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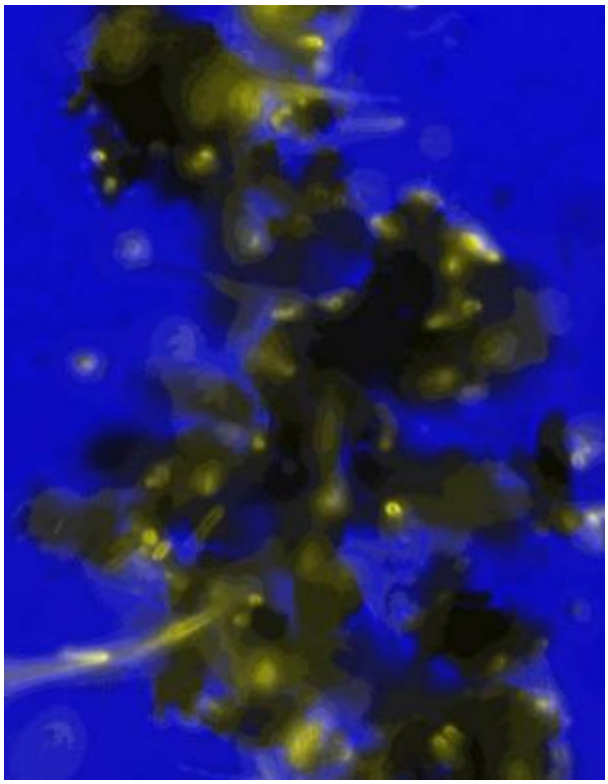
Scientists Open Electrical Link to Living Cells



An engineered Escherichia coli strain (yellow) attaching to solid iron oxide (black). Scientists at the Molecular Foundry took the first step toward electronically interfacing microbes with inorganic materials, without disrupting cell viability. (Credit: Image courtesy of Heather Jensen)

ScienceDaily (Oct. 23, 2010) — The Terminator. The Borg. The Six Million Dollar Man. Science fiction is ripe with biological beings armed with artificial capabilities. In reality, however, the clunky connections between living and non-living worlds often lack a clear channel for communication. Now, scientists with the Lawrence Berkeley National Laboratory (Berkeley Lab) have designed an electrical link to living cells engineered to shuttle electrons across a cell's membrane to an external acceptor along a well-defined path. This direct channel could yield cells that can read and respond to electronic signals, electronics capable of self-replication and repair, or efficiently transfer sunlight into electricity.

"Melding the living and non-living worlds is a canonical image in science fiction," said Caroline Ajo-Franklin, a staff scientist in the Biological Nanostructures Facility at the Molecular Foundry. "However, in most attempts to interface living and non-living systems, you poke cells with a sharp hard object, and the cells respond in a predictable way -- they die. Yet, in Nature many organisms have evolved to interact with the rocks and minerals that are part of their environment. Here, we took inspiration from Nature's approach and actually grew the connections out of the cell."

Coaxing electrons across a cellular membrane is not trivial: attempts to pull an electron from a cell may disrupt its function, or kill the entire cell in the process. What's more, current techniques to transfer cellular electrons to an external source lack a molecular roadmap, which means even if electrons do turn up outside a cell, there is no way to direct their behavior, see where they stopped along the way, or send a signal back to the cell's interior.

"We were interested in finding a pathway that wouldn't kill the living systems we were studying," said Heather Jensen, a graduate student at University of California, Berkeley whose thesis work is part of this

publication. "By using a living system in electronics, we can one day create biotechnologies that can repair and self-replicate."

In their approach, Jensen, Ajo-Franklin and colleagues first cloned a part of the extracellular electron transfer chain of *Shewanella oneidensis* MR-1, marine and soil bacteria capable of reducing heavy metals in oxygen-free environments. This chain or "genetic cassette," Ajo-Franklin notes, is essentially a stretch of DNA that contains the instructions for making the electron conduit. Additionally, because all life as we know it uses DNA, the genetic cassette can be plugged into any organism. The team showed this natural electron pathway could be popped into a (harmless) strain of *E. coli* -- a versatile model bacteria in biotechnology -- to precisely channel electrons inside a living cell to an inorganic mineral: iron oxide, also known as rust. Bacteria in environments without oxygen, such as *Shewanella*, use iron oxide from their surroundings to breathe. As a result, these bacteria have evolved mechanisms for direct charge transfer to inorganic minerals found deep in the sea or soil. The Berkeley Labs team showed their engineered E. coli could efficiently reduce iron and iron oxide nanoparticles -- the latter five times faster than *E. coli* alone.

"This recent breakthrough is part of a larger Department of Energy project on domesticating life at the cellular and molecular level. By directly interfacing synthetic devices with living organisms, we can harness the vast capabilities of life in photo- and chemical energy conversion, chemical synthesis, and self-assembly and repair," said Jay Groves, a faculty scientist at Berkeley Labs and professor of chemistry at University of California, Berkeley. "Cells have sophisticated ways of transferring electrons and electrical energy. However, just sticking an electrode into a cell is about as ineffective as sticking your finger into an electrical outlet when you are hungry. Instead, our strategy is based on tapping directly into the molecular electron transport chain used by cells to efficiently capture energy."

The researchers plan to implement this genetic cassette in photosynthetic bacteria, as cellular electrons from these bacteria can be produced from sunlight -- providing cheap, self-replicating solar batteries. These metal-reducing bacteria could also assist in producing pharmaceutical drugs, Ajo-Franklin adds, as the fermentation step in drug manufacturing requires energy-intensive pumping of oxygen. In contrast, these engineered bacteria breathe using rust, rather than oxygen, saving energy.

A paper reporting this research titled, "Engineering of a synthetic electron conduit in living cells," appears in *Proceedings of the National Academy of Sciences*. Co-authoring the paper with Jensen, Ajo-Franklin and Groves were Aaron Albers, Konstantin Malley, Yuri Londer, Bruce Cohen, Brett Helms and Peter Weigele.

Portions of this work at the Molecular Foundry were supported by DOE's Office of Science.

Story Source:

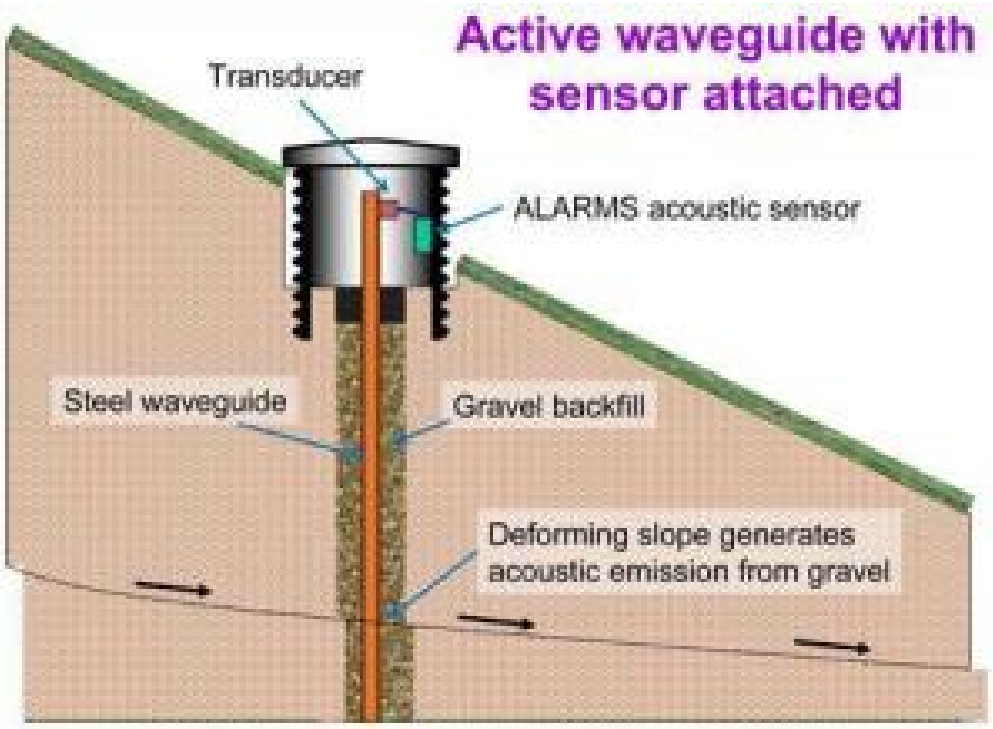
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **DOE/Lawrence Berkeley National Laboratory**.

Journal Reference:

1. H. M. Jensen, A. E. Albers, K. R. Malley, Y. Y. Londer, B. E. Cohen, B. A. Helms, P. Weigele, J. T. Groves, C. M. Ajo-Franklin. **Engineering of a synthetic electron conduit in living cells**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.1009645107

http://www.sciencedaily.com/releases/2010/10/101021103115.htm

Sound of the Underground: New Acoustic Early Warning System for Landslide Prediction



A diagram of the acoustic monitoring system. (Credit: Image courtesy of Engineering and Physical Sciences Research Council)

ScienceDaily (Oct. 23, 2010) — A new type of sound sensor system has been developed to predict the likelihood of a landslide.

Thought to be the first system of its kind in the world, it works by measuring and analysing the acoustic behaviour of soil to establish when a landslide is imminent so preventative action can be taken.

Noise created by movement under the surface builds to a crescendo as the slope becomes unstable and so gauging the increased rate of generated sound enables accurate prediction of a catastrophic soil collapse.

The technique has been developed by researchers at Loughborough University, in collaboration with the British Geological Survey, through two projects funded by the Engineering and Physical Sciences Research Council (EPSRC).

The detection system consists of a network of sensors buried across the hillside or embankment that presents a risk of collapse. The sensors, acting as microphones in the subsoil, record the acoustic activity of the soil across the slope and each transmits a signal to a central computer for analysis.

Noise rates, created by inter-particle friction, are proportional to rates of soil movement and so increased acoustic emissions mean a slope is closer to failure. Once a certain noise rate is recorded, the system can send a warning, via a text message, to the authorities responsible for safety in the area. An early warning allows them to evacuate an area, close transport routes that cross the slope or carry out works to stabilise the soil.

Neil Dixon, professor of geotechnical engineering at Loughborough University and principal investigator on the project, explains how the system -- thought to be a global first -- works. "In just the same way as bending a stick creates cracking noises that build up until it snaps, so the movement of soil before a landslide creates increasing rates of noise," said Professor Dixon.

"This has been known since the 1960s, but what we have been able to do that is new is capture and process this information so as to quantify the link between noise and soil displacement rates as it happens, in real time -- and hence provide an early warning," he added.

The system is now being developed further to produce low cost, self-contained sensors that do not require a central computer. This work, which is being carried out under the second project funded by EPSRC, is focused on manufacture of very low cost sensors with integrated visual and/or audible alarms, for use in developing countries. Ongoing work includes field trials, market research and planning commercial exploitation of the technology.
"The development of low cost independent acoustic slope sensors has only become possible in very recent times due to the availability of microprocessors that are fast, small and cheap enough for this task," says Dixon.
As well as the life-saving implications for countries prone to disastrous landslides, the technique can also be used in monitoring the condition of potentially unstable slopes built to support transport infrastructure, such as rail and road embankments, in developed countries such as the UK.
Current development work is being funded through Loughborough University's knowledge transfer account, a fund supplied by EPSRC to help commercial exploitation of inventions arising from its research projects. A commercially available Alarms sensor is expected to be launched in the next two years.

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Engineering and Physical Sciences Research Council**.

http://www.sciencedaily.com/releases/2010/10/101021104733.htm

Plants Play Larger Role Than Thought in Cleaning Up Air Pollution, Research Shows

Poplars, aspens, other trees provide extensive "ecosystem services." (Credit: USDA)

ScienceDaily (Oct. 22, 2010) — Vegetation plays an unexpectedly large role in cleansing the atmosphere, a new study finds.

The research, led by scientists at the National Center for Atmospheric Research (NCAR) in Boulder, Colo., uses observations, gene expression studies, and computer modeling to show that deciduous plants absorb about a third more of a common class of air-polluting chemicals than previously thought.

The new study, results of which are being published in *Science Express*, was conducted with co-authors from the University of Northern Colorado and the University of Arizona. It was supported in part by the National Science Foundation (NSF), NCAR's sponsor.

"Plants clean our air to a greater extent than we had realized," says NCAR scientist Thomas Karl, the lead author. "They actively consume certain types of air pollution."

The research team focused on a class of chemicals known as oxygenated volatile organic compounds (oVOCs), which can have long-term impacts on the environment and human health.

"The team has made significant progress in understanding the complex interactions between plants and the atmosphere," says Anne-Marie Schmoltner of NSF's Division of Atmospheric and Geospace Sciences, which funded the research.

The compounds form in abundance in the atmosphere from hydrocarbons and other chemicals that are emitted from both natural sources--including plants--and sources related to human activities, including vehicles and construction materials.

The compounds help shape atmospheric chemistry and influence climate.

Eventually, some oVOCs evolve into tiny airborne particles, known as aerosols, that have important effects on both clouds and human health.

By measuring oVOC levels in a number of ecosystems in the United States and other countries, the researchers determined that deciduous plants appear to be taking up the compounds at an unexpectedly fast rate--as much as four times more rapidly than previously thought.

The uptake was especially rapid in dense forests and most evident near the tops of forest canopies, which accounted for as much as 97 percent of the oVOC uptake that was observed.

Karl and his colleagues then tackled a follow-up question: How do plants absorb such large quantities of these chemicals?

The scientists moved their research into their laboratories and focused on poplar trees. The species offered a significant advantage in that its genome has been sequenced.

The team found that when the study trees were under stress, either because of a physical wound or because of exposure to an irritant such as ozone pollution, they began sharply increasing their uptake of oVOCs.

At the same time, changes took place in expression levels of certain genes that indicated heightened metabolic activity in the poplars.
The uptake of oVOCs, the scientists concluded, appeared to be part of a larger metabolic cycle.
Plants can produce chemicals to protect themselves from irritants and repel invaders such as insects, much as a human body may increase its production of white blood cells in reaction to an infection.
But these chemicals, if produced in enough quantity, can become toxic to the plant itself.
In order to metabolize these chemicals, the plants start increasing the levels of enzymes that transform the chemicals into less toxic substances.
At the same time, as it turns out, the plant draws down more oVOCs, which can be metabolized by the enzymes.
"Our results show that plants can actually adjust their metabolism and increase their uptake of atmospheric chemicals as a response to various types of stress," says Chhandak Basu of the University of Northern Colorado, a co-author.
"This complex metabolic process within plants has the side effect of cleansing our atmosphere."
Once they understood the extent to which plants absorb oVOCs, the research team fed the information into a computer model that simulates chemicals in the atmosphere worldwide.
The results indicated that, on a global level, plants are taking in 36 percent more oVOCs than had previously been accounted for in studies of atmospheric chemistry.
Additionally, since plants are directly removing the oVOCs, fewer of the compounds are evolving into aerosols.
"This really transforms our understanding of some fundamental processes taking place in our atmosphere," Karl says.

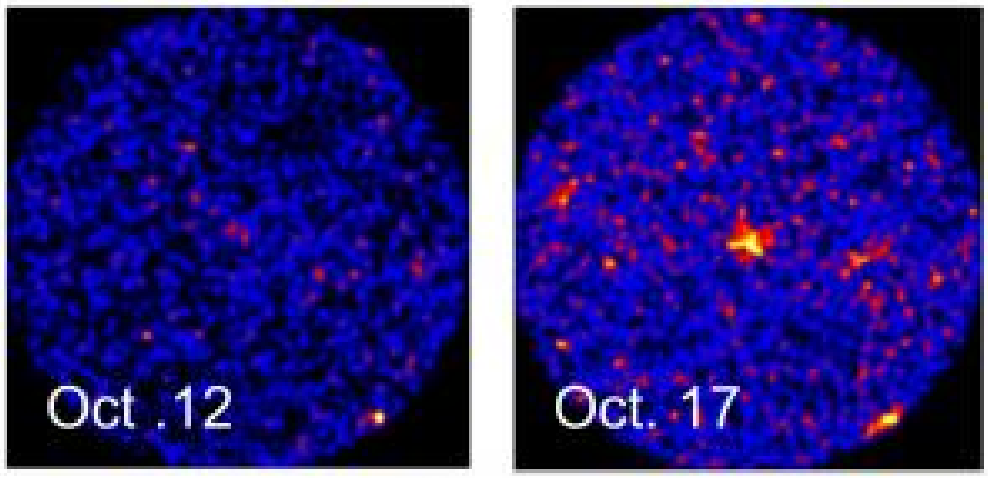
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **National Science Foundation**.

Journal Reference:

1. T. Karl, P. Harley, L. Emmons, B. Thornton, A. Guenther, C. Basu, A. Turnipseed, K. Jardine. **Efficient Atmospheric Cleansing of Oxidized Organic Trace Gases by Vegetation**. *Science*, 2010; DOI: 10.1126/science.1192534

http://www.sciencedaily.com/releases/2010/10/101021152401.htm

Space Telescopes Reveal Previously Unknown Brilliant X-Ray Explosion in Milky Way Galaxy



Images of areas of 10 degrees in radius around the nova MAXI J1409-619. A celestial body that was not observed on Oct. 12 shone bright on the 17th. (Credit: JAXA/RIKEN/MAXI team)

ScienceDaily (Oct. 22, 2010) — Astronomers in Japan, using an X-ray detector on the International Space Station, and at Penn State University, using NASA's Swift space observatory, are announcing the discovery of an object newly emitting X-rays, which previously had been hidden inside our Milky Way galaxy in the constellation Centaurus.

The object -- a binary system -- was revealed recently when an instrument on the International Space Station named MAXI (Monitor of All-Sky X-ray Image) on the Exposed Facility of the Japanese Experiment Module "Kibo" caught it in the act of erupting with a massive blast of X-rays known as an X-ray nova. The MAXI mission team quickly alerted astronomers worldwide to the discovery of the new X-ray source at 2:00 a.m. EDT on Wednesday, 20 October, and NASA's Swift Observatory quickly conducted an urgent "target-of-opportunity" observation nine hours later, which allowed for the location of the X-ray nova to be measured accurately.

"The collaboration between the MAXI and Swift teams allowed us to quickly and accurately identify this new object," said Jamie Kennea, the Swift X-ray Telescope instrument scientist at Penn State University who is leading the Swift analysis. "MAXI and Swift's abilities are uniquely complementary, and in this case have provided a discovery that would not have been possible without combining the knowledge obtained from both."

The Swift detection confirmed the presence of the previously unknown bright X-ray source, which was named MAXI J1409-619. "The Swift observation suggests that this source is probably a neutron star or a black hole with a massive companion star located at a distance of a few tens of thousands of light years from Earth in the Milky Way," said David Burrows, professor of astronomy and astrophysics at Penn State and the lead scientist for Swift's X-ray Telescope. "The contribution of Swift's X-ray Telescope to this discovery is that it can swing into position rapidly to focus on a particular point in the sky and it can image the sky with high sensitivity and high spatial resolution."

"MAXI has demonstrated its capability to discover X-ray novae at great distances," said Kazutaka Yamaoka, assistant professor at Aoyama Gakuin University and a member of the MAXI team. "The MAXI team is planning further coordinated observations with NASA satellites to reveal the identity of this source."

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

http://www.sciencedaily.com/releases/2010/10/101022132134.htm

Arctic Report Card: Region Continues to Warm at Unprecedented Rate

Wide-spread melt ponds observed by NOAA's North Pole Web cam. (Credit: Image courtesy of NOAA)

ScienceDaily (Oct. 22, 2010) — The Arctic region, also called the "planet's refrigerator," continues to heat up, affecting local populations and ecosystems as well as weather patterns in the most populated parts of the Northern Hemisphere, according to a team of 69 international scientists.

The findings were released Oct. 21, 2010 in the Arctic Report Card, a yearly assessment of Arctic conditions.

Among the 2010 highlights:

- Greenland is experiencing record-setting high temperatures, ice melt and glacier area loss;
- Summer sea ice continues to decline -- the 2009-2010 summer sea ice cover extent was the third lowest since satellite monitoring began in 1979, and sea ice thickness continues to thin. The 2010 minimum is the third lowest recorded since 1979, surpassed only by 2008 and the record low of 2007; and
- Arctic snow cover duration was at a record minimum since record-keeping began in 1966.

There is also evidence that the effect of higher air temperatures in the Arctic atmosphere in fall is contributing to changes in the atmospheric circulation in both the Arctic and northern mid-latitudes. Winter 2009-2010 showed a link between mid-latitude extreme cold and snowy weather events and changes in the wind patterns of the Arctic, related to a phase of the Arctic Oscillation.

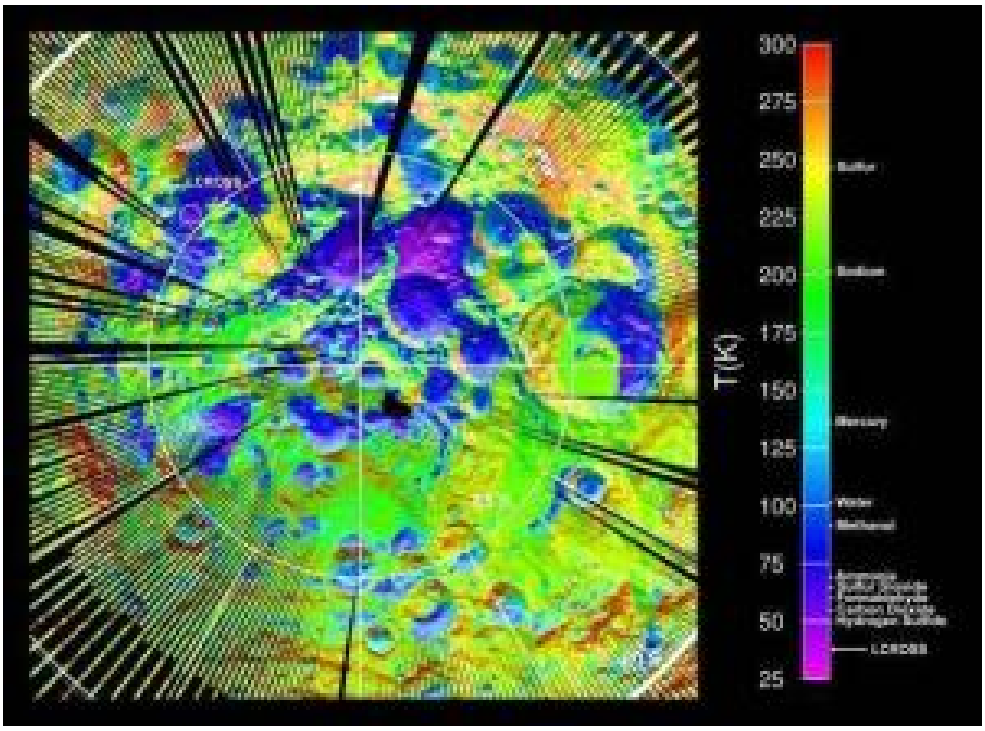
"To quote one of my NOAA colleagues, 'whatever is going to happen in the rest of the world happens first, and to the greatest extent, in the Arctic,'" said Jane Lubchenco, Ph.D, under secretary of commerce for oceans and atmosphere and NOAA administrator. "Beyond affecting the humans and wildlife that call the area home, the Arctic's warmer temperatures and decreases in permafrost, snow cover, glaciers and sea ice also have wide-ranging consequences for the physical and biological systems in other parts of the world. The Arctic is an important driver of climate and weather around the world and serves as a critical feeding and breeding ground that supports globally significant populations of birds, mammals and fish."

In 2006, NOAA's Climate Program Office introduced the annual Arctic Report Card, which established a baseline of conditions at the beginning of the 21st century to monitor the quickly changing conditions in the Arctic. Using a color-coded system of "red" to indicate consistent evidence of warming and "yellow" to show that warming impacts are occurring in many climate indicators and species, the Report Card is updated annually in October and tracks the Arctic atmosphere, sea ice, biology, ocean, land and changes in Greenland. The Report Card can be found online at http://www.arctic.noaa.gov/reportcard.

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

http://www.sciencedaily.com/releases/2010/10/101022071814.htm

Lunar 'Permafrost': Evidence for Widespread Water Ice on the Moon



LRO surface temperature map of the moon's south polar region. LRO Diviner Lunar Radiometer Experiment surface temperature map of the south polar region of the moon. Data were acquired during September and October 2009, when south polar temperatures were close to their annual maximum values. The map shows the locations of several intensely cold impact craters that are potential cold traps for water ice, as well as a range of other icy compounds commonly observed in comets. The approximate maximum temperatures at which these compounds would be frozen in place for more than a billion years is shown next to the scale on the right. (Credit: Based on a figure in the journal Science. UCLA/JPL/GSFC/NASA)

ScienceDaily (Oct. 22, 2010) — Scientists from NASA's Diviner Lunar Radiometer Experiment team have detected the widespread presence of water ice in large areas of the moon's south pole.

Their findings appear Oct. 22 in two papers published in the journal *Science*. The research was funded by NASA.

Diviner, an infrared spectrometer aboard NASA's Lunar Reconnaissance Orbiter (LRO), has made the first infrared measurements of temperatures in the permanently shadowed craters at the moon's poles.

In October 2009, Diviner also made the first infrared observations of a controlled impact on the moon, when NASA's Lunar Crater Observation and Sensing Satellite (LCROSS), the companion spacecraft to the LRO, slammed into one of the coldest of these craters in an experiment to confirm the presence or absence of water ice.

UCLA professor of planetary science David Paige, Diviner's principal investigator and lead author of one of the *Science* papers, used temperature measurements of the lunar south pole obtained by Diviner to model the stability of water ice both at and near the surface. The stability of water ice is an indication that is has existed in a particular location over an extended period of time.

"The temperatures inside these permanently shadowed craters are even colder than we had expected," Paige said. "Our model results indicate that in these extreme cold conditions, surface deposits of water ice would almost certainly be stable; but perhaps more significantly, these areas are surrounded by much larger permafrost regions where ice could be stable just beneath the surface."

