charges of anti-Semitism that resurfaced in Israel and the United States when "David Golder" was reissued and translated into English, have been polarizing. Jonathan Weiss, the author of a 2005 biography, "Irene Némirovsky: Her Life and Works," wrote in an e-mail message that because Némirovsky's critics used quotations from his book, he was inaccurately classified as someone who condemned her attitudes toward Jews, gaining him the enmity of her family. Mr. Weiss, who started his research in the 1990s, did not have access to the cache of personal writings or the family recollections made available to Mr. Philipponnat and Mr. Lienhardt.

The authors, who knew Némirovsky's work, approached a publisher about writing her biography in 2004, about two months before "Suite Française" first appeared. "When we presented the project, their first reaction was not to publish it because she was totally forgotten," Mr. Philipponnat said. He and Mr. Lienhardt had previously collaborated on a biography of Roger Stéphane, a founder of the French newspaper L'Observateur. Denise Epstein, Némirovsky's daughter, liked their treatment of Mr. Stéphane's Jewishness, Mr. Philipponnat said, and so "decided to give us all the archives as she could and her memories too."

Némirovsky wrote at least 50 short stories and 15 novels, including "Suite Française." That book barely mentions Jews. The two parts capture the chaotic escape of French civilians from the German Army in 1940 and present a sympathetic portrait of a billeted German soldier. In the thick of the maelstrom she was describing, Némirovsky wrote, "I'm working on burning lava."

Some of the 10 stories written between 1934 and 1942 and published in the new collection, "Dimanche and Other Stories," came from that same molten pit.

In "Monsieur Rose," written after the invasion, Némirovsky seems to be trying out characters and scenes for the exodus of French civilians depicted in "Suite Française."

"Fraternité" ("Brotherhood") will undoubtedly surface in the debate over Némirovsky's Jewish identity. The protagonist, Christian Rabinovitch, was based on a Jewish journalist, Pierre Loewel, Mr. Philipponnat said, yet there are several autobiographical details as well, like the reference to ancestors in Odessa, the city where Némirovsky's parents met, and her oft-repeated wish that she had been born in France.

Christian is a prosperous second-generation Frenchman, who notes that his "excessively long and pointed" nose and dry lips seemingly "parched by a thousand-year-old thirst" are "the only specifically Jewish traits I've kept." At a train station he meets a poor, disheveled Jew from Russia with the same last name, possibly a relation from generations back.

After Christian departs from this shtetl doppelgänger, she writes, "Was it possible that he was of the same flesh and blood as that man?"

"Impossible, grotesque! There's an abyss, a gulf between us!" Christian says, unsuccessfully trying to reassure himself that "he was a rich French bourgeois, pure and simple!"

In hindsight the story, written in 1936 but rejected by her publisher, seems both strangely prescient and unaware.

"Never, never can we settle!" the Jewish Rabinovitch bemoans. As soon as the Jews do, "there's a war, a revolution, a pogrom or something else and it's goodbye! 'Pack your bags, clear off.' "

Némirovsky and Epstein, of course, did not clear off after the German invasion — a choice that still angers her daughter Denise. Since 1935 the couple had been trying to gain French citizenship, and in 1939 they converted to Roman Catholicism. Distancing her family from the lower-class Jews of Eastern Europe, Némirovsky considered herself a "respectable" not an "unwanted foreigner," as she wrote Marshal Pétain, the head of the Vichy government in 1940 — in other words, a "French bourgeois, pure and simple."

But as Mr. Philipponnat and Mr. Lienhardt write in their final chapter, from the day the gendarmes arrested her, Irène Némirovsky "ceased to be a novelist, a mother, a wife, a Russian, a Frenchwoman: she was just a Jewess."

http://www.nytimes.com/2010/04/26/books/26nemirovsky.html?ref=books

One Man's Trash . . .
By PETER D. KRAMER
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STUFF

Compulsive Hoarding and the Meaning of Things

By Randy O. Frost and Gail Steketee

290 pp. Houghton Mifflin Harcourt. $27

Working with a patient he calls Debra, a compulsive hoarder, the psychologist Randy O. Frost tried a simple experiment. Frost proposed sending Debra a postcard, blank but for the name and address. Debra's assignment was to throw it away.

Days later, Debra complained that she had not had enough time with the card. She described the stamp and the postmark. When she finally let go, she pictured the card's position in the trash. Later, she confessed she had cheated by writing down everything about the card she could remember and then saving the notes.

In "Stuff: Compulsive Hoarding and the Meaning of Things," Frost, a professor at Smith College, and Gail Steketee, a professor and dean of the school of social work at Boston University, invite us graciously into territory that might otherwise make us squirm. They have spent nearly 20 years working with hoarders, sometimes in settings where tunnels lead through trash and roaches roam freely. Frost and Steketee introduce collectors who acquire through shopping, Dumpster diving and stealing. The resulting assemblages encompass broken machines and living things (cats and dogs, mostly).