This lunar 'permafrost' is analogous to the high-latitude terrain found on the Earth and on Mars, where subfreezing temperatures persist below the surface throughout the year, Paige said.
"These permafrost regions may receive direct sunlight at certain times of the year, but they maintain annual maximum subsurface temperatures that are sufficiently cold to prevent significant amounts of ice from vaporizing," he said.
Given that these permafrost regions are not in permanent shadow, surface lighting and thermal conditions in these locations would be far more hospitable for humans, which makes them of prime interest for future manned missions to the moon, Paige said. Subsurface water ice deposits are also likely to be more stable than surface deposits of water ice because they are protected from bombardment by ultraviolet radiation and energetic cosmic particles.
"We conclude that large areas of the lunar south pole are cold enough to trap not only water ice but other volatile compounds (substances with low boiling points) such as sulphur dioxide, carbon dioxide, formaldehyde, ammonia, methanol, mercury and sodium," Paige said.
A representative cross-section of these substances was detected by the LCROSS near-infrared spectrometers when its upper-stage rocket impacted the Cabeus crater, ejecting a host of material that was previously buried beneath the crater's surface.
The impact site was situated within a permanently shadowed part of Cabeus with an average annual temperature of 37 Kelvin (-393 degrees Fahrenheit), making it one of the coldest spots near the lunar south pole. Temperature data from Diviner played a key role in the selection of Cabeus as the target for LCROSS.
When it came time for impact, Diviner scientists and engineers made sure the instrument had a front-row seat: Diviner targeted the impact site for eight orbits, spaced roughly two hours apart, the closest of which was timed to pass by 90 seconds after impact. It observed an enhanced thermal signal on this and two subsequent orbits.
Paul Hayne, a graduate student in the UCLA Department of Earth and Space *Science*s and lead author of the second paper in *Science*, monitored the data in real time as it was sent back from Diviner.
"During the fly-by 90 seconds after impact, all seven of Diviner's infrared channels measured an enhanced thermal signal from the crater," Hayne said. "The more sensitive of its two solar channels also measured the thermal signal, along with reflected sunlight from the impact plume. Two hours later, the three longest-wavelength channels picked up the signal, and after four hours, only one channel detected anything above the background temperature."
Scientists were able to learn two things from these measurements: They were able to calculate a range for the mass of material that was ejected outwards into space from the impact crater, and they were able to infer the initial temperature and make estimates about the effects of ice in the soil on the observed cooling behavior.
"Diviner's solar channel measured scattered sunlight from the impact plume over an area of 54 square miles," Hayne said. "Using this measurement, we were able to calculate the mass of the cloud at between 2,600 and 12,800 pounds, which is consistent with measurements by the LCROSS Shepherding Spacecraft. This is important because the cloud mass is used to estimate the abundance of water observed by the LCROSS spectrometers.
"In addition, we determined that in order to agree with the data from each of Diviner's channels, the impact must have heated a region of 320 to 2,150 feet to at least 950 Kelvin (1,250 Fahrenheit). This concentrated region was surrounded by a larger, lower temperature component that would have included the surrounding blanket of material excavated by the impact."
Given that ice within pore spaces in the soil influences cooling because it uses up heat energy in the process of sublimating and conducts heat more efficiently than lunar soil itself does, scientists were able to use Diviner's measurements of cooling at the impact site to calculate a range for the proportion of volatile compounds present.
"The fact that heated material was still visible to Diviner after four hours indicates LCROSS did not hit a skating rink; the ice must have been mixed within the soil," Hayne said, "we estimate that for an area of 320 to 2,150 feet, the steaming crater could produce more than enough water vapor to account for what was observed by LCROSS over a four-minute period."

"Although Cabeus crater is typical of the coldest areas on the moon today, we have determined that billions of years ago, smaller craters with steeper walls would have made more favorable cold-traps," Paige said. "It is therefore possible that the craters which have accumulated the most ice are not the coldest ones."
The results presented in both papers represent strong evidence in support of the theory that volatile compounds have been delivered to the moon by impacts by icy bodies from the outer solar system and then 'cold-trapped' at the lunar poles.

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of California -- Los Angeles**. The original article was written by Michaela Shopland and Stuart Wolpert.

Journal Reference:

1. P. O. Hayne, B. T. Greenhagen, M. C. Foote, M. A. Siegler, A. R. Vasavada, D. A. Paige. **Diviner Lunar Radiometer Observations of the LCROSS Impact**. *Science*, 2010; 330 (6003): 477 DOI: 10.1126/science.1197135

http://www.sciencedaily.com/releases/2010/10/101022022904.htm

Younger Brains Are Easier to Rewire -- Brain Regions Can Switch Functions

Scientists offer evidence that it is easier to rewire the brain early in life. Researchers found that a small part of the brain's visual cortex that processes motion became reorganized only in the brains of subjects who had been born blind, not those who became blind later in life. (Credit: iStockphoto/Vasiliy Yakobchuk)

ScienceDaily (Oct. 22, 2010) — A new paper from MIT neuroscientists, in collaboration with Alvaro Pascual-Leone at Beth Israel Deaconess Medical Center, offers evidence that it is easier to rewire the brain early in life. The researchers found that a small part of the brain's visual cortex that processes motion became reorganized only in the brains of subjects who had been born blind, not those who became blind later in life.

The new findings, described in the Oct. 14 issue of the journal *Current Biology,* shed light on how the brain wires itself during the first few years of life, and could help scientists understand how to optimize the brain's ability to be rewired later in life. That could become increasingly important as medical advances make it possible for congenitally blind people to have their sight restored, said MIT postdoctoral associate Marina Bedny, lead author of the paper.

In the 1950s and '60s, scientists began to think that certain brain functions develop normally only if an individual is exposed to relevant information, such as language or visual information, within a specific time period early in life. After that, they theorized, the brain loses the ability to change in response to new input. Animal studies supported this theory. For example, cats blindfolded during the first months of life are unable to see normally after the blindfolds are removed. Similar periods of blindfolding in adulthood have no effect on vision.

However, there have been indications in recent years that there is more wiggle room than previously thought, said Bedny, who works in the laboratory of MIT assistant professor Rebecca Saxe, also an author of the Current Biology paper. Many neuroscientists now support the idea of a period early in life after which it is difficult, but not impossible, to rewire the brain.

Bedny, Saxe and their colleagues wanted to determine if a part of the brain known as the middle temporal complex (MT/MST) can be rewired at any time or only early in life. They chose to study MT/MST in part because it is one of the most studied visual areas. In sighted people, the MT region is specialized for motion vision.

In the few rare cases where patients have lost MT function in both hemispheres of the brain, they were unable to sense motion in a visual scene. For example, if someone poured water into a glass, they would see only a standing, frozen stream of water.

Previous studies have shown that in blind people, MT is taken over by sound processing, but those studies didn't distinguish between people who became blind early and late in life.
In the new MIT study, the researchers studied three groups of subjects -- sighted, congenitally blind, and those who became blind later in life (age nine or older). Using functional magnetic resonance imaging (fMRI), they tested whether MT in these subjects responded to moving sounds -- for example, approaching footsteps.
The results were clear, said Bedny. MT reacted to moving sounds in congenitally blind people, but not in sighted people or people who became blind at a later age.
This suggests that in late-blind individuals, the visual input they received in early years allowed the MT complex to develop its typical visual function, and it couldn't be remade to process sound after the person lost sight. Congenitally blind people never received any visual input, so the region was taken over by auditory input after birth.
"We need to think of early life as a window of opportunity to shape how the brain works," said Bedny. "That's not to say that later experience can't alter things, but it's easier to get organized early on."
Bedny believes that by better understanding how the brain is wired early in life, scientists may be able to learn how to rewire it later in life. There are now very few cases of sight restoration, but if it becomes more common, scientists will need to figure out how to retrain the patient's brain so it can process the new visual input.
"The unresolved question is whether the brain can relearn, and how that learning differs in an adult brain versus a child's brain," said Bedny.
Bedny hopes to study the behavioral consequences of the MT switch in future studies. Those would include whether blind people have an advantage over sighted people in auditory motion processing, and if they have a disadvantage if sight is restored.
***Editor's Note**: This article is not intended to provide medical advice, diagnosis or treatment.*

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Massachusetts Institute of Technology**. The original article was written by Anne Trafton, MIT News Office.

Journal Reference:

1. Bedny, M., Konkle, T., Pelphrey, K., Saxe, R., Pascual-Leone. **Sensitive period for a multi-modal response in human MT/MST**. *Current Biology*, 14 October, 2010 DOI: 10.1016/j.cub.2010.09.044

http://www.sciencedaily.com/releases/2010/10/101021124922.htm

Light on Silicon Better Than Copper?

This is Nan Jokerst, left, and Sabarni Palit in the lab. (Credit: Duke University Photography)

ScienceDaily (Oct. 22, 2010) — Step aside copper and make way for a better carrier of information -- light. As good as the metal has been in zipping information from one circuit to another on silicon inside computers and other electronic devices, optical signals can carry much more, according to Duke University electrical engineers. So the engineers have designed and demonstrated microscopically small lasers integrated with thin film-light guides on silicon that could replace the copper in a host of electronic products.

The structures on silicon not only contain tiny light-emitting lasers, but connect these lasers to channels that accurately guide the light to its target, typically another nearby chip or component. This new approach could help engineers who, in their drive to create tinier and faster computers and devices, are studying light as the basis for the next generation information carrier.

The engineers believe they have solved some of the unanswered riddles facing scientists trying to create and control light at such a miniscule scale.

"Getting light onto silicon and controlling it is the first step toward chip scale optical systems," said Sabarni Palit, who this summer received her Ph.D. while working in the laboratory of Nan Marie Jokerst, J.A. Jones Distinguished Professor of Electrical and Computer Engineering at Duke's Pratt School of Engineering.

The results of team's experiments, which were supported by the Army Research Office, were published online in the journal *Optics Letters*.

"The challenge has been creating light on such a small scale on silicon, and ensuring that it is received by the next component without losing most of the light," Palit said.

"We came up with a way of creating a thin film integrated structure on silicon that not only contains a light source that can be kept cool, but can also accurately guide the wave onto its next connection," she said. "This integration of components is essential for any such chip-scale, light-based system."

The Duke team developed a method of taking the thick substrate off of a laser, and bonding this thin film laser to silicon. The lasers are about one one-hundreth of the thickness of a human hair. These lasers are connected to other structures by laying down a microscopic layer of polymer that covers one end of the laser and goes off in a channel to other components. Each layer of the laser and light channel is given its specific characteristics, or functions, through nano- and micro-fabrication processes and by selectively removing portions of the substrate with chemicals.

"In the process of producing light, lasers produce heat, which can cause the laser to degrade," Sabarni said. "We found that including a very thin band of metals between the laser and the silicon substrate dissipated the heat, keeping the laser functional."

For Jokerst, the ability to reliably facilitate individual chips or components that "talk" to each other using light is the next big challenge in the continuing process of packing more processing power into smaller and smaller chip-scale packages.

"To use light in chip-scale systems is exciting," she said. "But the amount of power needed to run these systems has to be very small to make them portable, and they should be inexpensive to produce. There are applications for this in consumer electronics, medical diagnostics and environmental sensing."

The work on this project was conducted in Duke's Shared Materials Instrumentation Facility, which, like similar facilities in the semiconductor industry, allows the fabrication of intricate materials in a totally "clean" setting. Jokerst is the facility's executive director.

Other members of the team were Duke's Mengyuan Huang, as well as Dr. Jeremy Kirch and professor Luke Mawst from the University of Wisconsin at Madision.

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

Journal Reference:

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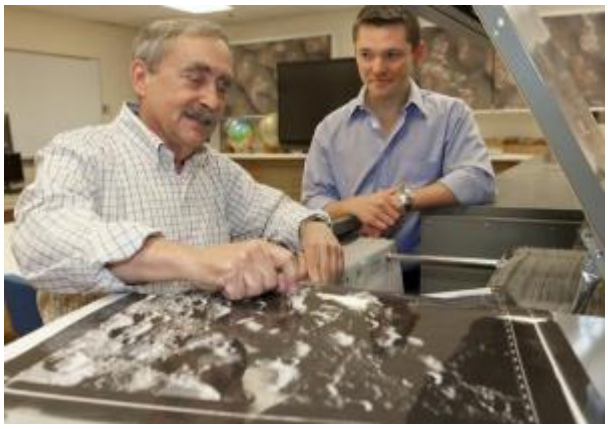
http://www.sciencedaily.com/releases/2010/10/101021113010.htm

NASA-Engineered Collision Spills New Moon Secrets



Peter Schultz and graduate student Brendan Hermalyn analyzed data from bits of the Moon's surface kicked up by a NASA-engineered collision. They found unexpected complexity -- and traces of silver. (Credit: Mike Cohea/Brown University)

ScienceDaily (Oct. 21, 2010) — Scientists led by Brown University are offering the first detailed explanation of the crater formed when a NASA rocket slammed into the Moon last fall and information about the composition of the lunar soil at the poles that never has been sampled. The findings are published in a set of papers in *Science* stemming from the successful NASA mission, called LCROSS for Lunar CRater Observing and Sensing Satellite.

Mission control at NASA Ames sent the emptied upper stage of a rocket crashing into the Cabeus crater near the Moon's south pole last October. A second spacecraft followed to analyze the ejected debris for signs of water and other constituents of the super-chilled lunar landscape.

In one of the papers, Brown planetary geologist Peter Schultz and graduate student Brendan Hermalyn, along with NASA scientists, write that the cloud kicked up by the rocket's impact showed the Moon's soil and subsurface is more complex than believed: Not only did the lunar regolith -- the soil -- contain water, it also harbored other compounds, such as hydroxyl, carbon monoxide, carbon dioxide, ammonia, free sodium, and, in a surprise, silver.

Combined, the assortment of volatiles -- the chemical elements weakly attached to regolith grains -- gives scientists clues where they came from and how they got to the polar craters, many of which haven't seen sunlight for billions of years and are among the coldest spots in the solar system.

Schultz, lead author on the *Science* paper detailing the impact crater and the ejecta cloud, thinks many of the volatiles originated with the billions of years-long fusillade of comets, asteroids and meteoroids that have pummeled the Moon. He thinks an assortment of elements and compounds, deposited in the regolith all over the Moon, could have been quickly liberated by later small impacts or could have been heated by the sun, supplying them with energy to escape and move around until they reached the poles, where they became trapped beneath shadows of the frigid craters.

"This place looks like it's a treasure chest of elements, of compounds that have been released all over the Moon," Schultz said, "and they've been put in this bucket in the permanent shadows."

Schultz believes the variety of volatiles found in Cabeus crater's soil implies a kind of tug of war between what is being accumulated and what is being lost to the tenuous lunar atmosphere.

"There's a balance between delivery and removal," explained Schultz, who has been on the Brown faculty since 1984 and has been studying the Moon since the 1960s. "This suggests the delivery is winning. We're collecting material, not simply getting rid of it."

Astronauts sent as part of NASA's Apollo missions found trace amounts of silver, along with gold, on the near-side (Earth-facing side) of the Moon. The discovery of silver at Cabeus crater suggests that silver atoms

throughout the moon migrated to the poles. Nevertheless, the concentration detected from Cabeus "doesn't mean we can go mining for it," Schultz said.
The crater formed by the rocket's impact within Cabeus produced a hole 70 to 100 feet in diameter and tossed up six-foot deep lunar material. The plume of debris kicked up by the impact reached more than a half-mile above the floor of Cabeus, high enough to rise into sunlight, where its properties could be measured for almost four minutes by a variety of spectroscopic instruments. The amount of ejecta measured was almost two tons, the scientists report. The scientists also noted there was a slight delay, lasting roughly one-third of a second, in the flash generated after the collision. This indicated to them that the surface struck may be different than the loose, almost crunchy surface trod by the Apollo astronauts.
"If it had been simply lunar dust, then it would have heated up immediately and brightened immediately," Schultz said. "But this didn't happen."
The scientists also noticed a one-half-mile, near-vertical column of ejecta still returning to the surface. Even better, the LCROSS spacecraft was able to observe the plume as it followed on the heels of the crashing rocket. Schultz and Hermalyn had observed such a plume when conducting crater-impact experiments using hollow spheres (that mimicked the rocket that crashed into Cabeus) at the NASA Ames Vertical Gun Range in California before the LCROSS impact.
"This was not your ordinary impact," Hermalyn said. "So in order to understand what we were going to see (with LCROSS) and maybe what effects that would have on the results, we had to do all these different experiments."
Even though the mission has been judged a success, Schultz said it posed at least as many questions as it answered.
"There's this archive of billions of years (in the Moon's permanently shadowed craters)," Schultz said. "There could be clues there to our Earth's history, our solar system, our galaxy. And it's all just sitting there, this hidden history, just begging us to go back."
Contributing authors on the paper include Anthony Colaprete, Kimberly Ennico, Mark Shirley, and William Marshall, all from NASA Ames Research Center in California. NASA funded the research.

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

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1. Peter H. Schultz, Brendan Hermalyn, Anthony Colaprete, Kimberly Ennico, Mark Shirley, and William S. Marshall. **The LCROSS Cratering Experiment**. *Science*, 2010; 330 (6003): 468-472 DOI: 10.1126/science.1187454
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http://www.sciencedaily.com/releases/2010/10/101021141449.htm

Efforts Underway to Rescue Vulnerable Bananas, Giant Swamp Taro, Other Pacific Island Crops

This is a giant swamp taro in Fiji. (Credit: Charlotte Lusty, Global Crop Diversity Trust)

ScienceDaily (Oct. 23, 2010) — Hoping to save the vulnerable varieties of bananas painted by the artist Paul Gauguin, rare coconuts, and 1,000 other unique varieties of staple fruit and vegetable crops across the Pacific, crop specialists from nine islands have launched a major effort to preserve the indigenous diversity of foods that are deemed critical to combating diet-related health problems.

"Through this project we will bring together 1,000 unique samples of Pacific crops for long-term conservation," said Dr. Mary Taylor, Manager of the Centre for Pacific Crops and Trees (CePaCT) at the Secretariat of the Pacific Community (SPC). "Crop collections in the Pacific are very vulnerable; all they need is a disease outbreak or a cyclone to destroy the entire collection. These collections are essential if we are going to maintain traditional Pacific crops for future generations."

For example, only a few of the varieties of the orange- and yellow-fleshed Fe'i banana, famously painted by former Pacific island resident Gauguin, are still found in farmers' fields. Studies by Dr. Lois Englberger from the Island Food Community of Pohnpei in the Federated States of Micronesia have shown that these bananas are an excellent source of beta-carotene, essential for the production of vitamin A. Vitamin A deficiency -- causing blindness, greatly weakened immune systems and even death in infants -- is now common in parts of the Pacific. Good beta-carotene levels in the diet also help protect against non-communicable diseases such as cancer, diabetes and heart disease that are now at epidemic rates throughout the Pacific Islands.

The Pacific region is made up of 22 countries and territories with a relatively small population spread out amongst approximately 7,500 islands covering 30 million square kilometers -- nearly twice the size of Russia. There is little maize, wheat, or rice grown in the region. Instead, farmers have cultivated many varieties of root crops and starchy fruits as their staple foods, such as taro, yam, sweet potato, breadfruit and cooking banana, along with coconut, that have been selected over the centuries for their suitability to island environments. Pacific island crop diversity is especially hard to save because most of the crops do not produce seed. Preserving them requires saving a part of the plant itself. In some parts of the region, national agriculture programs have set up field collections to conserve indigenous varieties. But the collections are constantly threatened by plant disease, harsh weather, and poor land management.

"These unique crop varieties are so important in the Pacific," said Cary Fowler, Executive Director of the Global Drop Diversity Trust. "In addition to having valuable nutritional traits, they will provide the key to developing crops in the future that can potentially deal with harsh island environments. It is essential that they are well conserved."

A recent Pacific Food Summit stressed the need to turn back to local foods to address diet-related health issues that are linked to a movement away from traditional staples. Today, life expectancy in some Pacific islands is actually decreasing because of diet-related illnesses. Diabetes rates are among the highest in the world, reaching up to 44 percent in Tokelau atolls, compared to around 8 percent in the United States.

The project to conserve some of this indigenous food diversity in the Pacific is being coordinated by the SPC CePaCT as part of a broader effort involving major crop species worldwide. The Trust, with support from the

UN Foundation and the Bill and Melinda Gates Foundation, is helping partners in 68 countries rescue and regenerate more than 80,000 endangered accessions in crop collections and send duplicates to international genebanks and the Svalbard Global Seed Vault in the Arctic Circle.
The assistance from the Trust will allow CePaCT to provide a safe home for crop varieties that may be in danger. CePaCT is partnering with public institutes in French Polynesia, Federated States of Micronesia, Fiji, Kiribati, New Caledonia, Papua New Guinea, Samoa, the Solomon Islands and Vanuatu. The partners, with support from the Trust, are replanting or gathering crop varieties unique to their islands, documenting their characteristics and sending duplicate plants for safekeeping to the laboratory at CePaCT.

The Fe'i Banana, the Niu Coconut, and Giant Swamp Taro

Once highly abundant as an everyday staple in the islands of French Polynesia, the Fe'i banana fell into disuse as populations shifted and cultural changes took place. Fortunately, in 2008 and 2009, Maurice Wong, an energetic genebank curator based in Tahiti, collected more than 100 samples of the bananas from isolated farms on six islands in French Polynesia. The samples will be conserved in a field collection with duplicates sent to CePaCT.
The Niu Afa coconut variety has also been rescued from a location that is now home to a penal colony. This rare coconut variety is recognized for producing the largest known coconuts. Farmers now rarely cultivate it since hybrid coconuts have become more common. The embryos from the seed of the Niu Afa coconuts have been extracted and taken to CePaCT to be cultured in the laboratory. Eventually, they will regenerate into whole plants to be planted back out in the field in multiple sites.
Another unique crop targeted for conservation is the giant swamp taro, a resilient crop that can survive harsh atoll conditions including sandy saline soils, and once planted can be neglected for several years until needed. This is the main crop of atoll islands and a major food crop elsewhere, also serving as a famine food; when other crops have failed, the edible underground stems of the swamp taro are dug up and can provide ample food for a village for several weeks or months.
At CePaCT, Taylor and her colleagues save the plants in small glass tubes and, to add extra security, are working with the Trust to test state-of-the-art cryoconservation methods. Cryoconservation allows researchers to freeze plant materials at ultra low temperatures and safely store them for decades.
Bringing these crop varieties into safe conservation is only the beginning of the story. Increasingly strong community movements that support local foods and encourage the cultivation of local crops are tapping into this diversity. Activists like Lois Englberger are encouraging people to "Go Local." "We have imported a lot of health problems to the Pacific, but by preserving and rediscovering our Fe'i banana and taro, we literally have a homegrown solution."
Editor's Note: *This article is not intended to provide medical advice, diagnosis or treatment.*

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

http://www.sciencedaily.com/releases/2010/10/101021103108.htm

First Implanted Device to Treat Balance Disorder Developed

This is a side view of the implantable device created by University of Washington researchers. The device will be implanted surgically in the first patient in the world on Thursday, Oct. 21, in Seattle, Wash. at UW Medical Center. (Credit: Cochlear Ltd.)

ScienceDaily (Oct. 23, 2010) — A University of Washington Medical Center patient on Thursday, Oct. 21, became the world's first recipient of a device that aims to quell the disabling vertigo associated with Meniere's disease.

The UW Medicine clinicians who developed the implantable device hope that success in a 10-person surgical trial of Meniere's patients will lead to exploration of its usefulness against other common balance disorders that torment millions of people worldwide.

The device being tested -- a cochlear implant and processor with re-engineered software and electrode arrays -- represents four-plus years of work by Drs. Jay Rubinstein and James Phillips of UW's Department of Otolaryngology-Head and Neck Surgery. They worked with Drs. Steven Bierer, Albert Fuchs, Chris Kaneko, Leo Ling and Kaibao Nie, UW specialists in signal processing, brainstem physiology and vestibular neural coding.

"What we're proposing here is a potentially safer and more effective therapy than exists now," said Rubinstein, an ear surgeon and auditory scientist who has earned a doctoral degree in bioengineering and who holds multiple U.S. patents.

In the United States, Meniere's affects less than one percent of the population. The disease occurs mostly in people between ages 30 and 50, but can strike anyone. Patients more often experience the condition in one ear; about 30 percent of cases are bilateral.

The disease affects hearing and balance with varying intensity and frequency but can be extremely debilitating. Its episodic attacks are thought to stem from the rupture of an inner-ear membrane. Endolymphatic fluid leaks out of the vestibular system, causing havoc to the brain's perception of balance. To stave off nausea, afflicted people must lie still, typically for several hours and sometimes up to half a day while the membrane self-repairs and equilibrium is restored, said Phillips, a UW research associate professor and director of the UW Dizziness and Balance Center. Because the attacks come with scant warning, a Meniere's diagnosis can cause people to change careers and curb their lifestyles.

Many patients respond to first-line treatments of medication and changes to diet and activity. When those therapies fail to reduce the rate of attacks, surgery is often an effective option but it typically is ablative (destructive) in nature. In essence, the patient sacrifices function in the affected ear to halt the vertigo -- akin to a pilot who shuts down an erratic engine during flight. Forever after, the person's balance and, often, hearing are based on one ear's function.

With their device, Phillips and Rubinstein aim to restore the patient's balance during attacks while leaving natural hearing and residual balance function intact.

A patient wears a processor behind the affected ear and activates it as an attack starts. The processor wirelessly signals the device, which is implanted almost directly underneath in a small well created in the

temporal bone. The device in turn transmits electrical impulses through three electrodes inserted into the canals of the inner ear's bony labyrinth.
"It's an override," Phillips said. "It doesn't change what's happening in the ear, but it eliminates the symptoms while replacing the function of that ear until it recovers."
The specific placement of the electrodes in the bony labyrinth is determined by neuronal signal testing at the time of implant. The superior semicircular canal, lateral semicircular canal and posterior semicircular canal each receive one electrode array.
A National Institutes of Health grant funded the development of the device and its initial testing at the Washington National Primate Research Center. The promising results from those tests led the U.S. Food and Drug Administration, in June, to approve the device and the proposed surgical implantation procedure. Shortly thereafter, the limited surgical trial in humans won approval from the Western Institutional Review Board, an independent body charged with protecting the safety of research subjects.
By basing their invention on cochlear implants whose design and surgical implantation were already FDA-approved, Phillips and Rubinstein leapfrogged scientists at other institutions who had begun years earlier but chosen to develop novel prototypes.
"If you started from scratch, in a circumstance like this where no one has ever treated a vestibular disorder with a device, it probably would take 10 years to develop such a device," Rubinstein said.
The device epitomizes the translational advancements pursued at UW's academic medical centers, he said. He credited the team's skills and its access to the primate center, whose labs facilitated the quick turnaround of results that helped win the FDA's support.
A successful human trial could lead the implant to become the first-choice surgical intervention for Meniere's patients, Phillips said, and spark collaboration with other researchers who are studying more widespread balance disorders.
The first patient will be a 56-year-old man from Yakima, Wash. He has unilateral Meniere's disease and has been a patient of Rubinstein's for about two years.
See a related video at UW Medicine's YouTube site. Drs. Rubinstein and Phillips discuss the device: http://www.youtube.com/watch?v=iu047vTckvA
Cochlear Ltd. of Lane Cove, Australia, will manufacture the device. Cochlear is a medical equipment company and longtime maker of devices for hearing-impaired people.
Editor's Note: *This article is not intended to provide medical advice, diagnosis or treatment.*

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

http://www.sciencedaily.com/releases/2010/10/101021090028.htm

'Lubricin' Molecule Discovered to Reduce Cartilage Wear

ScienceDaily (Oct. 20, 2010) — A team of researchers in North Carolina has discovered that lubricin, a synovial fluid glycoprotein, reduces wear to bone cartilage. This result, which has implications for the treatment of sufferers of osteoarthritis, will be presented at the AVS 57th International Symposium & Exhibition, taking place this week at the Albuquerque Convention Center in New Mexico.