People justify hoarding as curating and recycling, deeming odd objects beautiful and useful. Sometimes they act as if history were at stake. Andy Warhol, "straddling the border between eccentricity and pathology," the authors write, would periodically sweep everything — cash, artwork, apple cores — off his desk and into a cardboard box. He stored hundreds of these "time capsules."

To characterize hoarding, Frost and Steketee select what they call a "prototype" case involving a woman named Irene. Irene's home is filled with seemingly random items: newspapers, children's games, empty cereal boxes, expired coupons. The mess has driven Irene's husband from the house, and she worries that he will seek custody of their children, including a daughter whose dust allergies make it hard for her to live there.

To Frost and Steketee, patients like Irene demand a new understanding of hoarders. Past experts have depicted sufferers as isolated and paranoid — deprived in childhood and now unable to discard worthless junk even when it bears no sentimental value. But Irene's parents were comfortable financially. She has many friends. She treasures each item she owns and anticipates putting it to future use.

Hoarding has been linked to obsessive-compulsive disorder and its variants, and Irene, who displays contamination fears, probably meets criteria for O.C.D. But studies show that the genetics of hoarding differ from the genetics of obsessing. And while obsessionality is painful, Irene finds enjoyment in acquiring and revisiting her holdings. It is this pleasure in objects (think of Debra and the postcard) that distinguishes hoarding, in Frost and Steketee's view. They suggest that hoarders may "inherit an intense perceptual sensitivity to visual details," and speculate about "a special form of creativity and an appreciation for the aesthetics of everyday things."

This upbeat account of hoarding's basis has a humane ring: hoarders are discerning. But then, Irene can be indiscriminate, according every possession equal worth, whether it's a newspaper clipping or a photograph of her daughter. Frost and Steketee are too thoughtful to give a simple account of what drives Irene. Possessions help her preserve her identity and relive past events. The objects make her feel safe and allow her to express caring. Newspaper clippings point outward, speaking to Irene of opportunities in the wider world. Irene is depressed; collecting promises relief. Irene displays perfectionism and indecisiveness, character traits that have been linked to hoarding. When there are so many motivations, no single one seems central.

Hoarding can also arise in connection with senility, injuries to the brain's frontal lobes and Prader-Willi syndrome, a genetic disorder whose symptoms may include low intelligence. Ideally, any theory that ascribes a special aesthetic sensibility to hoarders would need to take account of patients whose thought processes are impaired. And as Frost and Steketee demonstrate, there is no end to competing explanations of how hoarding arises. The "terror management theory" holds that collecting mitigates fears of death, via the fashioning of a form of immortality. The "compensation theory" postulates that objects can provide reassurance to those who question their self-worth. Hoarding has been linked to gambling addiction; acquisition is a matter less of compulsion than of impulsivity. Frost and Steketee also connect hoarding with modern materialism and advertising (though they stress that materialism is associated with display and hoarding with secrecy); then again, they emphasize the condition's universality.

Certainly, collecting is a common human activity. One hoard, 1,100 seal impressions on clay from the Fertile Crescent, has survived 25 centuries. As many as 90 percent of children collect something, Frost and Steketee report, and two-thirds of American households include a collector.

What separates pastime from disorder? Frost and Steketee rely on distress and impairment, criteria that psychiatry employs to delineate diagnoses. But some of the subjects Frost and Steketee discuss function well enough. What of the wealthy, cultured twins, each of whom has stuffed a hotel penthouse with moldering artwork? Both brothers have friends. Both can afford to move to new apartments as old ones fill up. Both take pride in their collections. Are the twins ill? If not, is it resources that set them apart from Irene, who is struggling to hold on to her children? It seems paradoxical that if one twin were to become desperate because he recognized that he had lost control, he might be labeled a pathological hoarder, while his brother, blithely rationalizing his purchases, would be deemed healthy.

As Frost and Steketee's examples multiply, hoarding comes to seem an ever more diffuse concept. A majority of the subjects the authors study are clinically depressed. Frost and Steketee believe that hoarding causes the mood disorder. Working in different terrain, I see patients who complain first of depression. Twice, I have treated women who lived amid clutter because they could not discard the detritus of daily life, be it magazines or pay slips. I had no success with the filled rooms. But both times we made progress with the depression, and both times the patient moved, for business reasons. In the new house, each managed to keep up with the flow of paper.