Osteoarthritis is the most common form of arthritis, the degenerative joint disease. It mostly affects cartilage, the slippery tissue that covers the ends of bones where they meet to form a joint, and allows bones to glide over one another with limited friction and wear. Osteoarthritis causes cartilage to be broken down through a vicious cycle of mechanical and metabolic factors, and mechanical wear of cartilage is widely believed to contribute to this process. Eventually, the bones under the cartilage rub together, which can cause a tremendous amount of pain, swelling, and loss of motion at the joint.

Many studies have examined cartilage friction and lubrication with the goal of understanding cartilage wear prevention. Very few studies have focused on measuring wear directly, though, and until now no other studies have directly assessed the effects of synovial fluid constituents in mediating wear.

"We measured the effect of the synovial fluid protein lubricin on cartilage wear," explains research team member Stefan Zauscher, an associate professor of mechanical engineering and materials science, as well as biomedical engineering, at Duke University in Durham, N.C.

"Our measurements were performed at the surface level using an atomic force microscope with pressures and sliding speeds comparable to those seen in joints. The measurements show a direct link between lubricin in solution and reduction of cartilage wear," says Zauscher.

This indicates that lubricin is important for cartilage preservation physiologically, which may have important implications for treating or preventing joint disease in the future.

***Editor's Note**: This article is not intended to provide medical advice, diagnosis or treatment.*

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

http://www.sciencedaily.com/releases/2010/10/101020184136.htm

Factor Boosting Leukemia's Aggressiveness Identified

ScienceDaily (Oct. 23, 2010) — Chronic lymphocytic leukemia (CLL) cells survive and thrive not just by their own innate wiles, but by also acquiring aid and support from host cells in their surrounding environment. In a paper published online in the *Proceedings of National Academy of Sciences*, an international team of researchers led by cancer specialists at the University of California San Diego School of Medicine and the Moores UCSD Cancer Center identify a particular relationship that can promote notably aggressive leukemias and lymphomas.

"The microenvironment is the term used to describe the cells that cluster around CLL cells in the lymph nodes, spleen and bone marrow. These cells secrete factors that can protect CLL cells from dying," said Thomas J. Kipps, MD, PhD, Evelyn and Edwin Tasch Chair in Cancer Research, Professor of Medicine, Deputy Director of Research Operations at the Rebecca and John Moores UCSD Cancer Center and senior co-author of the paper with Michael Karin, PhD, Distinguished Professor of Pharmacology in UCSD's Laboratory of Gene Regulation and Signal Transduction.

Kipps, Karin and colleagues from Iowa, The Netherlands and Taiwan looked specifically at a protein called B-cell activating factor or BAFF, which is produced in high levels by "nurselike cells" in the CLL microenvironment. Nurselike cells are a subset of blood cells in CLL patients that help cancer cells avoid apoptosis or natural cell death. Kipps and colleagues first described this relationship in 2000.

The researchers found that BAFF interacts with a gene linked to leukemogenesis -- the development of leukemia -- called c-MYC. Normal MYC genes help regulate cell proliferation, but when upregulated or increased by mutations, c-MYC can promote more aggressive leukemias and lymphomas. To what degree this relationship influences CLL -- the most common form of adult leukemia -- remains unknown, though Kipps said the findings suggest therapeutic promise.

"We found that BAFF can upregulate expression of c-MYC in CLL cells and that patients who have CLL cells with high levels of c-MYC have aggressive disease," said Kipps. "These findings may lead to improvements in our ability to treat patients with CLL, either by blocking the effect of BAFF on CLL cells or inhibiting the signaling pathways triggered by BAFF that can lead to upregulation of MYC."

Co-authors of the paper include Weizhou Zhang of the Laboratory of Gene Regulation and Signal Transduction, Department of Pharmacology, UC San Diego School of Medicine and of the departments of Medicine and Radiology at Moores UCSD Cancer Center; Arnon P. Kater of the Department of Hematology, Academic Medical Center, The Netherlands; George F. Widhopf II, Han-Yu Chuang and Danelle F. James of UCSD's Department of Medicine; Thomas Enzler of Department of Medicine, Stanford School of Medicine; Maxim Poustovoitov of the Laboratory of Gene Regulation and Signal Transduction, Department of Pharmacology and UCSD School of Medicine; Ping-Hui Tseng of the Institute of Biochemistry and Molecular Biology, National Yang-Ming University, Taiwan' Siegfried Janz of the Department of Pathology at the University of Iowa Carver College of Medicine; Carl Hoh of UCSD's Department of Radiology and Harvey Herschman of the departments of Biological Chemistry and Pharmacology, UC Los Angeles.

Funding for this project was provided by the National Institutes of Health and a grant from the Leukemia and Lymphoma Society Specialized Center of Research.

Editor's Note: *This article is not intended to provide medical advice, diagnosis or treatment.*

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

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http://www.sciencedaily.com/releases/2010/10/101022160306.htm

Nanotube Thermopower: Efforts to Store Energy in Carbon Nanotubes

ScienceDaily (Oct. 23, 2010) — When weighing options for energy storage, different factors can be important, such as energy density or power density, depending on the circumstances. Generally batteries -- which store energy by separating chemicals -- are better for delivering lots of energy, while capacitors -- which store energy by separating electrical charges -- are better for delivering lots of power (energy per time). It would be nice, of course, to have both.

At the AVS 57th International Symposium & Exhibition, which takes place this week at the Albuquerque Convention Center in New Mexico, Michael Strano and his colleagues at MIT are reporting on efforts to store energy in thin carbon nanotubes by adding fuel along the length of the tube, chemical energy, which can later be turned into electricity by heating one end of the nanotubes. This thermopower process works as follows: the heat sets up a chain reaction, and a wave of conversion travels down the nanotubes at a speed of about 10 m/s.

"Carbon nanotubes continue to teach us new things -- thermopower waves as a first discovery open a new space of power generation and reactive wave physics," Strano says.

A typical lithium ion battery has a power density of 1 kW/kg. Although the MIT researchers have yet to scale up their nanotube materials, they obtain discharge pulses with power densities around 7 kW/kg.

Strano is also reporting new results on experiments exploiting carbon nanopores of unprecedented size, 1.7 nm in diameter and 500 microns long.

"Carbon nanopores," he says, "allow us to trap and detect single molecules and count them one by one," the first time this has been done. And this was at room temperature.

The single molecules under study can move across the nanotubes one at a time in a process called coherence resonance. "This has never been shown before for any inorganic system to date," says Strano, "but it underpins the workings of biological ion channels."

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

http://www.sciencedaily.com/releases/2010/10/101019212906.htm

Short-Range Scattering in Quantum Dots: Discovery Advances Novel Devices

ScienceDaily (Oct. 23, 2010) — Chinese researchers, reporting in the *Journal of Applied Physics,* published by the American Institute of Physics, have described a new breakthrough in understanding the way electrons travel around quantum dots. This might lead to promising new fabrication methods of novel quantum devices. Guodong Li and colleagues at the National Center for Nanoscience and Technology in Beijing carried out an experiment using self-assembled quantum dots and a two-dimensional electron gas, and then fit the data to a model to find out the type of scattering exhibited.

Much recent work has examined the internal structure of electron states of these 10-nm-scale quantum dots, which are tiny, very efficient energy absorbers that can release energy at custom frequencies depending on their size. Self-assembled quantum dots hold great promise for inexpensive fabrication of all kinds of novel applications such as lasers, detectors, and optical data storage, as well as in nanotechnology research. What is missing, says the team, is an understanding of the scattering effects of the electrons. Optimizing scattering may be useful as a way of efficiently transporting electrons and thereby maximizing the performance of quantum dot-based devices.

To study these effects, the researchers placed an AlGaAs/GaAs two-dimensional electron gas (2DEG) near embedded GaSb/GaAs type-II quantum dots at a temperature of 4.2 K.

"The type-II GaSb quantum dots only confine the holes and not the electrons," says coauthor Chao Jiang, "so they are free to interact with the 2DEG."

Measurements at various voltages in the coupled system showed that the scattering mechanism is short-range, an idea verified by a simple model with a constant scattering potential.

"For the first time, we have clarified that the mechanism of electron scattering in this type of quantum dot system is short-range," says Chao. "The result is particularly significant for the future designing of very efficient quantum-dot-based devices."

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

Journal Reference:

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http://www.sciencedaily.com/releases/2010/10/101020101657.htm

NOAA Lists Population of Spotted Seals as Threatened

Spotted seal leaves the ice flow. (Credit: Image courtesy of NOAA)

ScienceDaily (Oct. 23, 2010) — NOAA has listed the southern distinct population segment (DPS) of the spotted seal as threatened under the Endangered Species Act, strictly regulating importation of the animal or its parts into the U.S.

The southern DPS of about 3,300 spotted seals is centered in Liaodong Bay, China, and Peter the Great Bay, Russia. Because the known distribution of the southern DPS occurs in areas outside the jurisdiction of the United States, no critical habitat can be designated as part of the listing action.

Under the ESA, NOAA can list a population outside the U.S., and regulate its importation into the U.S. American fishermen would also be prohibited from taking the animal.

Climate change and sea ice decline is expected to affect the sea ice habitat of these spotted seals, which use the sea ice formed each year for reproduction and molting in the spring. During the summer months they can be found in the open ocean or hauled out on shore. In the southern DPS, spotted seals have shown some capability to reproduce and molt on shore when ice is not available. However, suitable sites such as offshore rocks and isolated island beaches are limited, and may expose seals to increased predation and human disturbance.

Because of the small number of these seals and their vulnerability to the potential lack of ice, as well as other risks such as incidental fishery takes and possible oil spills, NOAA concluded that this population segment qualifies as threatened under the ESA. This designation means that this population is likely to become in danger of extinction within the foreseeable future.

The listing comes a year after NOAA did not list two other northern spotted seal populations in Russian, Japanese, and U.S. waters under the ESA. The two northern populations are large, have many offspring, and have a broad distribution, lessening their need for ESA protection.

NOAA's Fisheries Service examined the best scientific and commercial data available in its determination to list the southern segment of the spotted seal as threatened. After completing the status review in October 2009, the public had an opportunity to comment on the proposal to list the species during a 60-day comment period. Nine comments were received. NOAA also initiated an independent peer review of the proposed listing determination. The agency fully considered all comments received from the public and peer reviewers in developing this final rule.

This rule will become effective 30 days after date of publication in the Federal Register. The final rule, status review, and other supporting materials can be found online at http://alaskafisheries.noaa.gov/.

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

http://www.sciencedaily.com/releases/2010/10/101022071537.htm

New Cometary Phenomenon Greets Approaching Spacecraft

NASA's Deep Impact/EPOXI spacecraft flew past Earth on June 27, 2010, to get a boost from Earth's gravity. It is now on its way to comet Hartley 2, depicted in this artist's concept, with a planned flyby this fall. (Credit: NASA/JPL-Caltech)

ScienceDaily (Oct. 22, 2010) — Recent observations of comet Hartley 2 have scientists scratching their heads, while they anticipate a flyby of the small, icy world on Nov. 4.

A phenomenon was recorded by imagers aboard NASA's Deep Impact spacecraft from Sept. 9 to 17 during pre-planned scientific observations of the comet. These observations, when coupled with expected images during the closest encounter with Hartley 2 on Nov. 4, will become the most detailed look yet at a comet's activity during its pass through the inner-solar system.

"On Earth, cyanide is known as a deadly gas. In space it's known as one of the most easily observed ingredients that is always present in a comet," said Mike A'Hearn of the University of Maryland, College Park. A'Hearn is principal of EPOXI, an extended mission that utilizes the already "in flight" Deep Impact spacecraft. "Our observations indicate that cyanide released by the comet increased by a factor of five over an eight-day period in September without any increase in dust emissions," A'Hearn said. "We have never seen this kind of activity in a comet before, and it could affect the quality of observations made by astronomers on the ground."

The new phenomenon is very unlike typical cometary outbursts, which have sudden onsets and are usually accompanied by considerable dust. It also seems unrelated to the cyanide jets that are sometimes seen in comets. The EPOXI science team believes that astronomers and interested observers viewing the comet from Earth should be aware of this type of activity when planning observations and interpreting their data.

"If observers monitoring Hartley 2 do not take into account this new phenomenon, they could easily get the wrong picture of how the comet is changing as it approaches and recedes from the sun," said A'Hearn.

Cyanide is a carbon-based molecule. It is believed that billions of years ago, a bombardment of comets carried cyanide and other building blocks of life to Earth.

The name EPOXI itself is a combination of the names for the two extended mission components: the extrasolar planet observations, called Extrasolar Planet Observations and Characterization (EPOCh), and the flyby of comet Hartley 2, called the Deep Impact Extended Investigation (DIXI). The spacecraft will continue to be referred to as "Deep Impact."
NASA's Jet Propulsion Laboratory, Pasadena, Calif., manages the EPOXI mission for NASA's Science Mission Directorate, Washington. The University of Maryland, College Park, is home to the mission's principal investigator, Michael A'Hearn. Drake Deming of NASA's Goddard Space Flight Center, Greenbelt, Md., is the science lead for the mission's extrasolar planet observations. The spacecraft was built for NASA by Ball Aerospace & Technologies Corp., Boulder, Colo.
For more information about EPOXI visit http://epoxi.umd.edu/.

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **NASA/Jet Propulsion Laboratory**.

http://www.sciencedaily.com/releases/2010/10/101022113117.htm

Another Winter of Extremes in Store for U.S. as La Niña Strengthens

Winter temperature probability outlook for U.S., Dec. 2010 to Feb. 2011. (Credit: Image courtesy of NOAA)

ScienceDaily (Oct. 22, 2010) — The Pacific Northwest should brace for a colder and wetter than average winter, while most of the South and Southeast will be warmer and drier than average through February 2011, according to the annual Winter Outlook released Oct. 21, 2010 by NOAA's Climate Prediction Center. A moderate to strong La Niña will be the dominant climate factor influencing weather across most of the U.S. this winter.

La Niña is associated with cooler than normal water temperatures in the Equatorial Pacific Ocean, unlike El Niño which is associated with warmer than normal water temperatures. Both of these climate phenomena, which typically occur every 2-5 years, influence weather patterns throughout the world and often lead to extreme weather events. Last winter's El Niño contributed to record-breaking rain and snowfall leading to severe flooding in some parts of the country, with record heat and drought in other parts of the country. Although La Niña is the opposite of El Niño, it also has the potential to bring weather extremes to parts of the nation.

"La Niña is in place and will strengthen and persist through the winter months, giving us a better understanding of what to expect between December and February," said Mike Halpert, deputy director of the Climate Prediction Center -- a division of the National Weather Service. "This is a good time for people to review the outlook and begin preparing for what winter may have in store."

"Other climate factors will play a role in the winter weather at times across the country," added Halpert. "Some of these factors, such as the North Atlantic Oscillation, are difficult to predict more than one to two weeks in advance. The NAO adds uncertainty to the forecast in the Northeast and Mid-Atlantic portions of the country."

Regional highlights include:

- **Pacific Northwest:** colder and wetter than average. La Niña often brings lower than average temperatures and increased mountain snow to the Pacific Northwest and western Montana during the winter months, which is good for the replenishment of water resources and winter recreation but can also lead to greater flooding and avalanche concerns;

- **Southwest:** warmer and drier than average. This will likely exacerbate drought conditions in these areas. All southern states are at risk of having above normal wildfire conditions starting this winter and lasting into the spring;

- **Northern Plains:** colder and wetter than average. Likely to see increased storminess and flooding;

- **Southern Plains, Gulf Coast States & Southeast:** warmer and drier than average. This will likely exacerbate drought conditions in these areas. All southern states are at risk of having above normal wildfire conditions starting this winter and lasting into the spring;

- **Florida:** drier than average, with an equal chance for above-, near-, or below-normal temperatures. Above normal wildfire conditions;

- **Ohio and Tennessee Valleys:** warmer and wetter than average. Likely to see increased storminess and flooding;

- **Northeast and Mid-Atlantic:** equal chances for above-, near-, or below-normal temperatures and precipitation. Winter weather for these regions is often driven not by La Niña but by weather patterns over the northern Atlantic Ocean and Arctic. These are often more short-term, and are generally predictable only a week or so in advance. If enough cold air and moisture are in place, areas north of the Ohio Valley and into the Northeast could see above-average snow;

- **Central U.S.:** equal chances of above-near-or below normal temperatures and precipitation;

- **Hawaii:** drier than normal through November, then wetter than normal December through February. Statewide, the current drought is expected to continue through the winter, with several locations remaining on track to become the driest year on record. Drought recovery is more likely on the smaller islands of Kauai and Molokai, and over the windward slopes of the Big Island and Maui;

- **Alaska:** odds favor colder than average temperatures with equal chances of above or below normal precipitation. The interior and southern portions of the state are currently drier than normal. A dry winter may set Alaska up for a greater chance of above normal wildfire conditions in the spring.

This seasonal outlook does not project where and when snowstorms may hit or total seasonal snowfall accumulations. Snow forecasts are dependent upon winter storms, which are generally not predictable more than several days in advance.

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

http://www.sciencedaily.com/releases/2010/10/101022072152.htm

From Bees to Coral Reefs: Mutualisms Might Be More Important to Global Ecosystem Than Previously Thought

By harassing bees and other flower visitors, invasive Argentine ants prevent insects from pollinating the flowers of this Californian cactus (Ferocactus viridescens), which is now endangered. (Credit: John Ludka)

ScienceDaily (Oct. 22, 2010) — Mutually beneficial partnerships among species may play highly important but vastly underrecognized roles in keeping the Earth's ecosystems running, a group of evolutionary biologists suggests in a study.

The authors present evidence that human impacts may be forcing these mutualist systems down unprecedented evolutionary paths.

"With global climate change, evolutionary change can happen very rapidly, over a few years," said Judith Bronstein, a professor of ecology and evolutionary biology at the UA's College of Science and senior author on the paper. "That can be a good thing or a bad thing, we don't know, but people need to start looking at those effects."

In an effort to distill out common traits underlying biological partnerships and to develop a set of lessons to guide future research and conservation efforts, the researchers sifted through almost 200 research studies on the effects of global change on mutualisms, or interactions between organisms that benefit both partners. Experts from several fields joined forces in this study and published their conclusions in *Ecology Letters*, one of the most influential journals in the field of ecology.

"The alarmist view is that if you disrupt an interaction, you lose the interaction, you lose the community, and, ultimately, the ecosystem," Bronstein said. "We are trying to challenge people to make that explicit and to figure out whether their data support that. We need to ask, 'What is the range of possible things that can happen?'"

"It is not all doom-and-gloom," lead author E. Toby Kiers added. "There are clear cases in which mutualisms show a surprising ability to adapt to global change."

Even though the study of mutualistic relationships in nature is young, biologists have already discovered that every species is in one way or another involved in one or more partnerships, sometimes hundreds.

Some examples of mutualisms are well known from high-school biology textbooks, such as the fig wasp, which ensures the fig tree's propagation by pollinating its flowers and whose larvae get to use the fig fruit as a safe -- and delicious -- nursery in return.

Others are less obvious, but crucial for the health and functioning of entire ecosystems. Corals, for example, the tiny polyps they are, could never build their reef structures -- massive hubs of marine biodiversity --

without the help of microscopic algae living in their tissues. The algae, called zooxanthellae, use sunlight to make nutrients and help the polyps build their calcareous skeleton.
Despite the importance of mutualisms for ecosystems worldwide, Kiers, an evolutionary biologist at the Free University of Amsterdam, pointed out "there is a gaping hole in the current science, namely the ways that humans are disrupting the evolution of mutualisms."
Bronstein has observed a tendency to look at species interactions in the face of human-caused change in ways that are too simplistic.
"The idea of co-extinction has received a lot of press, meaning that if you lose one species, the other will invariably vanish, too. It's certainly a risk, especially if the mutualism is highly specific in the sense that one cannot exist without the other. But there are very, very few relationships that are that specific and vulnerable."
Kiers added that in contrast to co-extinction, small changes or shifts in mutualistic relationships are the most ubiquitous and possibly the most potent global disruptions.
"Unfortunately, because they are more subtle, these processes are harder to see and rarely discussed," she said.
The authors argue that because every species is involved directly or indirectly in mutualistic partnerships and mutualists act as key players in global carbon and nutrient cycles, pollination and seed dispersal, the breakdown of those relationships could accelerate and worsen effects of global change on biodiversity loss and ecosystem disruption.
Bronstein pointed to pollination, a type of mutualism that has received "90 percent of the attention, because there is absolutely no doubt that plants are flowering earlier due to global climate change."
"This is causing a lot of concern," she said, "because it means that at the time the flowers open, their pollinators may not yet be around. That would mean that pollination of these plants would fail. While that is definitely a possibility and there is some good evidence for it in some situations, it is not the only thing that can happen when pollination gets disrupted. For example, there are known cases in which pollinators have been lost from an island through overhunting, and the plants have evolved traits that allow them to be pollinated by other animals."
Seed dispersal is another example. Many plants rely on mammals catching their fruit in their fur and carrying them to new habitats. Where large mammals were forced out of an ecosystem through habitat destruction or hunting, the plants were found to evolve smaller and smaller fruit that could be carried by smaller mammals or birds.
As different as the relationship between a flower and a bee may seem from coral polyps that cultivate microbes in their tissue, Bronstein and her co-workers identified certain recurring themes.
For example, how a mutualistic relationships plays out depends a lot on its ecological setting, Bronstein explained.
"Many species of ants milk aphids for the highly nutritious honeydew they produce. In return, the ants protect them from predators and parasites. But if the ants get starved for protein, they will eat the aphids, very readily. So the effect the ants have on the aphids ranges from highly beneficial to detrimental. To assess any mutualistic relationship, you have to know its context."
The authors identify three scenarios that can happen over the course of evolutionary timeframes when mutualist relationships are disrupted by human doing, regardless of their specific nature: a switch to new partners, a shift from mutual benefit to antagonism or abandonment of the interaction.
"If one or both of the groups that were interacting come into contact with new partners and adapt to them, as in the example of flowers adapting to new pollinators, the mutualistic interaction persitsts, just with different partners," Bronstein explained.
How humans shape their environment can drastically change a mutual interaction: One of nature's most widespread and important mutualisms is between tree roots and certain fungi in the soil. The fungi help the plant grow by providing nutrients such as nitrogen and phosphorus to them, while the plant pays them back in carbohydrates.
"What happens when we dump a lot of nitrogen fertilizer into the system?" Bronstein said. "The plants no longer need their fungi and sever their connections with them. The fungi don't have an option and potentially

just die or adapt to a more parasitic lifestyle. But what will happen if at some point in the future we stop using the fertilizer?"
"In the light of human-caused change, we have reason to be concerned about this, especially given the importance of these fungi to global carbon sequestration."
Kiers pointed to laboratory scale experiments suggesting that rapid evolutionary change can happen in very short timeframes.
"We have this wealth of knowledge from experiments looking at evolution on a short scale," she said. "Scientists have shown that it is possible for organisms to evolve in the lab. There is a lot to learn from these rapid evolution studies and it is time we start applying them to real world."
"There is an important message here," Bronstein added. "Throughout evolutionary history, habitats have changed enormously. Species have changed over these evolutionary time scales, but interactions have as well, and we expect this to continue. Our findings show that it is probably not enough to try and protect species on an individual level. We need to broaden our focus and start preserving mutualisms in the context of their ecosystems."
The co-authors on the paper are Todd Palmer (University of Florida, Gainsville), Anthony Ives (University of Wisconsin, Madison) and John Bruno (University of North Carolina, Chapel Hill).

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Arizona**. The original article was written by Daniel Stolte, University Communications.

Journal Reference:

1. E. Toby Kiers, Todd M. Palmer, Anthony R. Ives, John F. Bruno and Judith L. Bronstein. **Mutualisms in a changing world: an evolutionary perspective**. *Ecology Letters*, 2010; DOI: 10.1111/j.1461-0248.2010.01538.x

http://www.sciencedaily.com/releases/2010/10/101019111714.htm

Trying to Follow the Trail of Missing AIDS Patients

By DAVID TULLER

Thomas Mukoya/Reuters

KISUMU, Kenya — The young woman perched on the edge of the bed in her tiny hut. She was 29 years old, an AIDS widow who supported herself by frying and selling potato fries by the side of the nearby road.

Yes, she acknowledged to Peter Ouma Mchembere, a young counselor from a local H.I.V./AIDS project, she hadn't returned to the clinic for her antiretroviral medications in more than a year; no, she didn't plan to come back anytime soon.

She disliked the drugs, she explained: "The first time I started taking them, I was having the feeling that my heart was pounding and I had no strength." These days, she said, she chose to rely on prayer instead of medicine to give her strength so she could care for her two young children.

"It's not bad to pray, but getting care is also important, because this is biological," advised Peter, who works in Kisumu for Family AIDS Care and Education Services, or Faces. The organization is a joint clinical and research program of the Kenya Medical Research Institute and the University of California, San Francisco.

"It's very painful," Peter said to me after we left her home. "She has two kids and they're at a tender age, and if she dies, who'll take care of them?"

I was in Kisumu, the largest city in western Kenya, as both a journalist and a public health researcher from U.C. Berkeley. This scruffy but lively port of more than 300,000 people on the eastern shore of Lake Victoria is a regional hub for commerce, transient relationships and H.I.V. infection. About 15 percent of the adults in the region are believed to be infected.

At Peter's clinic, as elsewhere in Africa, patients who have not come for their medications in recent months are considered to have defaulted from treatment. As a "defaulter tracer," Peter tries to track them down, find out what's gone wrong and get them back into treatment, if possible.

Epidemiologists refer to such patients as "lost to follow-up," and their increasing numbers in sub-Saharan Africa are causing concern among providers of H.I.V. and AIDS care. Interruptions in treatment lead to viral strains that are resistant to the cheapest medications, and to higher rates of illness and death.

Several years ago, during the rapid international expansion of H.I.V. drug distribution, researchers reported very high rates of adherence to treatment in sub-Saharan Africa — as high as or higher than in the United States. More recently, however, studies have found that 15 to 40 percent of those who start treatment are lost to follow-up within one to three years. This unsettling trend has emerged at a difficult time; financing for treatment from the United States and other donors is not keeping pace with the rate of new infections, which has generated waiting lists for the lifesaving medications in some parts of Africa.

At Faces, the loss-to-follow-up rate is around 30 percent, according to Dr. Dennis Osiemo, the organization's technical adviser for care and treatment. In many instances, he said, problems over which patients have little or no control — like lack of child care, distance from a clinic or the high cost of transportation — force them to miss appointments or drop out of treatment. Others, of course, have died.

But recent research from Uganda found that a significant number of patients designated as lost to follow-up were actually receiving care elsewhere. A similar tracking effort is being started at Faces, but efforts to determine the status of lapsed patients are not always successful. "If a patient is outside the catchment area, it's very hard to trace them," Dr. Osiemo said.

H.I.V. programs in Africa are experimenting with various strategies to reduce loss to follow-up — offering a two- or three-month supply of medication per clinic visit, delivering drugs directly to patients' homes and reimbursing them for transportation costs. Faces is exploring modest projects to raise patients' income and stabilize their lives, like creating a microfinance system to provide water pumps and other agricultural support to help them grow more crops.

While accompanying Peter on his rounds of the district, I discovered that many cases elude easy solutions — the technological, financial or pharmacological fixes that Western-financed programs seek to carry out.

In search of the defaulted clients on Peter's list, we rode in matatus — the wheezing, overcrowded minivans that provide cheap local transportation — to outlying neighborhoods, past hundreds of ramshackle storefronts bearing names like Blessed Mum Butchery, Canaan General Retail Shop and the Yes We Can Hair Salon. (President Obama's ancestral village, Kogelo, is an easy drive from here.)

Peter, a tall, lanky man in his early 20s, lost both his parents to AIDS in 2006. He is supporting two younger brothers and a younger sister, all in their teens, and he struggles to pay their school fees so they can continue their education.

"I know what people are going through, so I have the heart to help them," he said. He spoke slowly, as if contemplating the import of each word, and wore a black and white rubber bracelet inscribed with the word "friendship."

Peter says he loves being able to reconnect patients with treatment, but his days can also prove fruitless and frustrating.

On this afternoon, one client was a woman who had stopped taking her young H.I.V.-positive grandson to the clinic every month. When we arrived in their neighborhood, Peter asked passers-by if they knew the family. Most said no.

Finally, a young boy stepped forward, led us across muddy paths and rows of shacks, and pointed out their home. No one was there, and it was clear no one had been for some time. A neighbor said they'd left for somewhere else a month before.

Next was a young disabled patient whose mother used to take her to the clinic. When we located the dwelling, we found the young woman, who was 20, sprawled in the dirt. She appeared to be suffering from serious neurological and cognitive problems.

The woman living next door told Peter that one recent morning she woke up to find that the mother — her sister — had disappeared, with no forwarding information. She knew nothing about her niece's medical condition, she said, as Peter tried to discuss arrangements to get the girl back into treatment.

But that day it was the decision of the young widow to continue praying instead of returning to the clinic that haunted Peter. Her determination to ignore the medical realities underscored the limitations of his efforts.

When the woman insisted that faith would heal her, Peter challenged her gently. "Even at the clinic, people are praying and still getting medication, because H.I.V. is in the body and blood," he said.

She acknowledged that she'd recently tested positive a second time, but that did not dissuade her. "I'm still hoping to be tested again and be negative," she said softly.

Peter and I stood up. He knew there was nothing more to say. He wished her well, encouraged her one last time to return. She smiled and shook her head.

David Tuller, a frequent contributor to Science Times, is coordinator of a new public health and journalism master's program at the University of California, Berkeley.

http://www.nytimes.com/2010/10/26/health/26cases.html?_r=1&nl=health&emc=healthupdateema2

The Long-Term Risks of Thyroid Cancer

R. Michael Tuttle, M.D.

By THE NEW YORK TIMES

Can radiation therapy for childhood conditions raise the risk of thyroid cancer in later life? Does a history of thyroid cancer have long-term risks? These are among the questions recently posed by readers of the Consults blog. Dr. R. Michael Tuttle, an endocrinologist at Memorial Sloan-Kettering Cancer Center in New York City, responds.

The Risks of Radiation

Q.

In the late ’60s I had radiation therapy over a period of many weeks/months for acne and I’ve always been told I have about a 1 in 3 chance of getting thyroid cancer. Is that accurate? It has now been over 40 years — if it hasn’t shown up yet, am I likely to still be at risk? And what type of thyroid cancer is most often linked to radiation treatment for acne?

Steven, Santa Cruz, Calif.

Q.

I had thyroid cancer at age 11 (1963) as a result of X-ray treatment of my thymus when I was a baby. I was treated by semi-radical thyroidectomy. I am now 58 and the only consequence of this surgery seems to be that I now need to take Synthroid — but I did not take it for many years as the remaining portion of my thyroid seemed to function well. Other than high cholesterol, I am healthy and active. Should I have any other follow-up tests or treatments? My primary care physician monitors my thyroid levels regularly. Thank you for the informative article and any response.

Tina, Midwest USA

A.

Dr. Tuttle responds:

In the last century, many childhood diseases were treated with ionizing radiation. Before the development of antibiotics, diseases like tonsillitis, ear infections and tuberculosis were commonly treated with external beam irradiation. In addition, we used to think that enlargement of the thymus, an organ in the upper chest above the heart, was abnormal, and therefore many infants received radiation therapy for an enlarged thymus. These practices largely stopped in the late 1950s and early ’60s. But numerous studies demonstrate that if radiation therapy is given to small children, they are at significant risk of developing thyroid cancer and benign thyroid nodules 20 to 30 years later. It remains uncertain if the risk decreases after 20 to 30 years or remains elevated. Nearly all thyroid cancers that develop after childhood radiation exposure are papillary thyroid cancers that have the same good outcomes seen with papillary thyroid cancers that developed without exposure to radiation.

Follow-up Care for Thyroid Cancer

Q.

I had papillary thyroid cancer (with lymph involvement) as a teenager in 1997. Currently, I am on 0.125 mg Synthroid. I've had several clean full body scans since then. Last year, one came back suspicious, but after another battery of tests (PET scan/MRI/ultrasound/blood test), they were unable to find anything. Two questions:

Is the full body scan the best option for finding a recurrence (better than ultrasound)? The prep (even with Thyrogen) is not fun and I'm worried about long-term effects.

Second, I've been on what my doc calls "suppression therapy" with the Synthroid. At any point, do patients go back to normal levels? Again, concerned about long-term effects.

Marika, Washington, D.C.

A.

Dr. Tuttle responds:

The follow-up of thyroid cancer patients has changed dramatically over the last 10 years. In the past, we relied primarily on whole-body radioactive iodine scans to find recurrent disease. However, these days we rely primarily on a blood test that measures a substance called thyroglobulin. Thyroglobulin is made only in the thyroid, so if a patient has had the thyroid removed and is then given radioactive iodine, the thyroglobulin level should be nearly undetectable. For most patients, it would be very rare to see a recurrence if the thyroglobulin level was undetectable. So after one to two years, if all is well, the primary follow-up is thyroglobulin blood tests done yearly.

While levothyroxine (thyroid hormone) is used to suppress the growth of thyroid cancer cells in patients at risk for recurrence, the dose can be adjusted after one to two years in patients who appear to be doing well. Most of my patients have the dose lowered to achieve thyroid hormone levels just above the normal range, which provides adequate "suppression" of any unknown microscopic thyroid cancer while not exposing the body to excessively high levels that could be associated with rapid heartbeats or softening of the bones over the years.

Does Having Thyroid Cancer Increase Your Risk of Other Cancers?

Q.

I've read literature that having thyroid cancer increases your risk for other primary cancers later in life. What are your thoughts on this?

PW, N.J.

A.

Dr. Tuttle responds:

In general, thyroid cancer is a disease that runs by itself. Except for rare hereditary forms of the disease, thyroid cancer patients do not appear to be more likely to develop another cancer.

The only exception may be breast cancer. But since thyroid cancer is generally a disease that affects 30- to 40-year-old women, it is not surprising that some of these same patients would also have breast cancer, since this is also a common age group in which breast cancer arises. So I think the association between breast cancer and thyroid cancer has more to do with the fact that both cancers tend to occur in women of this age group, and less to do with any specific genetic predisposition.

I recommend just age- and gender-appropriate screening for other cancers, such as pap smears, breast exams, mammograms and fecal occult blood tests, as recommended by the American Cancer Society, as if they never had thyroid cancer.

Do Thyroid Problems Cause Allergies?

Q.

Are you aware of increased food allergies post-thyroidectomy? I've noticed significantly increased food intolerances beginning about six months after surgery and radioactive iodine treatment eight years ago. Coincidence or common?

Moses, Detroit

A.

Dr. Tuttle responds: Probably coincidence. I'm not aware of any data that suggests that allergic problems are more common after thyroid surgery.

Follow-Up Care: Primary Care Doctor vs. Specialist?

Q.

After I was diagnosed with papillary carcinoma (less than 1 cm, no spread to lymph nodes), I had my thyroid taken out by a wonderful surgeon, Dr. Paul LoGerfo, who has since passed away. I planned to see him for my annual follow-ups, so I did not ask him to refer me to an endocrinologist. It's been about seven years, and I still haven't found a new specialist to monitor my condition. Instead, I've had my primary care physician check my TSH levels and quantitative thyroglobulin, and adjust my levothyroxin dosage accordingly. Do you think it is sufficient for me to see my primary care physician, or is it important to see a thyroid specialist? Thanks.

J, N.Y.

A.

Dr. Tuttle responds:

The background and the training of the specific doctor are less important to me than his or her knowledge of the condition. So a primary care doctor who has a specific interest in thyroid cancer can often provide long-term follow-up that is very similar to the care provided by a specialist. A frank discussion with the primary care doctor will allow the patient and the doctor to determine if referral to a specialist is necessary.

For more information, see Dr. Tuttle's additional responses in the Related Posts section, below, and The Times Health Guide: Thyroid Cancer.

http://consults.blogs.nytimes.com/2010/10/26/the-long-term-risks-of-thyroid-cancer/?ref=health

When Hormone Creams Expose Others to Risks

By TARA PARKER-POPE

Stuart Bradford

Veterinarians around the country are reporting a strange phenomenon: spayed dogs and cats, even some puppies and kittens, are suddenly becoming hormonal.

In female pets, the symptoms resemble heat: swollen genitals, bloody discharge and behavioral problems. Male animals are showing up with swollen breast tissue and hair loss. Standard treatments and even repeated operations have had no effect.

Now vets have identified the culprit. The pets were all owned by women who used hormone creams on their hands, arms and legs to counter symptoms of menopause. Animals who licked or cuddled their owners, or rubbed up against their legs, were being inadvertently exposed to doses of hormone drugs.

These anecdotal reports, about 20 of which were first collected by the Veterinary Information Network, a news service for veterinarians, suggest that many women are not taking proper precautions when using topical hormone products — putting not only pets but also family members at risk for hormone exposure.

"The dogs are licking and rubbing the treated area and absorbing the drug, which is putting them back into heat," said Dr. Terry Clekis, a veterinarian in Bradenton, Fla. Dr. Clekis has seen about five cases of pet exposure to menopause creams, including a dog that appeared to go into heat about six months after being spayed.

Dr. Clekis feared he had left remnants of ovarian tissue behind after the spaying. So he repeated it, but found nothing. It was his wife, chatting with the pet owner, who discovered she was using a hormone cream. Once the owner took precautions against exposing her pet, the symptoms disappeared.

The Food and Drug Administration issued a warning in the summer after eight children exposed to the estrogen spray Evamist showed signs of premature puberty like nipple swelling and enlarged breasts. The

agency also received two reports of dogs exposed to Evamist, and last year it issued another warning after eight children were exposed to topical testosterone.

Use of topical estrogen, in the form of creams, sprays and gels, has surged since a major government study linked oral menopause drugs with a higher risk of heart attacks and cancer.

Last year, doctors wrote 440,000 prescriptions for brand-name topical estrogen products alone, nearly triple the 2006 figure, according to IMS Health, a drug information service. And those numbers do not capture the estimated one million women using compounded hormone creams, which are custom-mixed by pharmacists and have been widely promoted as an alternative to commercial menopause drugs — even though the F.D.A. has said these so-called bio-identical hormones are no safer than hormones from drug companies. (The compounds' popularity surged after the former sitcom star Suzanne Somers wrote two books claiming they delivered many health benefits.)

Dr. Cynthia A. Stuenkel, an endocrinologist at the University of California, San Diego, and a former president of the North American Menopause Society, said the society was surveying its members to collect case reports of inadvertent hormone exposure to pets or children. The problem, she added, is that the doctors who prescribe the drugs typically treat older women, but the doctors who see the problems are pediatricians and veterinarians.

"We need to connect the dots between these groups so pediatricians and vets think of it early before subjecting these children and animals to extensive testing," she said. But some vets say women aren't forthcoming about the use of hormone drugs because it simply doesn't occur to them that it might be related to a pet's problem.

Dr. Walter R. Threlfall, a veterinarian who specializes in reproductive health, had a case involving a small lap dog that was experiencing a regular bloody discharge. During three different visits he asked the owner if the dog could have been exposed to an estrogen product, and she answered no each time before finally acknowledging she had been using an estrogen cream on her arm.

"The dog licks it off every night," she told Dr. Threlfall, who said in an interview, "She spent lots of money on that dog, and I could have solved it the first time by telling her to get the dog off the estrogen cream."

Dr. Richard Fried, owner of the Lincoln Square Veterinary Hospital in Manhattan, said he recently saw two cats that seemed to go back into heat after spaying by a different vet. Tests in one cat showed high blood levels of estrogen, but before he could spay it again, the cats' breeder suggested that the culprit might be the owner's hormone treatment.

"We are always warning pet owners to be careful about their medications," Dr. Fried said. "But this is a much more insidious kind of problem that most people don't think about."

Dr. Stuenkel says women should be counseled about safe use of the drugs.

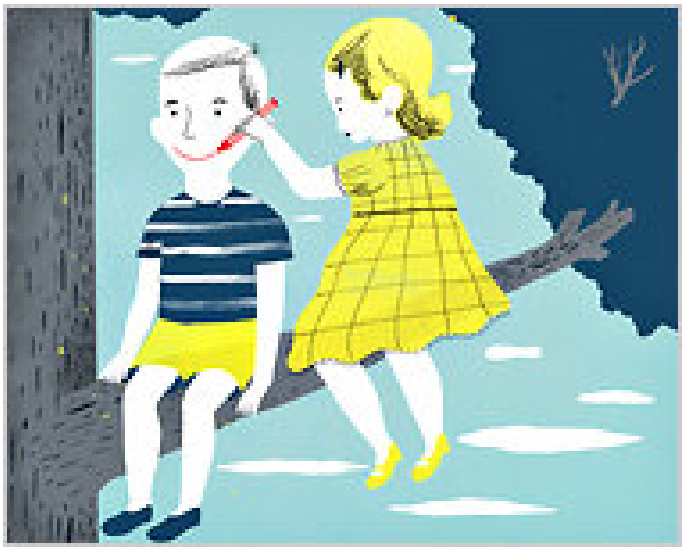
After using a topical hormone cream, they should thoroughly wash their hands before handling food, children or pets. Products should dry completely before the user comes into contact with people or animals, and women may want to consider changing the area where they apply the cream or covering it with long sleeves or slacks.

"We've learned a lot from these puppy stories," Dr. Stuenkel said. "People are letting dogs lick their hands after using the cream or holding them when the cream is fresh on them. We need to teach women to be sensible about how they use these products."

http://well.blogs.nytimes.com/2010/10/25/when-hormone-creams-expose-others-to-risks/?ref=health

Why Sisterly Chats Make People Happier

By DEBORAH TANNEN



Christopher Silas Nea

"Having a Sister Makes You Happier": that was the headline on a recent article about a study finding that adolescents who have a sister are less likely to report such feelings as "I am unhappy, sad or depressed" and "I feel like no one loves me."

These findings are no fluke; other studies have come to similar conclusions. But why would having a sister make you happier?

The usual answer — that girls and women are more likely than boys and men to talk about emotions — is somehow unsatisfying, especially to a researcher like me. Much of my work over the years has developed the premise that women's styles of friendship and conversation aren't inherently better than men's, simply different.

A man once told me that he had spent a day with a friend who was going through a divorce. When he returned home, his wife asked how his friend was coping. He replied: "I don't know. We didn't talk about it."

His wife chastised him. Obviously, she said, the friend needed to talk about what he was going through.

This made the man feel bad. So he was relieved to read in my book "You Just Don't Understand" (Ballantine, 1990) that doing things together can be a comfort in itself, another way to show caring. Asking about the divorce might have made his friend feel worse by reminding him of it, and expressing concern could have come across as condescending.

The man who told me this was himself comforted to be reassured that his instincts hadn't been wrong and he hadn't let his friend down.

But if talking about problems isn't necessary for comfort, then having sisters shouldn't make men happier than having brothers. Yet the recent study — by Laura Padilla-Walker and her colleagues at Brigham Young University — is supported by others.

Last year, for example, the British psychologists Liz Wright and Tony Cassidy found that young people who had grown up with at least one sister tended to be happier and more optimistic, especially if their parents had divorced. Another British researcher, Judy Dunn, found a similar pattern among older adults.

So what is going on?

My own recent research about sisters suggests a more subtle dynamic. I interviewed more than 100 women about their sisters, but if they also had brothers, I asked them to compare. Most said they talked to their sisters

more often, at greater length and, yes, about more personal topics. This often meant that they felt closer to their sisters, but not always.

One woman, for example, says she talks for hours by phone to her two brothers as well as her two sisters. But the topics differ. She talks to her sisters about their personal lives; with her brothers she discusses history, geography and books. And, she added, one brother calls her at 5 a.m. as a prank.

A prank? Is this communication? Well, yes — it reminds her that he's thinking of her. And talking for hours creates and reinforces connections with both brothers and sisters, regardless of what they talk about.

A student in my class recounted a situation that shows how this can work. When their family dog died, the siblings (a brother and three sisters) all called one another. The sisters told one another how much they missed the dog and how terrible they felt. The brother expressed concern for everyone in the family but said nothing about what he himself was feeling.

My student didn't doubt that her brother felt the same as his sisters; he just didn't say it directly. And I'll bet that having the phone conversations served exactly the same purpose for him as the sisters' calls did for them: providing comfort in the face of their shared loss.

So the key to why having sisters makes people happier — men as well as women — may lie not in the kind of talk they exchange but in the fact of talk. If men, like women, talk more often to their sisters than to their brothers, that could explain why sisters make them happier. The interviews I conducted with women reinforced this insight. Many told me that they don't talk to their sisters about personal problems, either.

An example is Colleen, a widow in her 80s who told me that she'd been very close to her unmarried sister throughout their lives, though they never discussed their personal problems. An image of these sisters has remained indelible in my mind.

Late in life, the sister came to live with Colleen and her husband. Colleen recalled that each morning after her husband got up to make coffee, her sister would stop by Colleen's bedroom to say good morning. Colleen would urge her sister to join her in bed. As they sat up in bed side by side, holding hands, Colleen and her sister would "just talk."

That's another kind of conversation that many women engage in which baffles many men: talk about details of their daily lives, like the sweater they found on sale — details, you might say, as insignificant as those about last night's ballgame which can baffle women when they overhear men talking. These seemingly pointless conversations are as comforting to some women as "troubles talk" conversations are to others.

So maybe it's true that talk is the reason having a sister makes you happier, but it needn't be talk about emotions. When women told me they talk to their sisters more often, at greater length and about more personal topics, I suspect it's that first element — more often — that is crucial rather than the last.

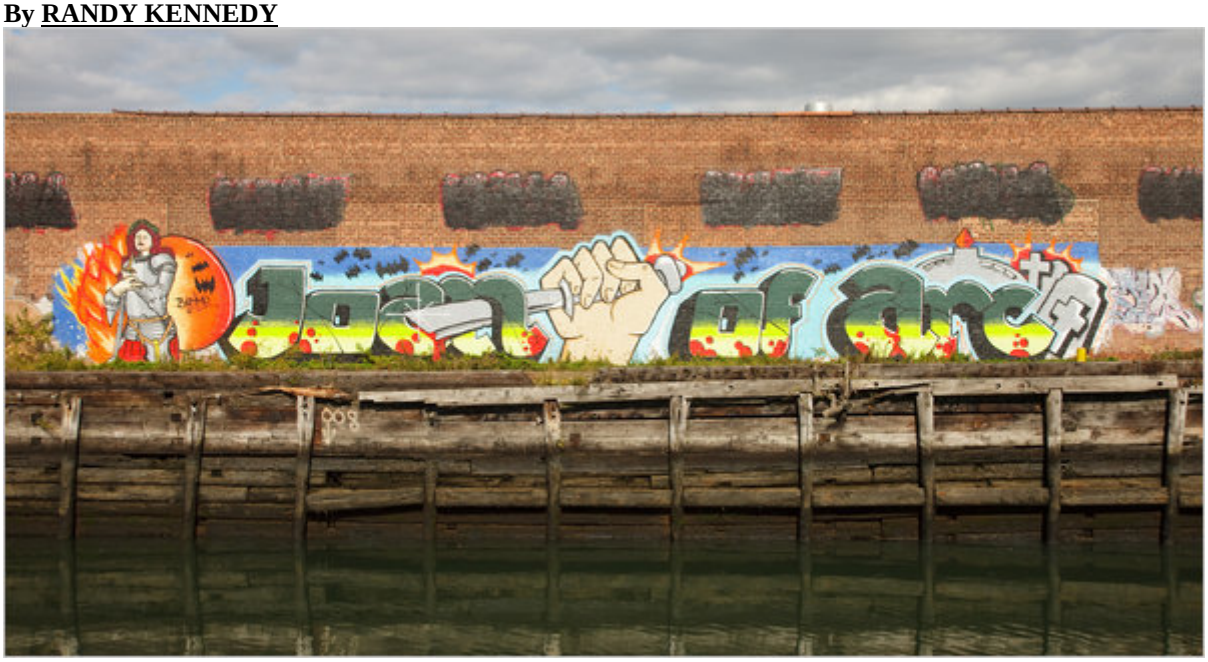
This makes sense to me as a linguist who truly believes that women's ways of talking are not inherently better than men's. It also feels right to me as a woman with two sisters — one who likes to have long conversations about feelings and one who doesn't, but who both make me happier.

Deborah Tannen is a professor of linguistics at Georgetown University and the author, most recently, of "You Were Always Mom's Favorite! Sisters in Conversation Throughout Their Lives."

http://www.nytimes.com/2010/10/26/health/26essay.html?ref=health

Graffiti of New York's Past, Revived and Remade

By RANDY KENNEDY



Robert Wright for The New York Times
With "Joan of Arc," at a warehouse along the Gowanus Canal in Brooklyn, the graffiti collective Slavery is paying homage to a 1980 work that read "Hand of Doom.

Anyone who has been lost in the last few weeks around the southern reaches of the Gowanus Canal in Brooklyn could be excused for experiencing a powerful Koch administration flashback. On the wall of a brick warehouse there, visible from the parking lot of a furniture store, a huge mural unfurls itself, a loving, seemingly spray-by-spray re-creation of one of the more infamous pieces of graffiti ever to ride the subway: a 1980 work by the artist known as Seen that covered the length of a No. 6 train car with the ominous phrase "Hand of Doom."

The original work — among those canonized in Henry Chalfant and Martha Cooper's 1984 landmark photographic history, "Subway Art" — was a token of its troubled urban times, a reference to the Black Sabbath song of the same title with the words flanked by a hooded executioner and a time bomb. The 21st-century version, on closer inspection, turns out to be a bit gentler and a lot more oblique. It reads "Joan of Arc," and the hatchet man has been replaced by an armored representation of the martyred French saint.

A few miles away, on a streetfront wall in the Sunset Park section of Brooklyn, a similarly odd example of historical revival has sprung up: a kinetic-looking 1980 piece by the graffiti writer Blade has been recreated, with the five letters of his name changed to read Plato. On a coffee shop wall in Bushwick, a name piece from the same year by the artist known as Dondi has been faithfully resurrected but changed to read Gandhi. And a copy of an early-'80s subway tag by the artist Sin appeared just last week on a row of lockers inside Louis D. Brandeis High School on the Upper West Side, with the addition of a few letters and some philosophical heft; the name is now Spinoza.

The pieces might sound like the result of some kind of graffiti-world version of Old-Timers' Day at Yankee Stadium. But they are actually the works of a newly formed collective of (mostly) former graffiti writers in their 20s and 30s, who have embarked on an unusual citywide campaign to summon 50 or more of the most famous pieces of old-school graffiti out of the history books and back onto the streets. The project, called "Subway Art History," is unusual not only because the artists are making the pieces with the permission of

businesses, schools and other perhaps nostalgic owners of blank vertical space, but also because of the nature of the pieces themselves. They are expressions of homage in a subculture that has almost always been defined by fierce competition, intense striving for originality and a kill-the-elders attitude toward the past.

"In graffiti it's like a teenage thing: 'No way am I going to become my father, no way am I going to make anything that looks like anyone else's' — and then, of course, you become your father," said a 32-year-old former graffiti writer who helped form the collective. He and other group members (there are 2 founders and a floating membership of about 10) asked that their names be withheld, not for the usual reason — the police — but because the collective, which calls itself Slavery, is seeking to get away from the ego jockeying that normally accompanies graffiti work.

The project was partly inspired, he said, by one completed last year along a blighted commercial stretch of West Philadelphia by the artist Steve Powers. As part of that city's Mural Arts Program, Mr. Powers created a series of eye-popping murals visible from the elevated train line, with the cooperation of local property owners.

In New York the idea is to use the pieces to try to teach a two-part history lesson. The first is about the glories (as the collective sees it) of the early days of graffiti and the invention of a vernacular art form that has swept the world. The second lesson is about world history itself, in neighborhoods where education remains low on the list of priorities for many struggling teenagers.

The 32-year-old artist painted graffiti illegally for many years but is now a teacher, working with often troubled adolescents. Interviewed at a cafe near the Gowanus Canal, he said that the group started with Joan of Arc because the members saw her, dead at 19, as an emblem of both the power and the perils of youth. Besides warriors, philosophers and characters from Western and Eastern mythology (Sisyphus is on the list of coming works), he said that they also plan to include artists, writers and political and religious figures.

"Jesus is a great one," he said. "I'd love to throw a Jesus in there somewhere, but also an Isis."

He added: "To me, this is like a real-life Wikipedia project. We hope that the people who see the words help each other figure out what they're about, and that these things start a conversation that keeps going on the streets."