Frost and Steketee, with their active collectors, do not see this sort of result. Forced clean-outs don't work; hoarders restock houses quickly, and the sudden loss of objects causes rage and anxiety. (Nantucket, we learn, stopped town-ordered cleanups when three hoarders died shortly after the interventions.) Frost and Steketee recommend self-help groups and variants of cognitive therapy to treat hoarding. Success is mixed. Clients report improvement, but their homes remain cluttered. One O.C.D. researcher tells Frost and Steketee that she excludes hoarders from her samples because they make therapy outcomes look bad — quite a statement when you consider that she is confronting a notoriously unyielding disease.

If Frost and Steketee have difficulty constructing a coherent new vision of compulsive hoarding, it is because they are too observant and too dedicated to the relief of suffering to make a complex phenomenon simple. They are collectors in their own right, stocking a cabinet of curiosities with intimate stories and evocative theories. To those who need to understand hoarders, perhaps in their own family, "Stuff" offers perspective. For general readers, it is likely to provide useful stimulus for examining how we form and justify our own attachments to objects.

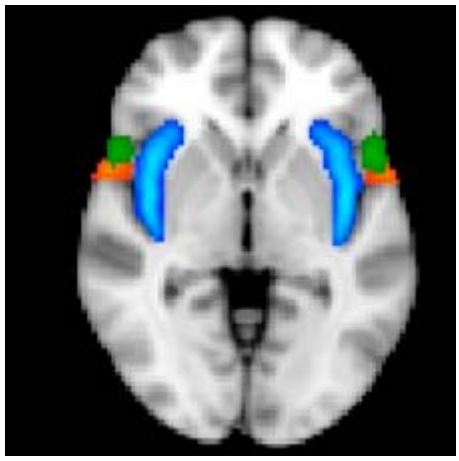
Peter D. Kramer, a psychiatrist, is the author of "Against Depression" and, most recently, "Freud: Inventor of the Modern Mind."

http://www.nytimes.com/2010/04/25/books/review/Kramer-t.html?ref=books

Under Threat, Women Bond, Men Withdraw

A new study suggests that stress boosts women's awareness of facial expressions and emotions—but has an antisocial influence in men

By Ingrid Wickelgren



MONTREAL—When we're under immediate stress—say, we are about to give a speech or about to be mugged—we either fight or flee, or so scientists have long preached. But some psychologists are now suggesting that this scenario may apply mainly to males. Men get antisocial under pressure, but women tend to react in the opposite way: they "tend and befriend," engaging in nurturing and social networking, perhaps as a way to protect their offspring, according to a theory proffered by neuroscientist Shelley Taylor of the University of California, Los Angeles. Here at the Cognitive Neuroscience Society 2010 annual meeting, psychologist Mara Mather of the University of Southern California presented powerful new support for Taylor's hypothesis in the divergent ways that stressed men and women respond to faces.

Mather and her colleagues asked male and female subjects to place their hand in ice water for three minutes, an activity that makes levels of the stress hormone cortisol shoot up over the next hour or so. Then these subjects—and a comparison group whose hands had been comfortably immersed in warm water—looked at angry or neutral faces while lying inside a brain scanner.

These conditions revealed a striking sex difference in the brain in the extent to which men and women process faces, and perform emotional assessments of others, under stress. The men under the influence of high cortisol levels showed less activity in a key face-processing region of the brain (the fusiform face area or FFA) than the unstressed men did, suggesting that stressful situations diminish the ability of men to evaluate facial expressions. By contrast, the brains of the women under strain worked harder on the faces: in these females, the FFA was more active than it was in women who did not experience the cortisol boost.

This sex difference was apparent not only in the face evaluation area, but also in a circuit of regions that enables people to internally simulate and understand the emotions of others. This circuit includes the insula, which governs feelings of empathy, and the temporal pole, which helps us understand others' states of mind. According to the researchers' analysis, stress appeared to increase the flow of information between these regions and the FFA in women, orchestrating a concerted response. But in males, cortisol worked to disconnect the brain's analysis of facial expression from its evaluation of others' emotions.

"Will stress increase females' accuracy in interpreting facial expressions—and fuel greater empathy?" Mather asks. Women do seek out affiliation during difficult or threatening times, she says, whereas men don't. Women's ability to read people's expressions more intensely and more accurately could partially underlie this propensity to bond under such circumstances—whether organizing a collective response to an earthquake or reaching out to a potential client during a tense negotiation. "When we start looking at stress, that is where the sex differences in behavior emerge," Mather says.

http://www.scientificamerican.com/article.cfm?id=under-threat-women-bond

When language is blocked, music may offer detour

By Carolyn Y. Johnson, Globe Staff | April 22, 2010

Lee and Mary-Helen Black had nearly given up hope their son would speak.

Physically, Tripp was fine, crawling, standing, and walking on schedule. But language eluded him. Lee Black vividly recalled when Tripp, nearly 2, sat in his highchair and tried to sing a children's song. He started to say "head,'' then faltered, as if the word had crumbled out of his grasp.