A print made of the Joan of Arc piece will be sold beginning next week as part of Edition One Hundred, a new online art gallery that sells limited-edition prints and gives 10 percent of the profits to charity. (The National Breast Cancer Foundation is its beneficiary because a friend of one of the collective's founders battled the disease.) The eventual plan is to compile photographs of all the pieces, which could take more than a year to complete, into a book.

Mr. Chalfant, the graffiti photographer and historian, said that he had given his blessings to the project partly because such a tribute had few precedents in the world of New York graffiti. "I think it's a wonderful reverse of what usually happens, which is that these people whose shoulders everyone has stood on don't get any credit," he said.

The artist-teacher allowed that, as feel-good as the project is, he decided not to seek permission systematically to recreate the older pieces from their creators or from the families of artists who are no longer living.

"It's still such a boys' club," he said of the graffiti world. "I almost felt that I'd be humbling myself too much to go ask them, 'Um, do you mind?' " he said.

But at least one of the veteran artists, Blade (whose real name is Steven Ogburn and who painted trains for more than a decade, starting in the early 1970s), said he didn't mind at all.

"It's nice the attention guys my age are finally starting to get for our work," he said. "It kind of amazes me actually. People in their teens and 20s come up to me, and they know every detail of my life story. I'm like, 'Wow, I don't even remember dating that girl back in '72, but this kid here knows all about it.' "

http://www.nytimes.com/2010/10/27/arts/design/27graffiti.html?hp

The Art of Social Change

By KWAME ANTHONY APPIAH

Rob Oechsle Collection
A woman with bound feet in a hotel in Shanghai, circa 1900.

In 1929, the Church of Scotland Mission, which had a long and successful history of missionary work among the Kikuyu in colonial Kenya, began a campaign to eradicate the practice of female circumcision. The results were hardly what church members hoped for. Large numbers of Kikuyu left the church, and Kenya's leading anticolonial political organization mounted a vigorous attack on the church's policies. Female circumcision became a nationalist issue, and a custom that might have gradually disappeared grew further entrenched. Nearly 40 percent of Kenyan women today are estimated to have undergone some form of it.

So if you care about the foreign victims of immemorial, immoral rituals, you will want to proceed carefully and perhaps learn from history. International humanitarian campaigns don't have to backfire. It might be useful to look at their notable successes, in fact, and see what swung the balance.

Take the late-19th-century campaign against foot-binding in China. The custom began to die out in the first decade of the 20th century. In most places, it happened quickly. The American political scientist Gerry Mackie, an expert on social norms, gives the example of a large group of families in a rural area south of Beijing, in which 99 percent of women born before 1890 had bound feet, and none of the women born after 1919 had bound feet. The campaign against foot-binding didn't work immediately. But when it took hold, that thousand-year-old practice essentially vanished in a single generation.

It wasn't that the campaigners had new arguments. The Chinese knew foot-binding produced suffering and debility. Foot-binding was done to young girls, crushing the four smaller toes under the sole and compressing the rear of the anklebone. After months and years the pain diminished, but walking was usually difficult.

As early as the Song dynasty (960-1279), a Chinese intellectual wrote that "children not yet 4 or 5 years old, innocent and without crime, are caused to suffer limitless pain." In the Qing dynasty (1644-1911), attempts were made to ban it, but did not succeed. The tiniest feet — three-inch "golden lotuses," as they were known — were important as a sign of status for women who could afford not to work in the fields or walk to market; the bound foot was a sign and instrument of chastity too, by limiting the movements of women. And you can't overstate the force of convention: Chinese families bound their daughters' feet because that was the normal thing to do.

The movement that eventually turned the Chinese around began with Christian missionaries in the 1860s. In 1875, the Rev. John Macgowan of the London Missionary Society, who had campaigned for some 15 years against foot-binding, called a meeting of Christian women in Xiamen. He asked them to sign a pledge to

abandon foot-binding. Nine women did. Eventually women joined the Quit-Footbinding Society in larger numbers, pledging not to bind the feet of their daughters and some choosing to undergo the often painful process of unbinding themselves. Then they were joined, in 1894, by the Unbound Foot Association, which the Confucian scholar and reformist leader Kang Youwei helped found. It eventually had more than 10,000 members. The next year, Mrs. Archibald Little, the wife of an English businessman, helped found the Natural Foot Society. Together, a mixture of campaigning outsiders and modernizing insiders built a national movement for change.

The wisest campaigners began by insisting on their respect for China's civilization. Christian missionaries set up newspapers and magazines like Review of the Times, founded in 1868, which gave the elite access — in classical Chinese — to ideas and events from the world outside China. The Rev. Timothy Richard of the Baptist Missionary Society, who edited The Eastern Times for a period beginning in 1890, was highly influential, too.

Richard grasped that the key to China lay with the literati, the scholarly class that produced the empire's policy makers. He dressed as they did, learned their language and studied the texts that formed the core of their education. As for Mrs. Little, her main strategy was to republish anti-foot-binding essays by distinguished Chinese writers.

Kang Youwei wrote in his autobiography that Review of the Times introduced him to Western ideas and that this was what led him to start thinking about foot-binding. He had, he said, been distressed by the pain his female relatives underwent when their feet were bound. He declined to allow the binding of his own daughters' feet. In 1898, Kang sent a memorandum to the emperor. "All countries have international relations, and they compare their political institutions with one another," he began, "so that if one commits the slightest error, the others ridicule and look down upon it." And he added, "There is nothing which makes us objects of ridicule so much as foot-binding."

Kang was ashamed that his society mutilated its daughters, but people like Richard and Little could hone that sense of shame only because their arguments were founded in respect, not in contempt.

A second essential reason for the campaign's success was that it created institutions; it didn't content itself with rhetoric. In particular, it created organizations whose members publicly pledged two things: not to bind their daughters' feet and not to allow their sons to marry women whose feet were bound. The genius of this strategy was that it created both unbound women and men who would marry them. To reform tradition, you had to change the shared commitments of a community. If Chinese families bound their daughters' feet because that was the normal thing to do, you had to change what was normal.

This isn't a complete explanation of the campaign's stunning success, of course. The particular circumstances of late Qing China mattered a great deal, too. Over the previous several decades, a society that had long regarded Westerners with contempt had to accept that these foreigners, however culturally inferior by Confucian standards, could beat it in battles on land and sea. Part of the reason the modernizers like Kang Youwei were drawn into dialogue with Westerners like Timothy Richard was precisely their sense that their society was failing to meet the challenges from abroad.

The abolition of foot-binding didn't come about without backlash. Far from it. Yet reform, if handled deftly, can brave the backlash and prevail. Once you grasp the elements that made for success against foot-binding, you can see examples around the world of what to do and what not to do. In 1997, in the village of Malicounda Bambara in Senegal, a group of women told a press conference that they were going to abandon female circumcision, or female genital cutting (F.G.C.). The decision was a result of discussions that began some years earlier, when Tostan, a human rights group based in Dakar, introduced its Community Empowerment Program. Tostan's aim wasn't to end F.G.C. It was to provide people in the community with knowledge about human rights. But gradually, through the course of discussions of health and human rights, both women and men in Malicounda Bambara turned against F.G.C.

The press conference was a mistake, because it prompted a reaction in the villages around Malicounda Bambara. As the imam of one such village, Keur Simbara, put it: "We are part of an intermarrying community, and unless all the villages involved take part, you are asking parents to forfeit the chance of their daughters getting married." Tostan's leadership recalibrated. They introduced those other villages to the same

ideas: if you're going to change the practices of girls, you have to make sure that you change the minds of the families of the boys who might marry them.

Two years later, the government of Senegal decided to criminalize those who "violate the integrity of the female genitalia." Suddenly, hundreds of thousands of Senegalese faced the possibility of up to five years in prison. Tostan had to cease work in the face of outrage from local communities. Many girls were cut in the following months in deliberate violation of the law. An approach based on respectful dialogue seemed to have been derailed.

Eventually, Tostan's efforts got back on track. Its strategists — Gerry Mackie is one — knew that once enough people in the community change their minds, they can stand up together and pledge their allegiance to new practices. Tostan, in short, applied the strategy that worked against foot-binding. By the end of the coming decade, a generation of girls will have grown to womanhood in villages like Malicounda Bambara free from F.G.C.; and they will find husbands in places like Keur Simbara. The reformers are following the double lesson of the movement against foot-binding. First, begin with a dialogue of mutual respect, free of self-congratulation. Second, when you have a core of converts, organize a program of public commitment to new practices, which takes into account the traditions of the community. To end one practice, as the anti-foot-binding campaigners grasped, you need to start another.

Kwame Anthony Appiah is the author of "The Honor Code: How Moral Revolutions Happen," from which this article is adapted.

http://www.nytimes.com/2010/10/24/magazine/24FOB-Footbinding-t.html?ref=magazine

Schomburg Center Gets Angelou Work

By FELICIA R. LEE

Travis Dove for The New York Times

The Schomburg Center in Harlem has acquired the personal archive of the poet Maya Angelou, above.
Maya Angelou's paper trail includes a rambling, typewritten letter from James Baldwin, dated Nov. 20, 1970, addressed to "Dear, dear Sister" discussing everything from his new book to his feelings about death.
And one from Malcolm X, written on Jan. 15, 1965, assuring her, "*You* can communicate because *you* have plenty of (soul) and you always keep your feet firmly rooted on the ground."
And a draft of her poem "On the Pulse of Morning," which she recited at the 1993 inauguration of President Bill Clinton, showing Ms. Angelou's changing the first line from "Rocks and Rivers and Trees" to the final, stark version: "A Rock, A River, A Tree."
All of these things and more — a total of 343 boxes containing her personal papers and documents — have been acquired by the Schomburg Center for Research in Black Culture. The trove has notes for Ms. Angelou's autobiography, "I Know Why the Caged Bird Sings"; a 1982 telegram from Coretta Scott King asking her to join a celebration at the King Center; fan mail; and personal and professional correspondence with Gordon Parks, Chester Himes, Abbey Lincoln and her longtime editor, Robert Loomis.
The acquisition is to be officially announced on Friday by New York Public Library officials at a news conference with Ms. Angelou, said Howard Dodson, the executive director of the Schomburg.
"It will be the largest collection of her material," Mr. Dodson said. "This is the collection that documents her literary career. This is a major, major, major addition to that body of documentation of the individual lives of writers and the worlds in which they lived."
Library officials declined to disclose a purchase price for the collection. The Angelou papers were paid for with private money.
The papers are "a major coup for the Schomburg, which too often loses important papers to more monied institutions," said Pamela Newkirk, a professor of journalism at New York University. For Professor Newkirk's 2009 book, "Letters From Black America," an anthology of letters written by African-Americans since the 1700s, she relied on the Schomburg archives for much of her research, she said.
The acquisition is something of a swan song for Mr. Dodson, who announced in April that he would retire in 2011. A committee is currently searching for his replacement at the Schomburg, a research library of the New York Public Library and a center for exhibitions and other cultural programs.
Ms. Angelou's archive will become part of holdings that include some 10 million items, including the personal collections of John Henrik Clarke, Lorraine Hansberry and Malcolm X. The Schomburg, at 135th Street and Lenox Avenue in Harlem, is also home to the original manuscript of Richard Wright's "Native

Son" and a signed first edition by Phillis Wheatley (1753-84), who has been called America's first black female poet.
"Nothing is as precious to me as that library," Ms. Angelou said of the Schomburg, speaking by telephone from Winston-Salem, N.C., where she is a professor of American Studies at Wake Forest University.
"For a person who grew up in the '30s and '40s in the segregated South, with so many doors closed without explanation to me, libraries and books said, 'Here I am, read me,' " Ms. Angelou said. "Over time I have learned I am at my best around books."
Ms. Angelou, 82, said it dawned on her that "I'd better make sure that my papers and books are taken care of, they are somewhere people can see them and read them." As part of the New York Public Library, the Schomburg is "part of the world," Ms. Angelou said, accessible to "students in the neighborhood and people in Tokyo and Germany."
Ms. Angelou has placed papers and documentation of her theatrical, film and television performances at Wake Forest over the years, she said, but she maintains a personal connection to Harlem and the Schomburg. She owns a brownstone in the neighborhood and counts Mr. Dodson as a friend. She is also the Schomburg's national membership chairwoman.
Her material has yet to be processed. Mr. Dodson said the contents included the yellow notepads on which Ms. Angelou typically scribbled in longhand, as well as typescripts and proofs or galleys of her published and unpublished work.
The collection will be available to researchers in about 18 months, and selected items will eventually be exhibited, Mr. Dodson said.
Ms. Angelou's papers are a window on 40 years of the times and the work of a Renaissance woman who became known as a "people's poet." An outspoken advocate for the rights of African-Americans and women, Ms. Angelou is perhaps most famous for "I Know Why the Caged Bird Sings," her 1970 memoir of a childhood scarred by sexual abuse, as well as for her poems "Phenomenal Woman" and "Still I Rise." She has won three Grammy Awards for her spoken-word albums, and President Clinton awarded her the National Medal of Arts in 2000.
Ms. Angelou said that transparency about her life and work connected her to a long African-American tradition of preserving and retelling personal history.
"Hold those things that tell your history and protect them," she said. "During slavery, who was able to read or write or keep anything? The ability to have somebody to tell your story to is so important. It says: 'I was here. I may be sold tomorrow. But you know I was here.' "
Ms. Angelou said that Frederick Douglass used the first-person singular to talk about the story of a whole group of people. "It stands in for all of us," she said. "We've been telling that story from the time of Phillis Wheatley and Jupiter Harmon." (Harmon was another black 18th-century poet.)
For those reasons, she said, it was not difficult to part with poignant letters from James Baldwin, who encouraged her to write "Caged Bird," and Malcolm X, whom she met in Ghana. She worked with him to build the Organization of Afro-American Unity after he parted ways with the Nation of Islam.
The Nov. 20, 1970, letter from Baldwin includes his feelings about leaving himself "wide open" in his book of conversations on race and society with Margaret Mead ("It was painful to do and even more painful to read") and his feelings about watching Lorraine Hansberry die, as he battled his own health problems. He says of writing another book: "What for? for whom? *to* whom?"
And he throws out this seeming non sequitur a few lines later: "No one will believe that I wanted children."
He ended the letter with a handwritten request: "When I option 'Soledad Brother' would you consider working on the scenario with me?"
Paul LeClerc, president of the New York Public Library, who will also step down in 2011, said the acquisition of the papers was a reflection of the importance of the Schomburg to the library's mission.
"A great library," he said, "never stops buying."

http://www.nytimes.com/2010/10/27/arts/design/27archive.html?ref=design

Where Art Meets Trash and Transforms Life

By CAROL KINO

Todd Heisler/The New York Times
Vik Muniz with one of the portraits in his "Pictures of Garbage" series.

THE photographer Vik Muniz often says that while he considers himself an American artist, his use of imagery owes everything to Brazil, where he was born and raised.
"I'm a product of a military dictatorship," he said recently at his New York gallery, Sikkema Jenkins & Company. "Under a dictatorship, you cannot trust information or dispense it freely because of censorship. So Brazilians become very flexible in the use of metaphors. They learn to communicate with double meanings."
Certainly his photographs are filled with the visual equivalent of double entendres. At first each seems to present a familiar image or artwork. But examine the picture up close, and it turns out to be made from surprising mediums, like Bosco syrup, which Mr. Muniz once dribbled across vellum to recreate Hans Namuth's photograph of Jackson Pollock making a drip painting; peanut butter and jelly, from which he molded a Warholesque "Double Mona Lisa"; or plastic toy soldiers, which he used to recast a Civil War photograph of a boyish-looking private.
This penchant for multilayered imagery may be one reason Mr. Muniz, a puckish 48-year-old who has been an art world fixture for more than a decade, is now a celebrity in Brazil. In the last two years his traveling retrospective, simply called "Vik," has been in five cities there, achieving record attendance. He has also funneled much time and money into nonprofits (which have flourished in Brazil's democracy), most of which are located in Rio de Janeiro, and intended to provide education and job training for street children.
At the time of our interview, the voluble, charismatic Mr. Muniz had just flown in overnight from the São Paulo Biennale on a 48-hour tour of New York, where he oversaw the renovation of the Brooklyn studio

where he lives part time (when not in Rio), checked in with his dealer and was an M.C. at a benefit gala for the nonprofit Brazil Foundation at the Metropolitan Museum of Art. There he was named a Unesco Goodwill Ambassador.

Now, as the star of "Waste Land," a touching documentary that opens on Friday after winning numerous film festival awards, he seems on the verge of reaching a broad audience in this country too.

The film, directed by Lucy Walker ("Blindsight," "Countdown to Zero"), tracks the development of a 2008 series of monumental photographic portraits made from trash. Called "Pictures of Garbage," they were created by Mr. Muniz in collaboration with the garbage pickers of Jardim Gramacho, a 321-acre open-air dump just outside Rio that is one of the largest landfills in Latin America.

This informal workforce — or catadores, as they are known — are the reason Brazil, with only a few municipal recycling programs, manages to reclaim a huge percentage of its trash, said Sonia Dias, the waste-picker specialist for Wiego, a global policy research group. This summer Brazil passed a law to eradicate open dumps and integrate the catadores into the recycling industry. Yet the catadores are still an underclass.

The film tells the story of Mr. Muniz's efforts to help those at Jardim Gramacho take charge of their lives, while giving them a new perspective on the world through art.

It begins in Mr. Muniz's Brooklyn home. "I'm at this point in my career where I'm trying to step away from the realm of fine arts," he says to the camera, "because I think it's a very exclusive, very restrictive place to be. What I want to be able to do is to change the lives of people with the same materials they deal with every day."

He informs his wife at the time, the artist Janaina Tschäpe, that he intends to spend two years at Gramacho, working with the catadores. Mr. Muniz is then seen amid Gramacho's majestic mountains of trash meeting the catadores with Fabio Ghivelder. "I grew up poor," Mr. Muniz says. "Now I've reached the point where I want to give back."

The catadores in the film soon reveal themselves to be as personality-packed as Mr. Muniz. They include Tião Santos, president of the workers' cooperative Association of Collectors of the Metropolitan Landfill of Jardim Gramacho; the scholarly Zumbi, who has educated himself by reading discarded books; Suellem, a teenage mother who has worked at Gramacho and lived in its shantytown since her childhood; and Magna, who became a catador when she and her husband fell on hard times. Though their work may be grim and dangerous, many of them seem to have a crystal clear idea of its environmental worth. And, as Magna says, "It's better than turning tricks at Copacabana."

Mr. Muniz eventually transforms their images into classical portraits, which he models in his studio with their help, using garbage they have scavenged from Gramacho. (The catadores were paid for their time and the materials.) Suellem, posing with her two children, becomes a Renaissance Madonna; with Zumbi Muniz recreates Millet's "Sower"; and Tião sits in a bathtub like David's Marat awash, in a sea of filthy clothes, plastic bottles and abandoned toilet seats.

By the film's end Tião's portrait has been sold at auction, and Mr. Muniz has donated his $50,000 take to the workers' cooperative. And the catadores have visited the Museu de Arte Moderna in Rio to see themselves in Mr. Muniz's 2009 retrospective. "Sometimes we see ourselves as so small," one tells reporters at the opening, "but people out there see us as so big, so beautiful."

Mr. Muniz has also acknowledged that with a twist of fortune he might have become a catador himself. "They just weren't born very lucky," he says in the film. "But we're going to change that."

Yet his own stars seem to have been remarkably well aligned. Although he grew up in a poor family in São Paulo, his habit of expressing himself with tiny hieroglyphic drawings won him a scholarship to an art school. At 18, buoyed by an intense fascination with perception and optics, he talked himself into a job with a billboard company and became something of an advertising wunderkind.

That career ended abruptly when he was shot in the leg on his way to his first black-tie gala. His assailant, to ensure that he didn't press charges, offered him cash. Mr. Muniz took the money and decided to try his luck in America.

By 1983 he was in New York, working as a framer and living in the East Village while its gallery scene was booming. When he happened across Jeff Koons's enigmatic vacuum cleaner and basketball sculptures at

International With Monument, he said: “I realized that I could be an artist too. He was speaking my language.”
A friend lent him a studio space, and Mr. Muniz began making his own objects, like a shiny shelf intended to gather dust, or a pre-Colombian drip coffee maker. In 1988 he had his first New York solo gallery show. Then he began experimenting with drawing and photography.
On a 1996 trip to St. Kitts he discovered the perfect blend of all three mediums when he befriended some families at a sugar plantation and took Polaroids of them. Back in New York, he tried to figure out what made the children look so luminous while their parents seemed so broken down. After realizing the difference was a lifetime spent working with sugar, he used the glittering grains to draw and form the children’s portraits on black paper, and photographed the results. The Museum of Modern Art chose them for its 1997 “New Photography” roundup, and Mr. Muniz’s career as a photographer was born.
“He was always interested in visual theory and the vernacular,” said Brent Sikkema, his dealer. “But this was a defining moment.”
The work’s accessibility often leads art cognoscenti to dismiss Mr. Muniz, said Peter Boswell, a curator at the Miami Art Museum who organized “Vik Muniz: Reflex,” a 2006 retrospective there. (It toured the United States, Canada and Mexico for two years, then went to Brazil in expanded form; it closed in August.)
“Because Vik is so prolific, some people are tempted to write him off,” Mr. Boswell said. “Even at the beginning, people were saying that it was just clever work that didn’t have substance. But I think people who say that aren’t looking very deeply. Vik’s got a whole lot of substance, both within the work and behind the work, in the whole machinery that he has put into place.”
And it’s increasingly clear that Mr. Muniz has ambitions beyond the art world — something to do with alchemical transformation, not just of garbage into art, and art into cash, but also of people’s lives.
In this he has been successful. Since the film wrapped, some of the catadores have found new jobs, and Mr. Muniz and the filmmakers have donated $276,000 to the cooperative, Mr. Ghivelder said, which has been used, among other things, to buy a truck and computers, found a library, provide capital funds for the organization and finance a small-business training program. (Another $50,000 from Mr. Muniz went to the catadores who posed for portraits.)
The project also seems to have changed Mr. Muniz’s perspective on imagery. “The really magical things are the ones that happen right in front of you,” he said. “A lot of the time you keep looking for beauty, but it is already there. And if you look with a bit more intention, you see it.”

http://www.nytimes.com/2010/10/24/arts/design/24muniz.html?ref=design

Abraham's Progeny, and Their Texts
By EDWARD ROTHSTEIN

The New York Public Library

"Three Faiths: Judaism, Christianity, Islam," at the New York Public Library, includes this 18th-century Ethiopian illustration of the Gospels of Matthew and Mark.

The sweep of the new exhibition at the New York Public Library — "Three Faiths: Judaism, Christianity, Islam" — is stunning. It stretches from a Bible found in a monastery in coastal Brittany that was sacked by the Vikings in the year 917, to a 1904 lithograph showing the original Temple Emanu-El on Fifth Avenue. It encompasses both an elaborately decorated book of 20th-century Coptic Christian readings and a modest 19th-century printing of the Gospels in the African language Grebo. There are Korans, with pages that shimmer with gold leaf and elegant calligraphy, and a 13th-century Pentateuch from Jerusalem, written in script used by Samaritans who traced their origins to the ancient Northern Kingdom of Israel.
The library's Gutenberg Bible is here, as well as its 1611 King James translation. The first Koran published in English is shown, from 1649, along with fantastical images from 16th-century Turkish and Persian manuscripts in which Muhammad is pictured with other prophets, his face a blank white space in obeisance to the prohibition against his portrait.
Out of many, one. That could well be the motto of this ambitious exhibition. It focuses on "the three Abrahamic religions" — Judaism, Christianity and Islam — each of which takes as a forebear an "itinerant herdsman" of the Middle East, Abraham, who affirmed belief in a single God. As the show puts it, Abraham rejected "the religions of antiquity with their plethora of gods, each imbued with a particular attribute, purpose and power," replacing the many with the one.

The Abrahamic religions share other characteristics as well. Each believes that God has made himself known to his prophets through acts of revelation. And such revelations shape groups of believers by being incorporated in canonical written texts: the Hebrew Bible, the Christian Gospels, the Islamic Koran.
Though the exhibition does not point this out, the connection between monotheism and such texts is no accident. Once multiple divinities are discarded, along with their rivalries and conflicting powers, religion is concerned with just two poles: the human and the divine. Religious events take place not on Mount Olympus or in some imagined godly castle, but in the earthly realm. Religious history becomes fully part of human history. And the telling of that history, along with commentary and reinterpretation, becomes an aspect of the religion itself. These faiths are *historical* faiths.
This exhibition grew out of a show mounted in 2007 at the British Library called "Sacred." The original plan was for a joint exhibition, but according to a New York Public Library spokesman, the British Library backed out, worried that post-9/11 inspections by the Transportation Security Administration could put its rare manuscripts at risk. So, while the British catalog is for sale here, the show is different, reconstructed using the New York library's own collection by H. George Fletcher, the library's retired director of special collections, and a team of five scholars and advisers.
The intent, though, is unchanged. These exhibitions have a distinctive post-9/11 cast. One reaction to Islamist terror attacks has been a self-conscious ecumenism; one of the main sponsors of "Three Faiths," for example, is the Coexist Foundation, whose aim is "to promote better understanding between Jews, Christians and Muslims." (The other main donor is the Stavros Niarchos Foundation.)
The focus on similarities among the three religions is partly meant to disconnect terrorism from the mainstream Islamic tradition. In the British catalog, Karen Armstrong, who has written widely about the Abrahamic religions, minimizes the scale of Islamist violence by suggesting that each religion has its dangerous extremists, but more important, she argues, is that the faiths share a devotion to the ideal of transcendence through holy texts. The British exhibition even had the subtitle "Discover What We Share." And in New York, too, the emphasis throughout is on commonality. At this historical moment, this is meant to defend Islam against anticipated accusations. Thus: out of three distinct monotheisms, one humanist perspective.
This argument deserves more analysis, but in any case, the resemblances are considerable. Because canonical texts are so crucial in each, interpretation and commentary become dominant modes of religious attentiveness, expanding the scriptural traditions. So here we see a 15th-century book of Islamic Tafsir — commentary on the Koran — from Syria or Egypt, in which the portions of the Koran being discussed appear in red in the volume's margins. There is also a late-12th-century French version of the Gospels of Matthew and Mark that presents the sacred words in large script, surrounded by columns of annotations. And the Jewish Talmud, represented with a volume from Daniel Bomberg's 16th-century printing, features a web of notes and analysis about law and Scripture incorporating material going back to the second century.
One section of the show also surveys the spread of these religions after their birth in the Middle East through "the growth of the Jewish Diaspora, the evangelical mission of Paul to the Gentiles, and the military conquests of the early Islamic armies." As the faiths spread, translations of sacred texts were needed; complex "polyglot" editions developed in which translations might appear in columns beside the original text or interwoven between its lines.
One lovely volume of the Psalms here from 1516, printed in Genoa, Italy, includes, along with the original Hebrew, columns of Septuagint Greek, Arabic, Aramaic and Latin, along with commentary. The exhibition's Christian texts from Czech, Polish, Russian and Lithuanian lands are extraordinary, growing out of a collection the library purchased from the Bolsheviks in the Soviet Union in the 1920s.
The similarity in religious traditions is also emphasized in an accompanying miniature exhibition in an adjacent gallery, called "Scriptorium" — the "place where scribes write and illuminate books or scrolls." Here are samples of parchment (skins of goats, sheep and deer); several kinds of traditional paper (including ahar — paper coated with alum and egg whites); display cases with the sources of pigments like pomegranate peel or dried insects; and videos on the creation of pens and inks and manuscripts. An activity table is also planned.

So much is shared in these three faiths. But the distinctions are also important and tend to be too aggressively minimized. For example: the biblical story of Abraham welcoming the three messengers who announce that his aged wife will give birth is pictured here in an elegant image from a 15th-century New Testament "Gospel According to Luke," from Muscovy. The haloed visitors actually anticipate the Magi bringing gifts, and, as the label points out, give a presentiment of the doctrine of the Trinity.

Or again, in the Koran, Moses and Mary, the mother of Jesus, are both treated as prophets, but they are reinterpreted as heralds of what is yet to come.

In fact, because Christianity developed out of Judaism, and Islam grew out of both, similarities and allusions are also the markers of great differences. Each religion aggressively reinterpreted its predecessors, accepting its sacred texts but radically altering their implications and meanings. And each predecessor religion, in turn, opposed attempts to treat it as a prelude to something greater.

These are not subtle disputes, and the consequences were far from ecumenical, particularly when successor religions sought to spread their beliefs through conquest and conversion. And while the three share many traits — these are not primarily meditative or contemplative religions, after all, and they are indeed historical faiths, concerned with action, even with mission — their commonalities also lead to profound contrasts. For two millenniums, Judaism, tied to a particular people, was the least outwardly directed, but all three religions saw themselves as shaping world history. Each one also imagined a distinctive role for believers within it. And here the three are quite diverse indeed.

This is, of course, beyond the scope of this show. But understanding this would mean examining the three faiths more closely for their differences. And it might lead to other conclusions as well, even about recent inspirations for contemporary ecumenicism. The practitioners of terror who proudly declare their Islamic allegiance, like the spiritual leaders who praise them, are presenting one Islamic view of what direction history should take and what part believers should play in it.

That interpretation is not as much an anomaly as it might seem — though it doesn't necessarily lead to violent acts. But it also may help explain why we do not hear much about exhibitions like this one, emphasizing "what we share," originating in lands where that vision flourishes.

"Three Faiths: Judaism, Christianity, Islam" is on view through Feb. 27 at the New York Public Library; nypl.org.

http://www.nytimes.com/2010/10/23/arts/design/23faiths.html?ref=design

Believing Is Seeing (Or, the Meat Of the Matter)

By HOLLAND COTTER

Marcus Yam for The New York Times

By HOLLAND COTTER

Paul Thek, the subject of a ragged, moving and much-anticipated retrospective at the Whitney Museum of American Art, was only 54 when he died of AIDS in 1988. But by then he had already slipped through the cracks of art history. Or rather he had fallen into one of the deep trenches that divide that history into artificial islands with names like Pop and Minimalism.

Thek came to art with so much going for him — talent, looks, energy and imaginative peculiarity — that for a decade or so he was an island unto himself, an archipelago even. In the early 1960s, when everyone else in New York was into hands-off fabrication and Benday dots, he was modeling hyper-realistic images of meat, raw and bleeding, from beeswax. Gross and funny, they had people buzzing.

Then in 1967 Thek abruptly left for Europe and radically changed his art. Instead of sculpture, he created immense, collaborative, ephemeral environments from throwaway stuff: newspapers, candles, flowers, onions, eggs, sand. When their time was up, these works went into the rubbish bin. Thek, with his long blond hair and pied-piper charm, was a big success in Europe. Museums threw open their doors. He stayed for nine years.

In 1976 he returned to New York and had a nasty shock. Almost no one here remembered the work he had done in the 1960s, or knew what he had been up to in Europe in the years since, or cared about what he was doing in the present. He had been away too long. The ’60s were over.

He had a few Manhattan gallery shows and a museum solo in Philadelphia, but people stayed away. Depressed and angry, he painted quick, small pictures in his East Village walk-up, smoked a lot of pot, cruised local parks and kept an obsessively confessional diary. To support himself, he bagged groceries in a

supermarket, washed hospital floors. Europe was far, far away; 1980s New York, with its bottomless cash and gated art world, far too close.

His memorial service at St. Mark's Church in-the-Bowery was a fair gauge of his stature. The church wasn't packed, but the eulogists — Robert Wilson, Susan Sontag — were stars. Sontag, an old friend, had dedicated her breakthrough book, "Against Interpretation," to Thek in 1966. In 1989 she would dedicate another, "AIDS and Its Metaphors," to his memory.

Since his death Thek's reputation, always high in Europe, has grown in the United States. In the 1990s, a time of identity politics and AIDS, there were Thek shows, articles, books. In the early 2000s, with young artists interested in the quirky and the personal in art, his influence was strong and was acknowledged by older figures like Robert Gober and Mike Kelley.

Now, finally, if with slightly behind-the-beat timing, comes "Paul Thek: Diver, a Retrospective," at the Whitney. What do we find? Less than hoped for, perhaps, but more than anticipated: solid concentrations of the early sculptures and the later paintings; mere scraps of the great environments that came between. Do they add up to a career survey? With the help of documentary photographs, an accessible catalog, and an application of Thek's own definition of faith — "Believing is seeing" — they do.

The beginnings of that career were ordinary. The artist was born George Joseph Thek — the Paul came later — to a middle-class Brooklyn family of German and Irish descent. His parents were Roman Catholic; the first art he saw was in churches. His connection to religion remained deep, and deeply conflicted.

He studied painting at Cooper Union in the 1950s and at that time met Sontag, Eva Hesse and the photographer Peter Hujar. Thek was alert to the new art and artists around him: Jasper Johns, Allan Kaprow, Claes Oldenburg and Robert Rauschenberg; later Joseph Beuys and Arte Povera. He readily spoke of their impact on him.

His made a momentous first trip to Europe in 1962. He cried in front of van Goghs in Amsterdam, stood drop-jawed before Michelangelo in Rome. The major event, though, came when he and Hujar, traveling as lovers, stumbled on Capuchin catacombs in Sicily: caves packed with corpses encased in glass coffins and propped against walls. Hujar took photographs; Thek got ideas for a new kind of art.

What resulted were the sculptures of meat and amputated limbs, which Thek sealed into sleek Formica and plexiglass containers, and in one instance into an Andy Warhol Brillo box turned on its side. Collectively called "Technological Reliquaries," they were clearly sendups of Minimalism's industrial machismo and Pop's complicit consumerism — though at a time when a brutal war was building in Southeast Asia, they also hinted at larger politics.

The culminating work from this period, "The Tomb — Death of a Hippie," became Thek's most famous, and infamous, piece: it consisted of a full-size cast of his body laid out as if dead, surrounded by sacramental bowls and possible drug paraphernalia, inside a pink wooden pyramid. Readings of the image have been endless: it's a symbol of the putrefying ideals of the 1960s; it's a narcissistic joke. Whatever its meaning, the piece now exists only in photographs.

The European environments have met the same fate. Assembled by Thek and teams of artist friends, they were a form of performance art, continual works in progress. The retrospective's organizers — Elisabeth Sussman, curator of photography at the Whitney, and Lynn Zelevansky, the director of the Carnegie Museum of Art in Pittsburgh — have made little attempt to reconstitute them, and this was wise. The few elements that survive from the environments are without charisma. One that's in the show, a latex cast of Thek's nude body covered with a school of latex fish, is a ruin: once poetic, now grotesque.

By contrast, the paintings have held their own. A gallery hung with seascapes beautifully evokes Thek's blue-washed studio on the Italian island of Ponza. Pink paintings of dinosaurs and cherries project a distinctly Freudian nursery atmosphere common in his art. An arrangement hung over an Oriental carpet strewn with small bronze sculptures recalls a 1977 gallery show that Thek designed to look like sidewalk bazaar. He kept adding fresh pictures as he made them.

The little bronzes were among the last things Thek made in Europe, and are a kind of farewell to his itinerant life there. Titled "The Personal Effects of the Pied Piper," they include a loaf of bread, a campfire, a bowl holding seeds and a rosary, and a miniature house with a tower rising from its roof. The house, called "Uncle

Tom's Cabin With Tower of Babel," in turn provided the central image for the one American museum solo Thek had in his lifetime, at the Institute of Contemporary Art in Philadelphia.

The exhibition space there was awkward. But Thek got to stretch again, to make magic. The tower became a two-story-high version of Tatlin's monument to the Third International, itself based on the Mosque of Al Mutawakkil in Iraq. Uncle Tom's home, equipped with a baptismal bathtub and an illuminated world globe, was tucked inside.

As the years passed, Thek received a few more installation commissions, one for the São Paulo Biennial in 1985. But embittered and paranoid, he was unable to take advantage of most opportunities that involved interactions with an art world he had come to loathe, in part because it didn't embrace him.

The solitary painting went on. There were cityscapes seen from his tenement windows, and jazzy compositions based on verbal and visual puns. In 1988 came near-abstractions, mostly blue, on newspaper. In one an image of a clock is accompanied by the phrase "The Face of God." In another the word "Dust" floats half-obscured in a snow of flickering dots.

The blue pictures were in the last exhibition he personally installed, at an East Village storefront gallery. He hung them very close to the floor and set some kindergarten chairs nearby, implying that this was art for children, or for someone lying down. The installation, replicated at Brooke Alexander Gallery the summer Thek died, concludes the Whitney show.

And what of Thek today? There is little room for him in the existing history books, with their cut-and-dried geographies. Nor is his art a natural fit in conventional museums like the Whitney. The meat pieces are still frontal attacks on formalism, the art world's closely guarded safety zone. The installation leftovers are moldy stains on the modernist white box: organic to its inorganic, dirty to its clean; emotion to its reason.

So if Thek is taken seriously, and his widespread influence demonstrates that he is, traditional history has to be resurveyed and rewritten. It will no longer be a tale of fortress islands but of ships and swimmers moving among them. It will be a history of gigantic obsolescence, and precious semi-permanent slightness, of active anger and hard-earned relief. ("Afflict the comfortable; comfort the afflicted," is how Thek put it in a late painting.) And, of course, in that history he will take his rightful place.

http://www.nytimes.com/2010/10/22/arts/design/22thek.html

At Brookyn Museum, African-American Artworks Pre-1945

By CAROL VOGEL

Collection of Charlynn and Warren Goins/Brooklyn Museum

A detail of "Dream of Arcadia After Thomas Cole" (1852), by Robert S. Duncanson, has been promised to the Brooklyn Museum for its initiative devoted to collecting African-American art.

For the last decade the Brooklyn Museum has been actively acquiring work by contemporary African-American artists. Now curators there have started to look back in time. This week the museum announced it was embarking on a new collecting initiative focusing on the work of African-American artists from the mid-19th century to 1945, so that visitors can get a more complete picture of where contemporary artists like Rashid Johnson, Adrian Piper, Lorna Simpson and Kara Walker looked for inspiration.

"A lot of these older works are by artists many people have never heard of," said Arnold L. Lehman, director of the museum. "Yet there are many contemporary black artists looking back at their predecessors."

The institution has set a three-year goal for the project, aiming to raise $500,000 for a dedicated purchase fund. It has already received $100,000 from Saundra Williams-Cornwell, a trustee, and her husband, W. Don Cornwell, as well as $100,000 more promised by the Cornwells as a matching grant. Another trustee, Charlynn Goins, and her husband, Warren, have promised a gift of a painting: "Dream of Arcadia After Thomas Cole," an 1852 landscape by Robert S. Duncanson.

"Forty-five percent of our audience are people of color," Mr. Lehman said. "While we are doing this from a curatorial point of view, it does reflect what our visitors expect when they come to the museum."

Since the 1940s the Brooklyn Museum has been a showcase for African-American art, starting with its landmark exhibition "The Negro Artist Comes of Age." It has also organized several monographic exhibitions by artists like Jacob Lawrence, Romare Bearden, Martin Puryear and Jean-Michel Basquiat.

Mr. Lehman said that while there were no planned exhibitions of this work right now, the curators were working on developing a program of shows.

RESTORED MADONNA GLOWS

Keith Christiansen remembers all the times he stood in front of "Madonna and Child," a painting by the Italian Renaissance master Filippino Lippi, and thought, "What a dull, disappointing picture."

Yet Mr. Christiansen, chairman of European paintings at the Metropolitan Museum of Art, saw clues that suggested otherwise. The Strozzi family coat of arms — in the shape of three crescents — appears on the painting twice, once on a column capital to the left of the Madonna's head, and another time right above her, decorating the stonework, which suggests that "Madonna and Child" was commissioned by that super-rich ruling Florentine family. (The Strozzis had commissioned the artist many times; their chapel in the church of

Santa Maria Novella in Florence is decorated with Filippino frescos, so it was assumed that "Madonna and Child" was commissioned by the same family.)

When the painting entered the Met's collection in 1949, however, its surface was so dark that it seemed drab and quite ordinary, Mr. Christiansen said. The provenance showed that from 1923 to 1928 "Madonna and Child" had been owned by Joseph Duveen, the notorious art dealer who was known to send paintings like this to a restorer to make them more saleable.

In this case, that meant darkening the surface with varnishes so that the work would fit a preconceived idea of what collectors in those days thought an old master painting should look like. The results did not wear well. The layers of varnish and toning applied to "Madonna and Child" in the early 1920s became darker and duller over time.

Recently, when the Met received a request from the Scuderie del Quirinale in Rome to borrow "Madonna and Child" for an exhibition of Flippino's work there next year, Mr. Christiansen asked Michael Gallagher, the Met's chief conservator, and Karen Thomas, associate conservator, to take a look.

The conservators first had the painting X-rayed to make sure that the surface varnish and toning did not disguise extensive paint loss or severe abrasions. Once it was confirmed that "Madonna and Child" was in stable condition, Ms. Thomas went to work, carefully removing the added layers. As the painting's rich tones began appearing, workers in the museum's conservation studio started to gather and watch.

"We were hovering like vultures," Mr. Gallagher recalled. "As the layers easily came off, the transformation was dramatic."

Mr. Christiansen said the painting didn't just become brighter; details in the background, like a black servant fishing or a woman pouring water, suddenly became clearer too. And the Madonna, who had looked "brainless" before the cleaning, "actually has a refined, delicate expression," Mr. Christiansen said.

The metamorphosis is so startling that Mr. Christiansen now considers "Madonna and Child" among the Met's most important Italian Renaissance paintings. He is planning a small exhibition in mid-January around the painting and other works from the Strozzi family in the museum's collection.

GIFT TO ATLANTA MUSEUM

The West Foundation — whose founders, Charles and Marjorie West, have amassed an extensive collection of American paintings and sculptures in Atlanta — is giving 90 works to the High Museum of Art there. The art, which is worth more than $50 million, has been on loan to the institution for more than 20 years and includes landscape paintings by Frederic Edwin Church and Jasper Cropsey; portraits by Rembrandt Peale and William Sidney Mount; and sculptures by Hiram Powers and Chauncey Bradley Ives.

"This gift of American art puts us in the top five or six institutions in this country," said Michael E. Shapiro, director of the High. "Until now we never had this kind of work in our collection."

The foundation gave four of its Hudson River School paintings in honor of Gudmund Vigtel, the High's longtime director, who retired in 1991. It was Mr. Vigtel, Mr. Shapiro said, who had originally advised Mr. West, working closely with him during the years he was forming the collection.

Starting next Friday, the gift will be on view in the permanent-collection galleries. "This is a huge leap forward in one fell swoop," Mr. Shapiro said.

http://www.nytimes.com/2010/10/22/arts/design/22vogel.html?ref=design

Those Greek Heroes, Sometimes Behaving Badly

By KAREN ROSENBERG

Badisches Landesmuseum Karlsruhe.
Heroes, Mortals and Myths in Ancient Greece, at the Onassis Cultural Center, has a krater attributed to the Sappho Painter showing Odysseus escaping the Cyclops.

The ancient Greeks did not require perfection of their heroes, only greatness. They would certainly recognize some of our heroic figures (trapped miners, soldiers, quick-thinking pilots), but not our shock at the personal conduct of others (sports stars, politicians). Greek heroes misbehaved frequently, and when they did — Achilles dragging Hector's body behind his chariot, Odysseus boasting to the Cyclops Polyphemus — it was a matter to be settled between the hero and the gods.

"Heroes, Mortals and Myths in Ancient Greece," a rousing exhibition at the Onassis Cultural Center in Midtown Manhattan, offers an unusually down-to-earth look at some major heroic figures. It may help that the setting is the subterranean level of an office building rather than, say, the sunlit Greek and Roman galleries of the Metropolitan Museum.

Though light on connoisseurship and classical archaeology, the show is an excellent refresher course on myths and epics. And for children, it's a fine introduction to characters like Hercules and Odysseus.

The Onassis center is the final stop for this touring show, which was organized by, and made its debut at, the Walters Art Museum in Baltimore before traveling to the Frist Center for the Visual Arts in Nashville and the San Diego Museum of Art. It features about 90 objects from the Archaic, Classical and Hellenistic periods (the sixth through the first centuries B.C.), many of which come from major museums across North America and Europe.

The exhibition begins with a parade of four figures — Odysseus, Achilles, Hercules and Helen — as seen on painted vessels and in sculpture. Later sections widen the focus to include athletes, soldiers and other local heroes who are now obscure.

The shaggy, bearded Odysseus in a Roman bust looks like a humble fisherman, but a one-eyed head of Polyphemus nearby reminds you of Odysseus' harrowing escape from the Cyclops's cave. Recalling the episode in further detail, a krater attributed to the Sappho Painter shows a grimacing Odysseus making his way to safety while strapped to the underbelly of a sheep.

Not surprisingly, artists delighted in depicting some of Odysseus' less fortunate crew members. The painting on a tall lekythos, or oil jug, from the National Archaeological Museum in Athens shows two men transforming into pigs under the spell of the sorceress Circe.

Cunning was Odysseus' chief attribute, as Homer constantly reminds us. Achilles, meanwhile, was admired for his martial intelligence that, if unchecked, could result in vengeance of the ugliest variety. But the objects here show his softer side: his education by the centaur Chiron, his board-game sessions with Ajax and his eventual release of Hector's brutalized body after pleas from Priam.

Depicted on a huge amphora from the Toledo Museum of Art, that scene is one of the exhibition's most intense. It shows an imperious Achilles reclining on a chaise above Hector's bloodied corpse, as a supplicating Priam seems to reach forward for his son with every muscle in his body. Behind him Hermes gives a nudge to a servant bearing gifts — a reminder that the gods had the power to make or break heroes.
Heroism as destiny is the subtext of several images of the young Achilles (and his parents, the mortal Peleus and the sea nymph Thetis). Many Greek heroes had one divine parent and were, in essence, groomed for greatness from birth.
Hercules, the son of Zeus and the mortal Alcmene, was strong enough to strangle snakes as an infant (thus thwarting a death wish from his stepmother, Hera). In a Roman copy of a Hellenistic sculpture, he's a chubby toddler with a club and an impish smile.
Unlike most of the other heroes, who were associated with local cults, Hercules had pan-Hellenic appeal. He was also the only one to enjoy a semidivine status, ascending to Olympus to join his immortal wife Hebe, after much trial and tribulation on earth. The marriage is celebrated here in a pyxis attributed to the Meleager Painter.
Hercules had weaknesses too: wine and women. But artists mostly obsessed about the strength manifested in his extraordinary labors, to judge from the works on view. In a row of vessels, an action-film-like sequence, he overpowers Cerberus, the Hydra and the Erymanthian Boar, among others.
Things get even more interesting when Hercules meets the Amazons, the female warriors who used men as slaves and occasionally deigned to reproduce with them. The wall labels note that the ancient Greeks saw Amazons as quasi-heroes and paragons of beauty and athleticism.
They're more compelling, anyway, than the show's main heroine: Helen, the bride of Menelaus and catalyst of the Trojan War. She's a passive hero, a gorgeous liability. Or so it seems to modern-day viewers, seeing her passed from Menelaus to Paris and back again.
Yet the ancient Greeks worshiped her, particularly the young women of Sparta, who made ritual offerings to Helen in the hope that she would bless them with fertile marriages. The show's final sections include many other examples of hero-cult activity, mainly small votives and large reliefs that were placed at tombs or shrines.
Many of these heroes and their deeds, unlike those in the myths and epics, are unknown to us. Some were soldiers who died in battle, depicted in memoriam as idealized, beardless youths. (The inscription on one striking image of a warrior reads, "The boy is beautiful.") Others were mere children. (In the show's substantial catalog, the scholar John H. Oakley has a fascinating and unsettling essay on child-heroes in Greek art.)
Athletic competitions were also a form of hero worship, linked to Hercules and other strongmen. Horse racers, wrestlers and disc throwers populate the show's final gallery, inviting comparisons with contemporary sports celebrities. That idea can be misleading; the Panhellenic Games, for instance, were as much a religious and musical festival as a sporting event.
Why did the Greeks pay so much attention to heroes, especially minor ones, when they already had an entire pantheon of gods? One reason is that heroes, in death, were believed to have godlike powers over the living — powers they could use for good or evil.
They were ultimately mortal — a point underscored in the opening lines of the Iliad, in which "strong souls of heroes" are "hurled in their multitudes to the house of Hades"— but fame gave them a kind of immortality. (As W. H. Auden wrote, "No hero is immortal till he dies.")
The word hero has long since lost the ancients' sense of ambiguity, but the art retains it.
"Heroes, Mortals and Myths in Ancient Greece" continues through Jan. 3 at the Onassis Cultural Center, 645 Fifth Avenue, near 52nd Street; (212) 486-4448, onassisusa.org.

http://www.nytimes.com/2010/10/22/arts/design/22heroes.html?ref=design

Tweaking Tradition, Even in Its Temple

By ROBERTA SMITH

Los Angeles County Museum of Art, Modern and Contemporary Art Council Fund

If "John Baldessari: Pure Beauty" is any indication, the Metropolitan Museum of Art may finally be catching up to the 21st century. Granted, the museum has never met a century whose art it hasn't embraced. But its relationship to the latest thing has often felt forced and out of it.

Not so with its full-dress, lucidly installed retrospective of the art of John Baldessari, a tall, laconic Conceptual artist from California who turns 80 next year. The show may reach back nearly five decades, but it still has a hip quotient that is unusually high for the Met, given the expanses of hard-core Conceptual Art at its center — texts, photographs, jokes, philosophical propositions, video, art about art and more photographs — and the noticeable lack of conventional painting and sculpture.

Subtitle aside, the show is not, on the whole, a traditionally pretty sight. Visual pleasantry — which is nothing to sneer at — has never been Mr. Baldessari's main goal. His work amuses, unsettles, questions and makes you look twice and think thrice; laugh out loud; and in general gain a sharpened awareness of the overlapping processes of art-making, art viewing and art thinking.

It is notable for its drolleries of language and image, occasional descents into outright corniness and flat-footed insistence on randomness, coincidence or uninflected information as the artist's main compositional options. It is also remarkable for its early grasp of the role that photographs — both found and made, still and moving — could play in opening art to the outside world and to the strangeness of everyday life, and for its determination that the viewer participate in the process of creating a work's meaning.

Mr. Baldessari's art is saved from its own rigors by his love of color, born of his beginnings as a painter, and his passion for film, or at least the film stills of obscure B-movies, to which he seems to have been led by his pursuit of photography in all forms. These elements converge with a surprisingly triumphal sweep in the show's final galleries in the large, handsome rebuslike photo-montage installations that he has developed, with increasing complexity and hand-painted bits, over the past quarter century.

Organized by the Los Angeles County Museum of Art and the Tate Modern in London, and overseen at the Met by Marla Prather, senior consultant in the Met's department of 19th-century, modern and contemporary art, the exhibition occupies 11 galleries with more than 120 works from 1962 to 2010. Given Mr. Baldessari's cerebral mind-set, this sometimes verges on relentless.

You get a good dose of this mind-set at its strictest with the show's first work: "A Painting That Is Its Own Documentation" made in the late '60s. A landmark of Conceptual Art, this text painting in black on seven gray panels narrates its own life and exhibition history, starting with its inception ("June 19, 1968 Idea Conceived at 10:25 a.m.") and its initial public showing, in Mr. Baldessari's first gallery solo, also in 1968, at the Molly Barnes Gallery in Los Angeles. The work was painted and has been amended by various professional sign painters, its size increasing with its exhibition history. (A panel was added to accommodate the listing of the current show.)

Mr. Baldessari was a prime mover in the Conceptual Art revolution, when the art object was in disrepute and ideas were pre-eminent. But this exhibition establishes him as more than that. It reveals his career as a vital, unbroken through line from Pop to 1970s Conceptual Art to 1980s appropriation art, a movement that is unthinkable without his unusually direct influence. (Several 1980s appropriation artists like David Salle, Jack Goldstein, Matt Mullican and Troy Brauntuch were his students at the California Institute of the Arts in the 1970s.) Mr. Baldessari managed this span partly by being 10 years older than most Conceptualists. He was born in 1931 (a year after Jasper Johns) and was already making art when most of his artistic peers were barely in high school.

The show unfolds in three acts, beginnings with a gallery of early Pop-oriented, proto-Conceptualist work from the 1960s that will take many people by surprise for the evocations of nearly contemporary art by Andy Warhol, Jim Dine, Claes Oldenburg and the precocious king of Los Angeles Pop, Ed Ruscha. (The 1963 grid of photographs titled "The Backs of All the Trucks Passed While Driving From Los Angeles to Santa Barbara, California, Sunday, January 20, 1963" presages Mr. Ruscha's well-known book of photographs, "Every Building on the Sunset Strip," from 1966.)

In "Bird #1," from 1962, Mr. Baldessari paints a headless bird over a large printed image of one intended to be part of a billboard. (He had a friend in the business.) More baldly, "Autotire," from 1965, consists of an unaltered close-up of a tire tread, also from a billboard.

Just at the moment when the art critic Clement Greenberg was campaigning for the flatness of the picture plane, this work confronts the viewer with a mute, implacable image of flatness, industrial style. The next gallery includes a text-painting of a quotation from Greenberg about the instantaneousness of aesthetic judgment — which is considerably slowed down here by the reading process.