"I watched him freeze,'' his father said. "That was the ultimate moment.''

Tripp was later diagnosed with autism, a disorder that can impair children's ability to speak. Despite years of therapy, he did not talk.

Then last fall, at age 8, he began an experimental program that coaxes speech using singing, movement, and imitation. After 10 weeks, he could say "mama,'' "dada,'' "bubbles,'' and "bye.''

One evening, his brother, Luke, was having trouble getting the family dog onto his bed. "Journey, up!'' he called.

"Up, up, up!'' Tripp chimed in.

For his mother, that simple exchange was huge — Tripp had spontaneously used his voice, joining in a bedtime ritual.

"That's what a family is supposed to feel like; when you're putting your kids to bed, everybody's supposed to be participating,'' she said later. "A little thing like that can carry me for a month.''

The language gains from the Beth Israel Deaconess Medical Center therapy may seem small to an outsider. Tripp, now 9, is learning words and short phrases, and his pronunciation is inexact: "All done!''

sounds more like “Ah-duh!’’, pizza more like “bee-dah.’’ He still uses sign language and cards with pictures on them to communicate. But for such children to begin to say words is immensely gratifying for parents and a critical step for the children to be able to benefit from traditional speech therapy.

“There’s very little available for these kids. A lot of things have basically failed so far,’’ said Gottfried Schlaug, director of the music and neuroimaging laboratory at Beth Israel Deaconess.

Estimates vary, but as many as a quarter of children with autism are nonverbal. Children with autism tend to have superior auditory skills and have a particular attraction to music, Schlaug said, so “music-making may provide an alternative entry into a broken or dysfunctional brain system.’’

The therapy is built on two threads of research. One has found that music-making can change the brains of healthy normal people and plays a role in engaging and strengthening connections between the auditory and motor regions of the right side of the brain. The intervention also draws on a treatment that helps stroke patients regain speech after suffering damage to the speech centers in their brain, by singing words and phrases and using a coordinated movement of one hand.

Schlaug’s team adapted the stroke therapy for children. Researchers sing words or phrases to the children while showing them a picture of the action or object, and guide their hands to play two pitched drums.

Supported by a grant from the Nancy Lurie Marks Family Foundation, Schlaug and colleagues have tested the eight-week, daily therapy in about 10 children, and they have measured improved speech production and increased speech output. The results have yet to be published, but the researchers hope these findings will help them raise money to expand the study.

The theory behind the therapy is that the combination of sound and movement can activate a network of brain regions that overlap with brain areas thought to be abnormal in children with autism. Researchers think the intensive, repetitive training on sound paired with motion will help strengthen those abnormal areas.

Earlier this month, at a two-month follow-up session, Tripp hung up his sweatshirt and sat down at a table. Patient, but exhausted from a day at school and an earlier testing session, he tapped his fingernails on the table as if to say, let’s get started.

Postdoctoral fellow Catherine Wan sat across from him and sang “Hello,’’ guiding Tripp’s hands to the drums. “Heh-wo,’’ he responded, hitting the drums at the same time.

She showed him a jar of bubbles, one of his favorite rewards. “Bub-buh,’’ he said.

To researchers who specialize in autism, the approach is exciting.

“I was just really very impressed with what I saw,’’ Boston University psychology professor Helen Tager-Flusberg said after watching videos of the therapy sessions. She has agreed to collaborate with the Beth Israel Deaconess group on future research.

“Obviously that’s not a full-fledged controlled experiment at this point . . . but I don’t know of other approaches that have been particularly effective in getting children beyond the age of 5 or 6 to start speaking. I think the idea of using this rhythmic motor approach . . . makes an enormous amount of sense from a neurological perspective,’’ she said.

Ruth Grossman, assistant professor of communication disorders at Emerson College, said she was intrigued by the approach, which was informed by the work with stroke patients.

"I don't think it happens enough. If we stop thinking of patients as groups but think of deficits as the common denominators, I think we might find a lot more fertile ground for interesting things to do with different populations,'' Grossman said.

For the Blacks, who live in Allston, the therapy has offered a new perspective on what is possible.

Tripp's father helps him stretch before bedtime — a nightly ritual that has been getting louder. Lee Black usually counts during the exercise, and now Tripp joins in.

He's got "eight'' and "nine,'' and he's started working on "ten.''

"What we feel now is he can get this stuff,'' Tripp's father said. "We understand he's capable of a wider breadth than where we've been with him.''

Carolyn Y. Johnson can be reached at cjohnson@globe.com. ■

http://www.boston.com/news/health/articles/2010/04/22/when_language_is_blocked_music_may_offer_detour/?page=full