The show's first act concentrates on Mr. Baldessari's gradual leave taking of painting and his embrace of photo-based works. In 1969 he commissioned paintings from commercial artists, each based on a photograph he took of his hand pointing at this or that. My favorite is "Commissioned Painting: A Painting by Elmire Bourke," which centers on a paint-splattered surface that resembles a work by Jackson Pollock. The three examples here quietly satirize Photo Realism's celebration of exacting technique by demonstrating that it was available for hire.

There's a similar frisson — this time directed at the early alone-in-the-studio videos of Mr. Baldessari's fellow Conceptualist Bruce Nauman — in the 1971 video "I Am Making Art." It shows Mr. Baldessari standing in front of the camera assuming different poses and saying, "I am making art" with each shift of his hand or elbow.

Mr. Baldessari's excursions into Conceptual photography leave few stones unturned and are consistently amusing. He excels at playing photography off reality; a rudimentary example is a 1973 series of found photographs of natural disasters displayed in frames that are askew, even though the images are not.

His affinity for color is evident in two works from the ‘70s, the wonderfully dumb “Floating: Color,” for which he photographed big sheets of colored paper tossed one at a time from the second-story window of his house in Santa Monica, and the 33-minute video “Six Colorful Inside Jobs.” “Jobs” is an unvarying overhead shot of a person painting the walls and floor of a small room, first red, then orange and so on through six main colors of the spectrum.

In 1975 Mr. Baldessari began to leave Conceptual Art behind, apparently becoming fascinated with how movie stills, amended with shapes of bright color, could be used to structure meaning in ways porous enough for viewers to add their own. Wordless except for their often useful titles, and gray except for their startling bits of painted colors, these pieces fully exploit and usually satisfy our tendency to read narrative into every image that comes our way, a skill developed in no small part by watching movies.

At times I half-jokingly thought the show might have been better subtitled “Fun With Photography” or “I Survived Conceptual Art.” But in the end a kind of pure beauty does accrue. It is the beauty of economy that we perhaps more often associate with mathematics, and the purity of an artist who has never seen himself as the center of his art. It is not, contrary to expectations, a modest achievement.

“John Baldessari: Pure Beauty” is on view through Jan. 9 at the Metropolitan Museum of Art; (212) 535-7710, metmuseum.org.

http://www.nytimes.com/2010/10/22/arts/design/22baldessari.html?ref=design

A Show Is All Cyber, Some of the Time

By KAREN ROSENBERG

Benoit Pailley

It may seem like a stroke of morbid journalistic humor that the New Museum's "Free," a show exploring the Internet as a public art space, coincides with another exhibition titled "The Last Newspaper." On the third floor, artists are toiling in a makeshift newsroom; on the second, they're dismantling the last traces of print culture.

Or so you might think. In reality, the shows offer similar experiences — lots of reading, supplemented by video, photography, performance and multifarious conceptual object-tweaking.

Certainly the organizer of "Free" — Lauren Cornell, the executive director of Rhizome.org and an adjunct curator at the New Museum — deserves credit for thinking off-screen. "Art engaged with the Internet does not require it to exist online," she writes in her essay in the virtual catalog.

So sculptures that make use of objects found on eBay, by Hanne Mugaas and Amanda Ross-Ho, are fair game. So are Rashaad Newsome's collages of Web-based images, though these don't feel substantially different from the print variety.

Meanwhile, some significant platforms go ignored; none of the 50 works on view engage Facebook, YouTube (for that, you'll have to go to the Guggenheim — see Roberta Smith's review of "YouTube Play" on Page 29) or Twitter. (Tumblr, a Twitter competitor, does play a significant role.) These omissions feel like a missed opportunity.

In many ways "Free" is most interesting as an exercise in open-source curating. In her essays and labels, Ms. Cornell makes frequent references to the Creative Commons co-founder Lawrence Lessig's 2004 book "Free Culture" and the artist Seth Price's 2002 essay "Dispersion." Mr. Price's "Dispersion" is particularly relevant because it talks about the Web's superseding of physical public space.

"We should recognize that collective experience is now based on simultaneous private experiences, distributed across the field of media culture, knit together by ongoing debate, publicity, promotion and discussion," he writes.

True to its argument, "Dispersion" exists in multiple forms — one of which is a screenprinted-polystyrene wall sculpture titled "Essay With Knots" (2008).

But the art in "Free" doesn't always rise to the level of the dialogue. It's also darker and more cynical — or maybe it just looks that way, weeks after a Webcam prank made one teenager distraught enough to jump off the George Washington Bridge.

"LEAVE ME ALONE" says a giant T-shirt by Ms. Ross-Ho, despite the mellow associations of its tie-dyed rainbow spiral. The message is reinforced by three Northern Irish teenagers making an obscene gesture to a Google Street View camera, in one of several images painstakingly recovered and isolated by Jon Rafman.

Even projects rooted in creative problem-solving have a way of becoming dystopian. At last year's "Seven on Seven" conference, initiated by Ms. Cornell, artists were paired with Internet entrepreneurs and asked to innovate under strict time limits. The Internet-video artist Ryan Trecartin teamed up with David Karp, founder of the microblogging platform Tumblr. Their brainchild, "River the Net," is now projected on a large screen in the museum. Essentially it's a stream of video clips uploaded by visitors to their site, with tags that allow the viewer to toggle from one 10-second clip to the next. In an interview on an art blog, Mr. Trecartin described it as "a movie made by everyone and the plot arc is the life of a tag." With its attention-deficit pacing, it shares some of the qualities of Mr. Trecartin's own videos. It also looks a lot like the site Chatroulette, and has some of the same problems — becoming, at times, a vehicle for pornography. (The museum version, like the Web site, isn't censored.) But the real thrill is in the often odd coupling of words (each clip has three tags) and moving images.

An intense desire for communal experience underlies many of the works in "Free," whether or not they exist or were produced on the Internet. Aleksandra Domanovic's "19:30," a split-screen video installation, combines introductory graphics from local news programs from the former Yugoslavia with footage of techno-raves.

Similarly, Lisa Oppenheim's series of slide projections, "The Sun Is Always Setting Somewhere Else," mines the Flickr posts of United States soldiers in Iraq and Afghanistan for postcard-worthy photographs of sunsets. The Flickr images, printed out and held up to actual skies, transcend banality with a nagging sense of homesickness.

Other artists cleverly subvert the protocol of online communities. Using Yahoo! Answers, Joel Holmberg aims profound, existential inquiries at an audience more accustomed to supplying practical knowledge. It's amusing to see people struggle to field questions like, "How do you occupy space?"

Martijn Hendricks, meanwhile, infiltrates an online forum on the video of Saddam Hussein's execution. His "Untitled Black Video" (2009) shows the comments only, in white text at the bottom of a dark screen. Some cheer and others express outrage, but a sizable number simply complain about the poor video quality.

Technical difficulties inspire Andrea Longacre-White, who repeatedly reshoots low-resolution photographs of car accidents until the images themselves become blurry wrecks. Working in black and white, she's a Weegee for what we used to call the information superhighway.

Not everything in the show is gloomy, suspicious or sinister. The tone of Alexandre Singh's "School of Objects Criticized," a quirky and compelling sculptural tableau, is defiantly antic. Using spotlighted pedestals and a soundtrack, he transforms toys and household items into characters in a lively comedy of manners (after Molière's "School for Wives").

A feminist Slinky toy and a "neo-post-Marxist" bottle of bleach, among others, engage in dinner-party discussions about Duchamp, Woody Allen and other cultural touchstones. On paper it's childish, but in practice it skewers the chattering class and shows off Mr. Singh's excellent ear for dialogue (also flaunted in his lecture-style performances).

"School of Objects Criticized" has a room to itself, at the end of the show, and in many ways it stands apart. It doesn't seem to have much to do with the Internet, or "free culture"; in fact, an analog tape recorder is among the anthropomorphized items.

That's the problem with "Free," in general. It's a conversation and an exhibition that aren't quite on the same page.

"Free" continues through Jan. 23 at the New Museum, 235 Bowery, at Prince Street, Lower East Side; (212) 219-1222, newmuseum.org.

http://www.nytimes.com/2010/10/22/arts/design/22free.html?ref=design

Heeding a Call to Cross the River

By GUY TREBAY

Jerry Schatzberg

Jerry Schatzberg's 1966 portrait of the Rolling Stones; from left, Brian Jones, Keith Richards, Mick Jagger, Charlie Watts and Bill Wyman (seated).

A STIFF wind was blowing through Chelsea, driving the cold rain sideways. It was last Thursday, early evening, just after quitting time. Seven in the evening is hardly a decent hour for a must-attend party, let alone one held outdoors in a space sheltered, though barely, by the elevated train tracks of the High Line. Still, New York being New York, there were already people lining up by a half-shuttered riot gate, umbrellas blown inside-out, waiting to get in.

"Beyond! Beyond! *Beyond* was 'the city,'" the New York intellectual Alfred Kazin once wrote in a tender memoir of his Brownsville boyhood. Manhattan beckoned then and somehow it beckons still.

The guest of honor at this particular party may have been raised at the opposite geographic pole from Brownsville, way up on the Grand Concourse in the Bronx. But, like Kazin — like so many, really — Jerry Schatzberg once felt the magnetic pull of Manhattan and followed it across the river to a place where he could set about inventing himself.

First he was a fashion photographer, discovered and trained by the great Russian-born designer and photographer Alexey Brodovitch. Mr. Schatzberg photographed for Vogue, Esquire and Glamour, along with other magazines that dominated the publishing world 50 years ago and that anyone ineligible for a senior discount has never seen: Life, for instance, or McCall's.

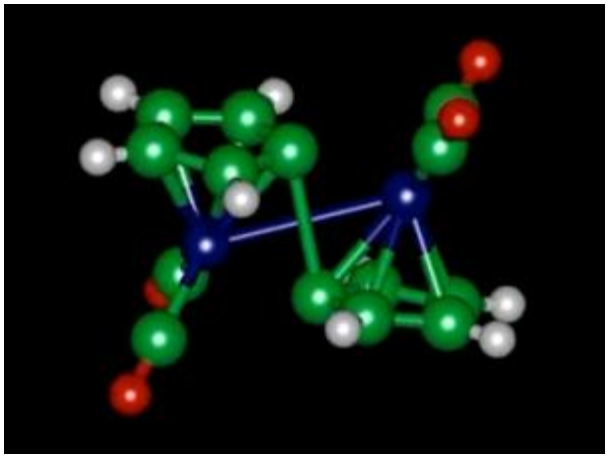
Then, somehow, in the mysterious way that can occur here, Jerry Schatzberg became a celebrity photographer, his lens trained "on everybody," as he said, the everybody in this case notably including Bob Dylan, whose friend and unofficial portraitist he became. The scowling, defining cover image for "Blonde on Blonde" was shot by Mr. Schatzberg, who by 1967 had become more than an auxiliary of the famous but a minor celebrity himself.

In a. Los Angeles Times article about Mr. Schatzberg, a journalist described coming upon him at the George V Hotel in Paris, where he was holed up with Faye Dunaway, one of the numerous beauties he was associated with across the years. "I guessed that this must be Jerry Schatzberg, 40-year-old fashion photographer and

Ms. Dunaway's true love of two years' standing," the reporter wrote. "He looks about 30, and was once the hero of an article in the late New York Herald Tribune entitled 'The Sweet Life of Jerry Schatzberg.' "
The sweet life of Jerry Schatzberg remains so, and not merely because he still looks 60 at 83. The sweet life after the years of fashion photography led to relationships, professional and otherwise, with stars of the era, people like Andy Warhol and Edie Sedgwick and Aretha Franklin and the Rolling Stones, whom he photographed at their manager's urging dressed in matronly costumes. "They were really into it," Mr. Schatzberg said of a now-legendary sitting for which all of the Rolling Stones, then still including Brian Jones, dragged-up in military woolens and support hose, dressed as war widows or members of the W.A.A.F. "They wanted to wear it all, including the underwear," Mr. Schatzberg said.
For the fans attending Thursday's party, an event celebrating publication of a new book titled "Women Then" (Rizzoli, $60) — "then" being the years from 1954 to 1969 — the shank of Mr. Schatzberg's career, the years he spent making movies, was surely the most memorable. That his films, often dismissed by critics here or else treated as cult obscurities, found a passionate following abroad owed a great deal to their sharp observations of the city, the coldness of its structure so at odds with the passions people bring here in their will to succeed. The followings his films attracted resulted in no small part from the performances he got out of actors — Stockard Channing, Al Pacino, Gene Hackman, Alan Alda, Sam Waterston — who, long before Hollywood claimed them, belonged to New York.
"I go to other countries and I'm treated like a spoiled child," Mr. Schatzberg said on Thursday. The spoiling, if that is the right word, has included accolades like the Palme d'Or at the Cannes Film Festival, which he was awarded for "Scarecrow," in 1973.
IN the New York of now, all that Mr. Schatzberg gets by way of celebration is an outdoor party with donated booze and hay bales for seating in a pop-up "Tea Shop" off 10th Avenue. All the same, he is not complaining. "I've spent so much time walking the city over the years," he said, "that there isn't any part of it that isn't like a studio for me."
His apartment is on the Upper West Side. His photography lab is in Bushwick. Wherever he goes, he takes his little digital Ricoh. Pulling the camera from the pocket of his leather jacket, he showed off a snapshot of an enormous warehouse standing in isolation on a desolate block in Bushwick. Blanketed with graffiti, it looked like a great monument to a lost civilization. Possibly it was.
The routes of Jerry Schatzberg's wanderings vary. He rides the subway sometimes and exits wherever the mood strikes, and hoofs it home. Not long ago, he led the German crew filming a documentary about him to one of those stops, near 175th Street and the Grand Concourse, which happens to be the neighborhood where he was raised.
Far from being unrecognizable, his old haunts, he said, were little altered. P.S. 70, which he attended, is still standing. It still looks a lot like it did then and also, he said, a lot like the backdrop for a freak death chillingly described in "World's Fair" by E. L. Doctorow, another neighborhood boy. The vendor who once sold two-penny ices is long gone. Yet 70 years later there remains a man on a corner with a cart selling shaved ice sweetened with syrup in poisonous colors. "The ices are $2 now," Mr. Schatzberg remarked.
Despite the wistful title of Mr. Schatzberg's new book, he is not nostalgic. He does not say so, but New York itself appears as a recurring character in "Women Then," alongside Faye Dunaway and Charlotte Rampling and Catherine Deneuve and Edie Sedgwick and the fashion models (Anne St. Marie, Betsy Pickering) whose stylized beauty is not so very different from that of the women at Thursday's party, the ones with Dries van Noten dresses and eager expressions, lovely and slightly, though necessarily, hard.
The city itself, Mr. Schatzberg said, is after all not so different now from the place it was then. "It's still the best experiment ever, because, like it not, we all come here and we come together with the same goals," he said, referring to the disparate hopefuls, the outlanders, the ones from distant countries and the ones like himself who come from places that once seemed pretty foreign, back when the rivers separating Manhattan from the other boroughs could seem impassable. "We all want the same thing when we come here," Jerry Schatzberg said. "We want to produce."

http://www.nytimes.com/2010/10/21/fashion/21Gimlet.html?ref=design

Stable Way to Store the Sun's Heat: Storing Thermal Energy in Chemical Could Lead to Advances in Storage and Portability



A molecule of fulvalene diruthenium, seen in diagram, changes its configuration when it absorbs heat, and later releases heat when it snaps back to its original shape. (Credit: Jeffrey Grossman)

ScienceDaily (Oct. 25, 2010) — Researchers at MIT have revealed exactly how a molecule called fulvalene diruthenium, which was discovered in 1996, works to store and release heat on demand. This understanding, reported in a paper published on Oct. 20 in the journal *Angewandte Chemie*, should make it possible to find similar chemicals based on more abundant, less expensive materials than ruthenium, and this could form the basis of a rechargeable battery to store heat rather than electricity.

The molecule undergoes a structural transformation when it absorbs sunlight, putting it into a higher-energy state where it can remain stable indefinitely. Then, triggered by a small addition of heat or a catalyst, it snaps back to its original shape, releasing heat in the process. But the team found that the process is a bit more complicated than that.

"It turns out there's an intermediate step that plays a major role," said Jeffrey Grossman, the Carl Richard Soderberg Associate Professor of Power Engineering in the Department of Materials Science and Engineering. In this intermediate step, the molecule forms a semi-stable configuration partway between the two previously known states. "That was unexpected," he said. The two-step process helps explain why the molecule is so stable, why the process is easily reversible and also why substituting other elements for ruthenium has not worked so far.

In effect, explained Grossman, this process makes it possible to produce a "rechargeable heat battery" that can repeatedly store and release heat gathered from sunlight or other sources. In principle, Grossman said, a fuel made from fulvalene diruthenium, when its stored heat is released, "can get as hot as 200 degrees C, plenty hot enough to heat your home, or even to run an engine to produce electricity."

Compared to other approaches to solar energy, he said, "it takes many of the advantages of solar-thermal energy, but stores the heat in the form of a fuel. It's reversible, and it's stable over a long term. You can use it where you want, on demand. You could put the fuel in the sun, charge it up, then use the heat, and place the same fuel back in the sun to recharge."

In addition to Grossman, the work was carried out by Yosuke Kanai of Lawrence Livermore National Laboratory, Varadharajan Srinivasan of MIT's Department of Materials Science and Engineering, and Steven Meier and Peter Vollhardt of the University of California, Berkeley.

The problem of ruthenium's rarity and cost still remains as "a dealbreaker," Grossman said, but now that the fundamental mechanism of how the molecule works is understood, it should be easier to find other materials that exhibit the same behavior. This molecule "is the wrong material, but it shows it can be done," he said. The next step, he said, is to use a combination of simulation, chemical intuition, and databases of tens of millions of known molecules to look for other candidates that have structural similarities and might exhibit the same behavior. "It's my firm belief that as we understand what makes this material tick, we'll find that there will be other materials" that will work the same way, Grossman said.
Grossman plans to collaborate with Daniel Nocera, the Henry Dreyfus Professor of Energy and Professor of Chemistry, to tackle such questions, applying the principles learned from this analysis in order to design new, inexpensive materials that exhibit this same reversible process. The tight coupling between computational materials design and experimental synthesis and validation, he said, should further accelerate the discovery of promising new candidate solar thermal fuels.
Funding: The National Science Foundation and an MIT Energy Initiative seed grant.

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Journal Reference:

1. Yosuke Kanai, Varadharajan Srinivasan, Steven K. Meier, K. Peter C. Vollhardt, Jeffrey C. Grossman. **Mechanism of Thermal Reversal of the (Fulvalene)tetracarbonyldiruthenium Photoisomerization: Toward Molecular Solar-Thermal Energy Storage**. *Angewandte Chemie International Edition*, 2010; DOI: 10.1002/anie.201002994

http://www.sciencedaily.com/releases/2010/10/101025161219.htm

Robotic Gripper Runs on Coffee ... and Balloons

Graduate student John Amend, left, and associate professor Hod Lipson with the universal robotic gripper. (Credit: Robert Barker/University Photography)

ScienceDaily (Oct. 25, 2010) — The human hand is an amazing machine that can pick up, move and place objects easily, but for a robot, this "gripping" mechanism is a vexing challenge. Opting for simple elegance, researchers from Cornell University, University of Chicago and iRobot have bypassed traditional designs based around the human hand and fingers, and created a versatile gripper using everyday ground coffee and a latex party balloon.

They call it a universal gripper, as it conforms to the object it's grabbing rather than being designed for particular objects, said Hod Lipson, Cornell associate professor of mechanical engineering and computer science. The research is a collaboration between the groups of Lipson, Heinrich Jaeger at the University of Chicago, and Chris Jones at iRobot Corp. It is published Oct. 25 online in *Proceedings of the National Academy of Sciences*.

"This is one of the closest things we've ever done that could be on the market tomorrow," Lipson said. He noted that the universality of the gripper makes future applications seemingly limitless, from the military using it to dismantle explosive devises or to move potentially dangerous objects, robotic arms in factories, on the feet of a robot that could walk on walls, or on prosthetic limbs.

Here's how it works: An everyday party balloon filled with ground coffee -- any variety will do -- is attached to a robotic arm. The coffee-filled balloon presses down and deforms around the desired object, and then a vacuum sucks the air out of the balloon, solidifying its grip. When the vacuum is released, the balloon becomes soft again, and the gripper lets go.

Jaeger said coffee is an example of a particulate material, which is characterized by large aggregates of individually solid particles. Particulate materials have a so-called jamming transition, which turns their behavior from fluid-like to solid-like when the particles can no longer slide past each other.

This phenomenon is familiar to coffee drinkers familiar with vacuum-packed coffee, which is hard as a brick until the package is unsealed.

"The ground coffee grains are like lots of small gears," Lipson said. "When they are not pressed together they can roll over each other and flow. When they are pressed together just a little bit, the teeth interlock, and they become solid."

Jaeger explains that the concept of a "jamming transition" provides a unified framework for understanding and predicting behavior in a wide range of disordered, amorphous materials. All of these materials can be driven into a 'glassy' state where they respond like a solid yet structurally resemble a liquid, and this includes many liquids, colloids, emulsions or foams, as well as particulate matter consisting of macroscopic grains.

"What is particularly neat with the gripper is that here we have a case where a new concept in basic science provided a fresh perspective in a very different area -- robotics -- and then opened the door to applications none of us had originally thought about," Jaeger said.

Eric Brown, a postdoctoral researcher, and Nick Rodenberg, a physics undergraduate, worked with Jaeger on characterizing the basic mechanisms that enable the gripping action. Prototypes of the gripper were built and tested by Lipson and Cornell graduate student John Amend as well as at iRobot.
As for the right particulate material, anything that can jam will do in principle, and early prototypes involved rice, couscous and even ground- up tires. They settled on coffee because it's light but also jams well, Amend said. Sand did better on jamming but was prohibitively heavy. What sets the jamming-based gripper apart is its good performance with almost any object, including a raw egg or a coin -- both notoriously difficult for traditional robotic grippers.
The project was supported by the Defense Advanced Research Projects Agency.
Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Cornell University**. The original article was written by Anne Ju.

Journal Reference:

1. Eric Brown, Nicholas Rodenberg, John Amend, Annan Mozeika, Erik Steltz, Mitchell R. Zakin, Hod Lipson, Heinrich M. Jaeger. **Universal robotic gripper based on the jamming of granular material**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.1003250107

http://www.sciencedaily.com/releases/2010/10/101025161140.htm

Vast Amber Deposit from India: New Trove of Fossils Suggests Global Distribution of Tropical Forest Ecosystems in the Eocene

This spider was found in the Cambay amber deposit of western India. (Credit: David Grimaldi/AMNH)

ScienceDaily (Oct. 26, 2010) — A vast new amber deposit in India has yielded 100 fossil spiders, bees, and flies that date to the Early Eocene, or 52-50 million years ago. These arthropods are not unique -- as would be expected on an island (which India was at that time) -- but have close evolutionary relationships with fossils from the Americas, Europe, and Asia. The amber is also the oldest evidence of a tropical broadleaf rainforest in Asia.

Bees, termites, spiders, and flies entombed in a newly-excavated amber deposit are challenging the assumption that India was an isolated island-continent in the Early Eocene, or 52-50 million years ago. Arthropods found in the Cambay deposit from western India are not unique -- as would be expected on an island -- but rather have close evolutionary relationships with fossils from other continents. The amber is also the oldest evidence of a tropical broadleaf rainforest in Asia.

The discovery is published this week in *Proceedings of the National Academy of Sciences*.

"We know India was isolated, but when and for precisely how long is unclear," says David Grimaldi, curator in the Division of Invertebrate Zoology at the American Museum of Natural History. "The biological evidence in the amber deposit shows that there was some biotic connection."

"The amber shows, similar to an old photo, what life looked like in India just before the collision with the Asian continent," says Jes Rust, professor of Invertebrate Paleontology at the Universität Bonn in Germany. "The insects trapped in the fossil resin cast a new light on the history of the sub-continent."

Amber from broadleaf trees is rare in the fossil record until the Tertiary, or after the dinosaurs went extinct. It was during this era that flowering plants rather than conifers began to dominate forests and developed the ecosystem that still straddles the equator today. The new amber, and amber from Colombia that is 10 million years older, indicates that tropical forests are older than previously thought.

In the research paper, Grimaldi, Rust, and colleagues describe the Cambay amber as the oldest evidence of tropical forests in Asia. The amber has been chemically linked to Dipterocarpaceae, a family of hardwood trees that currently makes up 80 percent of the forest canopy in Southeast Asia. Fossilized wood from this family was found as well, making this deposit the earliest record of these plants in India and showing that this family is nearly twice as old as was commonly believed. It most likely originated when portions of the southern supercontinent Gondwana were still connected.

Also reported in the paper are 100 arthropod species that represent 55 families and 14 orders. Some of these species are early relatives of highly social, or eusocial, insects like honey bees and stingless bees, rhinotermitid termites, and ants, suggesting that these groups radiated during or just prior to the early Eocene. And many of the Cambay fossils have relatives on other continents -- although not where it would be expected. Rather than finding evolutionary ties to Africa and Madagascar, landmasses that India had most recently been linked to as part of Gondwana, the researchers found relatives in Northern Europe, Asia, Australia, and the Americas.

"What we found indicates that India was not completely isolated, even though the Cambay deposit dates from a time that precedes the slamming of India into Asia," says Michael Engel, a professor in the Department of Ecology and Evolutionary Biology and curator of entomology at the University of Kansas. "There might have been some linkages."

Climate might have also played a role in the fauna found in the Cambay amber. The Early Eocene was a time of great climatic warmth: the tropics reached the poles. The researchers predict that the climate would have had an effect on the distribution of arthropods.

"The Cambay Formation spans a period of great warmth which led to a profusion of tropical groups spread around the world," says Grimaldi. "The diversity and evolutionary relationships in the Cambay deposit show how profound an effect climate has on groups."

In addition to Grimaldi, Rust, and Engel, authors include Tom McCann, Frauke Gerdes, and Monica Solórzano-Kraemer of the Universität Bonn in Germany; Hukam Singh of Birbal Sahni Institute of Palaeobotany in India; Rajendra S. Rana and Lacham Singh of H.N.B. Garhwal University in India; Ken Anderson of Southern Illinois University in Carbondale; Nivedita Sarkar and Ashok Sahni of the University of Lucknow in India; Paul C. Nascimbene of the American Museum of Natural History; Jennifer C. Thomas of the University of Kansas; and Christopher J. Williams of Franklin and Marshall College in Pennsylvania.

The research was funded in part by several organizations: American Museum of Natural History, U.S. National Science Foundation, National Geographic Society, and DFG (German Research Foundation).

Story Source:

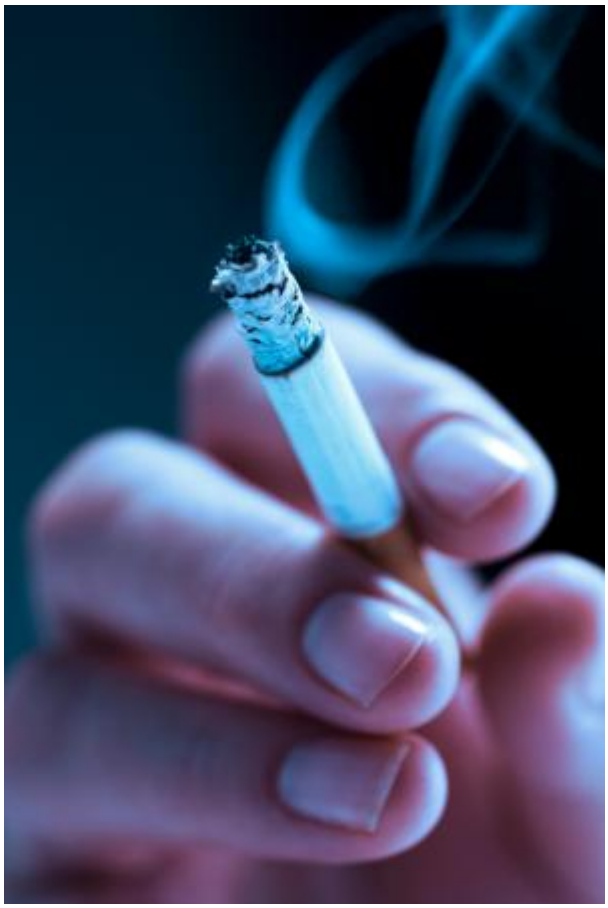
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **American Museum of Natural History**.

Journal Reference:

1. Jes Rust, Hukam Singh, Rajendra S. Rana, Tom Mccann, Lacham Singh, Ken Anderson, Nivedita Sarkar, Paul C. Nascimbene, Frauke Stebner, Jennifer C. Thomas, Monica Solórzano Kraemer, Christopher J. Williams, Michael S. Engel, Ashok Sahni, and David Grimaldi. **Biogeographic and evolutionary implications of a diverse paleobiota in amber from the early Eocene of India**. *PNAS*, October 25, 2010 DOI: 10.1073/pnas.1007407107

http://www.sciencedaily.com/releases/2010/10/101025152256.htm

Heavy Smoking in Midlife May Be Associated With Dementia in Later Years



New research finds that heavy smoking in middle age appears to be associated with more than double the risk for Alzheimer's disease and other forms of dementia two decades later. (Credit: iStockphoto/Mark Fairey)

ScienceDaily (Oct. 26, 2010) — Heavy smoking in middle age appears to be associated with more than double the risk for Alzheimer's disease and other forms of dementia two decades later, according to a report posted online that will be published in the February 28 print issue of *Archives of Internal Medicine*, one of the JAMA/Archives journals.

Current estimates suggest smoking is responsible for several million deaths per year from causes such as heart disease and cancer, according to background information in the article. Although smoking increases risks of most diseases and of death, some studies have shown a reduced risk of Parkinson's disease and other neurodegenerative conditions among smokers. "The link between smoking and risk of Alzheimer's disease, the most common subtype of dementia, has been somewhat controversial, with some studies suggesting that smoking reduces the risk of cognitive impairment," the authors write.

Minna Rusanen, M.D., of University of Eastern Finland and Kuopio University Hospital, Kuopio, Finland, and colleagues analyzed data from 21,123 members of one health care system who participated in a survey between 1978 and 1985, when they were 50 to 60 years old. Diagnoses of dementia, Alzheimer's disease and vascular dementia were tracked from Jan. 1, 1994 (when participants were an average of 71.6 years old), through July 31, 2008.

A total of 5,367 participants (25.4 percent) were diagnosed with dementia during an average of 23 years of follow-up, including 1,136 with Alzheimer's disease and 416 with vascular dementia. Those who smoked more than two packs per day in middle age had an elevated risk of dementia overall and also of each subtype,

Alzheimer's disease and vascular dementia, compared with non-smokers. Former smokers, or those who smoked less than half a pack per day, did not appear to be at increased risk.
Associations between smoking and dementia did not vary by race or sex. Smoking is a well-established risk factor for stroke, and may contribute to the risk of vascular dementia through similar mechanisms, the authors note. In addition, smoking contributes to oxidative stress and inflammation, believed to be important in the development of Alzheimer's disease. "It is possible that smoking affects the development of dementia via vascular and neurodegenerative pathways," the authors write.
"To our knowledge, this is the first study evaluating the amount of midlife smoking on long-term risk of dementia and dementia subtypes in a large multiethnic cohort," they conclude. "Our study suggests that heavy smoking in middle age increases the risk of both Alzheimer's disease and vascular dementia for men and women across different race groups. The large detrimental impact that smoking already has on public health has the potential to become even greater as the population worldwide ages and dementia prevalence increases."
Editor's Note: *This article is not intended to provide medical advice, diagnosis or treatment.*

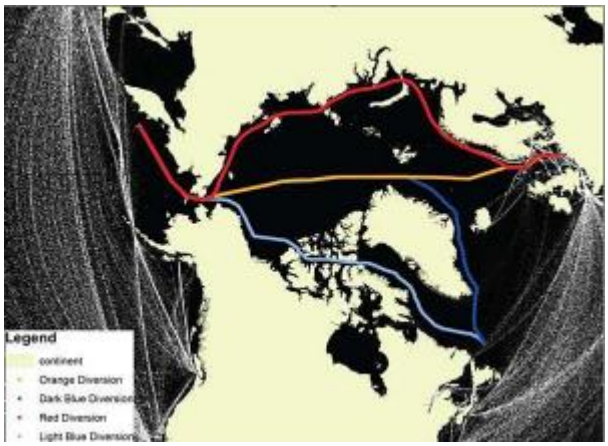
Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **JAMA and Archives Journals**.

Journal Reference:

1. Minna Rusanen; Miia Kivipelto; Charles P. Quesenberry, Jr; Jufen Zhou; Rachel A. Whitmer. **Heavy Smoking in Midlife and Long-term Risk of Alzheimer Disease and Vascular Dementia**. *Archives of Internal Medicine*, 2010; DOI: 10.1001/archinternmed.2010.393

http://www.sciencedaily.com/releases/2010/10/101025161034.htm

As Arctic Warms, Increased Shipping Likely to Accelerate Climate Change



If the Arctic Ocean continues to warm, new shipping lanes could emerge at the top of the world, as shown in these scenarios. An increase in shipping under current pollution controls in the Arctic could further accelerate warming. (Credit: Image courtesy of Prof. James Corbett, University of Delaware; published in Atmospheric Chemistry and Physics, Vol. 10, 2010.)

ScienceDaily (Oct. 26, 2010) — As the ice-capped Arctic Ocean warms, ship traffic will increase at the top of the world. And if the sea ice continues to decline, a new route connecting international trading partners may emerge -- but not without significant repercussions to climate, according to a U.S. and Canadian research team that includes a University of Delaware scientist.

Growing Arctic ship traffic will bring with it air pollution that has the potential to accelerate climate change in the world's northern reaches. And it's more than a greenhouse gas problem -- engine exhaust particles could increase warming by some 17-78 percent, the researchers say.

James J. Corbett, professor of marine science and policy at UD, is a lead author of the first geospatial approach to evaluating the potential impacts of shipping on Arctic climate. The study, "Arctic Shipping Emissions Inventories and Future Scenarios," is published in *Atmospheric Chemistry and Physics.*

Corbett's coauthors include D. A. Lack, from the National Oceanic and Atmospheric Administration (NOAA) Earth System Research Laboratory in Boulder, Colo.; James J. Winebrake, of the Rochester Institute of Technology; Susie Harder of Transport Canada in Vancouver, British Columbia; Jordan A. Silberman of GIS Consulting in Unionville, Pa.; and Maya Gold of the Canadian Coast Guard in Ottawa, Ontario.

"One of the most potent 'short-lived climate forcers' in diesel emissions is black carbon, or soot," says Corbett, who is on the faculty of UD's College of Earth, Ocean, and Environment. "Ships operating in or near the Arctic use advanced diesel engines that release black carbon into one of the most sensitive regions for climate change."

Produced by ships from the incomplete burning of marine fuel, these tiny particles of carbon act like 'heaters' because they absorb sunlight -- both directly from the sun, and reflected from the surface of snow and ice. Other particles released by ship engines also rank high among important short-lived climate forcers, and this study estimates their combined global warming impact potential.

To better understand the potential impact of black carbon and other ship pollutants on climate, including carbon dioxide, methane and ozone, the research team produced high-resolution (5-kilometer-by-5-kilometer) scenarios that account for growth in shipping in the region through 2050, and also outline potential new Arctic shipping routes.

Among the research team's most significant findings:

- Global warming potential in 2030 in the high-growth scenario suggests that short-lived forcing of ~4.5 gigatons of black carbon from Arctic shipping may increase the global warming potential due to ships' carbon dioxide emissions (~42,000 gigagrams) by some 17-78 percent.

- Ship traffic diverting from current routes to new routes through the Arctic is projected to reach 2 percent of global traffic by 2030 and to 5 percent in 2050. In comparison, shipping volumes through the Suez and Panama canals currently account for about 4 percent and 8 percent of global trade volume, respectively.

- A Northwest Passage and Northeast Passage through the Arctic Ocean would provide a distance savings of about 25 percent and 50 percent, respectively, with coincident time and fuel savings. However, the team says tradeoffs from the short-lived climate forcing impacts must be studied.

- To calculate possible benefits of policy action, the study provides "maximum feasible reduction scenarios" that take into account the incorporation of emissions control technologies such as seawater scrubbers that absorb sulfur dioxide emitted during the burning of diesel fuel. Their scenario shows that with controls, the amount of Arctic black carbon from shipping can be reduced in the near term and held nearly constant through 2050.

"To understand the value of addressing short-lived climate forcers from shipping, you need to know the impacts of these emissions, the feasibility and availability of technologies that could be put in place to reduce these impacts, and then engage the policy-making community to debate the evidence and agree on a plan," Corbett notes. "Our hope is that this study will enable better communication of emerging science with policy makers and aid the eight Arctic Council nations with climate policy."

Story Source:

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

Journal Reference:

1. J. J. Corbett, D. A. Lack, J. J. Winebrake, S. Harder, J. A. Silberman, M. Gold. **Arctic shipping emissions inventories and future scenarios**. *Atmospheric Chemistry and Physics*, 2010; 10 (19): 9689 DOI: 10.5194/acp-10-9689-2010

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Haiti Earthquake Caused by Unknown Fault; Blamed Fault Ready to Produce Large Earthquake

After earthquake in Haiti. Researchers found a previously unmapped fault was responsible for the devastating Jan. 12 earthquake in Haiti and that the originally blamed fault remains ready to produce a large earthquake. (Credit: iStockphoto/Niko Guido)

ScienceDaily (Oct. 26, 2010) — Researchers found a previously unmapped fault was responsible for the devastating Jan. 12 earthquake in Haiti and that the originally blamed fault remains ready to produce a large earthquake.

Eric Calais, a Purdue University professor of earth and atmospheric sciences, led the team that was the first on the ground in Haiti after the magnitude 7.0 earthquake, which killed more than 200,000 people and left 1.5 million homeless.

The team determined the earthquake's origin is a previously unmapped fault, which they named the Léogâne fault. The newly discovered fault runs almost parallel to the Enriquillo fault, which was originally thought to be the source of the earthquake, he said.

"This means that the Enriquillo fault is still capable of producing large earthquakes and that Haiti has to adapt to this seismic hazard," said Calais, who in September was appointed science adviser for the United Nations Development Program in Haiti. "The fault system is more complex than we originally thought, and we don't yet know how the January earthquake impacted the other faults. Preliminary measurements indicate that the Enriquillo fault did not release any accumulated seismic energy and, therefore, remains a significant threat for Haiti, and Port-au-Prince in particular. We need to investigate the fault system further to be able to determine where the next earthquakes might occur and how large they could be."

The shifting of the Earth's crust after a major earthquake can add to or reduce stresses building up in nearby faults and can apply pressures that effectively stop or release other earthquakes. Because of this, the earthquake along the Léogâne fault may have delayed or advanced the timing for the next earthquake on the Enriquillo fault, he said.

"For practical purposes, speculating on when the next earthquake might happen is not an effective strategy," Calais said. "We rather need to focus attention, energy and funds on proactive measures to help the country adapt to earthquake hazards and, eventually, reduce economic losses and save lives. Our finding raises many important scientific questions and we are working to find the answers, but we already know that the earthquake threat in Haiti is inexorable. The reconstruction process that is now starting in Haiti is an opportunity to build better, of course, but also to develop an effective prevention and mitigation strategy for the future."

The team analyzed data they recorded before the Jan. 12 earthquake and new measurements taken after the event. Their work is detailed in a paper that will be published in the November issue of *Nature Geosciences*.

Andrew Freed, paper co-author and a Purdue professor of earth and atmospheric sciences, said the absence of any surface rupture was the first clue that the earthquake did not happen along the Enriquillo fault.

"It was a big surprise that we couldn't find a surface rupture anywhere," Freed said. "We did find other physical changes that we expected after an earthquake of that magnitude, but in entirely the wrong location to have come from the Enriquillo fault."

For instance the team found that the epicenter area rose by a little more than half a meter and that the earthquake caused contraction of the Earth's crust opposite of what would be expected from the Enriquillo fault, he said.

The team used global positioning system equipment and radar interferometry to measure how the ground moved during the earthquake, which provides insight into what is happening as much as 20 kilometers below the surface. The team then used a computer model to determine what characteristics the source of the earthquake must have in order to produce the observed changes.

Through this work, the team discovered the previously unmapped Léogâne fault, which is located just to the north of the Enriquillo fault and dips by a 60-degree angle to the north. The fault is a blind thrust, meaning one side of the fault is being thrust over the other, but the fault does not reach the surface.

About 30 kilometers of the fault shifted during the January earthquake, and the sides of the fault moved by as much as five meters relative to each other below the Earth's surface. The full length of the fault is not known, Freed said.

"Only portions of a fault are affected during any given earthquake, and the length of the portion affected is relative to the magnitude of the event," Freed said. "Because this is a blind fault, we don't have some of the clues at the surface, like scars from past ruptures, that show where the fault runs. On the Enriquillo fault you can almost walk the line of the fault because scars from many past events reveal the fault below. That isn't the case with the Léogâne fault."

The team plans to continue to take measurements of the postseismic processes that allow them to understand changing stresses within the Earth's crust over time that could help point to areas where seismic hazard is increasing. In addition they plan to create models to better understand the fault systems, their behavior and why they exist at these particular locations, Freed said.

In addition to Freed, co-authors include Glen Mattioli of the University of Arkansas; Falk Amelung, Sang-Hoon Hong and Timothy Dixon of the University of Miami; Sigurjón Jónsson of the King Abdullah University of Science and Technology in Saudi Arabia; Pamela Jansma of the University of Texas at Arlington; Claude Prépetit of the Bureau of Mines in Haiti; and Roberte Momplaisir of the State University of Haiti.

Calais has studied the Enriquillo and Septentrional faults on the island of Hispaniola, which includes Haiti and the Dominican Republic, since 1989. His research team has been measuring the build up of energy along these faults using global positioning system technology for 10 years. The team first reported the risk for a major earthquake there in 2008.

This work was funded by the National Science Foundation and the National Disaster Risk Management System Development Program of the United Nations Development Program in Haiti. It was performed in collaboration with, and in support to, the Haitian National System for Disaster Risk Reduction.

Story Source:

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

Journal Reference:

1. Eric Calais, Andrew Freed, Glen Mattioli, Falk Amelung, Sigurjón Jónsson, Pamela Jansma, Sang-Hoon Hong, Timothy Dixon, Claude Prépetit, Roberte Momplaisir. **Transpressional rupture of an unmapped fault during the 2010 Haiti earthquake**. *Nature Geoscience*, 2010; DOI: 10.1038/ngeo992

http://www.sciencedaily.com/releases/2010/10/101025161154.htm

Why Does Lack of Sleep Affect Us Differently? Study Hints It May Be in Our Genes

New research suggests that genetic differences may explain why some people breeze along on four hours of sleep when others can barely function. (Credit: iStockphoto/Chris Bernard)

ScienceDaily (Oct. 25, 2010) — Ever wonder why some people breeze along on four hours of sleep when others can barely function? It may be in our genes, according to new research and an accompanying editorial published in the October 26, 2010, print issue of *Neurology®,* the medical journal of the American Academy of Neurology.

The study looked at people who have a gene variant that is closely associated with narcolepsy, a sleep disorder that causes excessive daytime sleepiness. However, having the gene variant, called DQB1*0602, does not mean that a person will develop narcolepsy; depending on the population, 12 to 38 percent of those with the variant do not have the sleep disorder and are considered healthy sleepers. Also, people without the gene variant can develop narcolepsy, though this is less common.

For the study, 92 healthy adults without the gene variant were compared to 37 healthy adults who had the gene variant but did not have any sleep disorders. All of the participants came to a sleep laboratory. For the first two nights, they spent 10 hours in bed and were fully rested. The next five nights they underwent chronic partial sleep deprivation, also known as sleep restriction, where they were allowed four hours in bed per night. During the remaining time, lights were kept on and participants could read, play games, or watch movies to help them stay awake.

Researchers measured their sleep quality and self-rated sleepiness and tested their memory, attention and ability to resist sleep during the daytime.

The people with the DQB1*0602 gene variant were sleepier and more fatigued while both fully rested and sleep deprived. Their sleep was more fragmented. For example, those with the gene variant woke up on average almost four times during the fifth night of sleep deprivation, compared to those without the gene variant, who woke up on average twice. Those with the gene variant also had a lower sleep drive, or desire to sleep, during the fully rested nights.

Those with the gene variant also spent less time in deep sleep than those without the variant, during both the fully rested and sleep deprivation nights. During the second fully rested night, those with the variant had an average of 34 minutes in stage three sleep, compared to 43 minutes for those without the variant. During the fifth night of sleep deprivation, those with the variant spent an average of 29 minutes in stage three sleep, compared to 35 minutes for those without the variant.

The two groups performed the same on the tests of memory and attention. There was also no difference in their ability to resist sleep during the daytime.

"This gene may be a biomarker for predicting how people will respond to sleep deprivation, which has significant health consequences and affects millions of people around the world. It may be particularly

important to those who work on the night shift, travel frequently across multiple time zones, or just lose sleep due to their multiple work and family obligations. However, more research and replication of our findings are needed," said lead study author Namni Goel, PhD, of the University of Pennsylvania School of Medicine in Philadelphia.

The study was supported by the National Space Biomedical Research Institute, the National Institutes of Health, the Institute for Translational Medicine and Therapeutics and the National Center for Research Resources.

Editor's Note: *This article is not intended to provide medical advice, diagnosis or treatment.*

Story Source:

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

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http://www.sciencedaily.com/releases/2010/10/101025161023.htm

Beauty from the Bottom Up: Flamingos Add Natural 'Make-Up' to Their Feathers to Attract Mates

New research reveals that flamingos apply natural make-up to their feathers to stand out and attract mates. (Credit: iStockphoto/Charles Gibson)

ScienceDaily (Oct. 25, 2010) — Flamingos apply natural make-up to their feathers to stand out and attract mates, according to a new study by Juan Amat, from the Estación Biológica de Doñana in Seville, Spain, and colleagues. Their research is the first to demonstrate that birds transfer the color pigments (carotenoids) from the secretions of their uropygial gland for cosmetic reasons. The uropygial or preen gland is found in the majority of birds and is situated near the base of the tail.

The study is published online in *Behavioral Ecology and Sociobiology*, a Springer journal.

There is evidence that the color of feathers may change due to abrasion, photochemical change and staining, either accidental or deliberate. Some bird species modify the color of their feathers by deliberately applying substances that are either produced by the birds themselves or from external sources. Among the substances produced by birds are the secretions of the uropygial gland, which may be pigmented orange, red or yellow. Amat and team studied seasonal variations in plumage color in relation to courtship activity of the greater flamingo *Phoenicopterus roseus* in Spain. They then looked for the pigments that may tinge the plumage both in the secretions of the uropygial gland and on the surface of feathers. They also observed whether the birds displayed a specific behavior to acquire and maintain the coloration of their feathers. Lastly, they compared the timing of cosmetic coloration with annual reproductive patterns -- egg-laying specifically.

They found that the plumage of flamingos was more colorful during periods in which the birds were displaying in groups and faded during the rest of the year. This fading occurred shortly after the birds started to breed. They also found evidence that the birds transferred carotenoids from their uropygial gland to their feathers by rubbing their head on their neck, breast and back feathers. Because rubbing behavior was much more frequent during periods when the birds were displaying in groups and the color of the feathers faded after egg hatching, the authors believe that the primary function of cosmetic coloration in flamingos may be related to mate choice.

They conclude: "Our findings in flamingos have important implications for the theories of sexual selection and signaling, highlighting the key role of the manipulation of plumage color by the birds themselves to improve signal efficacy."

Story Source:

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

Journal Reference:

1. Juan A. Amat, Miguel A. Rendón, Juan Garrido-Fernández, Araceli Garrido, Manuel Rendón-Martos, Antonio Pérez-Gálvez. **Greater flamingos Phoenicopterus roseus use uropygial secretions as make-up**. *Behavioral Ecology and Sociobiology*, 2010; DOI: 10.1007/s00265-010-1068-z

http://www.sciencedaily.com/releases/2010/10/101025101634.htm

Global Warming to Bring More Intense Storms to Northern Hemisphere in Winter and Southern Hemisphere Year Round

Stormy sea in the Southern hemisphere. More intense storms will occur in the Southern Hemisphere throughout the year, whereas in the Northern Hemisphere, the change in storminess will depend on the season -- with more intense storms occurring in the winter and weaker storms in the summer. (Credit: iStockphoto/Paul Pegler)

ScienceDaily (Oct. 25, 2010) — Weather systems in the Southern and Northern hemispheres will respond differently to global warming, according to an MIT atmospheric scientist's analysis that suggests the warming of the planet will affect the availability of energy to fuel extratropical storms, or large-scale weather systems that occur at Earth's middle latitudes. The resulting changes will depend on the hemisphere and season, the study found.

More intense storms will occur in the Southern Hemisphere throughout the year, whereas in the Northern Hemisphere, the change in storminess will depend on the season -- with more intense storms occurring in the winter and weaker storms in the summer. The responses are different because even though the atmosphere will get warmer and more humid due to global warming, not all of the increased energy of the atmosphere will be available to power extratropical storms. It turns out that the changes in available energy depend on the hemisphere and season, according to the study, published in the *Proceedings of the National Academy of Sciences*.

Fewer extratropical storms during the summer in the Northern Hemisphere could lead to increased air pollution, as "there would be less movement of air to prevent the buildup of pollutants in the atmosphere," says author Paul O'Gorman, the Victor P. Starr Career Development Assistant Professor of Atmospheric Science in MIT's Department of Earth, Atmospheric and Planetary Sciences. Likewise, stronger storms year-round in the Southern Hemisphere would lead to stronger winds over the Antarctic Ocean, which would impact ocean circulation. Because the ocean circulation redistributes heat throughout the world's oceans, any change could impact the global climate.

O'Gorman's analysis examined the relationship between storm intensity and the amount of energy available to create the strong winds that fuel extratropical storms. After analyzing data compiled between 1981 and 2000 on winds in the atmosphere, he noticed that the energy available for storms depended on the season. Specifically, it increased during the winter, when extratropical storms are strong, and decreased during the summer, when they are weak.

Because this relationship could be observed in the current climate, O'Gorman was confident that available energy would be useful in relating temperature and storminess changes in global-warming simulations for the 21st century. After analyzing these simulations, he observed that changes in the energy available for storms were linked to changes in temperature and storm intensity, which depended on the season and hemisphere. He

found that available energy increased throughout the year for the Southern Hemisphere, which led to more intense storms. But for the Northern Hemisphere, O'Gorman observed that available energy increased during the winter and decreased during the summer.
This makes sense, O'Gorman says, because the changes in the strength of extratropical storms depend on where in the atmosphere the greatest warming occurs; if the warming is greatest in the lower part of the atmosphere, this tends to create stronger storms, but if it is greatest higher up, this leads to weaker storms. During the Northern Hemisphere summer, the warming is greatest at higher altitudes, which stabilizes the atmosphere and leads to less intense storms.
Although the analysis suggests that global warming will result in weaker Northern Hemisphere storms during the summer, O'Gorman says that it's difficult to determine the degree to which those storms will weaken. That depends on the interaction between the atmosphere and the oceans, and for the Northern Hemisphere, this interaction is linked to how quickly the Arctic Ocean ice disappears. Unfortunately, climate scientists don't yet know the long-term rate of melting.

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Massachusetts Institute of Technology**. The original article was written by Morgan Bettex, MIT News Office.

Journal Reference:

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http://www.sciencedaily.com/releases/2010/10/101025152249.htm

Tiny Brained Bees Solve a Complex Mathematical Problem

New research shows that bumblebees can find the solution to a complex mathematical problem which keeps computers busy for days. (Credit: iStockphoto/Alexey Kryuchkov)

ScienceDaily (Oct. 25, 2010) — Bumblebees can find the solution to a complex mathematical problem which keeps computers busy for days. Scientists at Royal Holloway, University of London and Queen Mary, University of London have discovered that bees learn to fly the shortest possible route between flowers even if they discover the flowers in a different order. Bees are effectively solving the 'Travelling Salesman Problem', and these are the first animals found to do this.

The Travelling Salesman must find the shortest route that allows him to visit all locations on his route. Computers solve it by comparing the length of all possible routes and choosing the shortest. However, bees solve it without computer assistance using a brain the size of grass seed.

Dr Nigel Raine, from the School of Biological Sciences at Royal Holloway explains: "Foraging bees solve travelling salesman problems every day. They visit flowers at multiple locations and, because bees use lots of energy to fly, they find a route which keeps flying to a minimum."

The team used computer controlled artificial flowers to test whether bees would follow a route defined by the order in which they discovered the flowers or if they would find the shortest route. After exploring the location of the flowers, bees quickly learned to fly the shortest route.

As well as enhancing our understanding of how bees move around the landscape pollinating crops and wild flowers, this research, which is due to be published in *The American Naturalist*, has other applications. Our lifestyle relies on networks such as traffic on the roads, information flow on the web and business supply chains. By understanding how bees can solve their problem with such a tiny brain we can improve our management of these everyday networks without needing lots of computer time.

Dr Raine adds: "Despite their tiny brains bees are capable of extraordinary feats of behaviour. We need to understand how they can solve the Travelling Salesman Problem without a computer. What short-cuts do they use?'

Editor's Note: *This article is not intended to provide medical advice, diagnosis or treatment.*

Story Source:

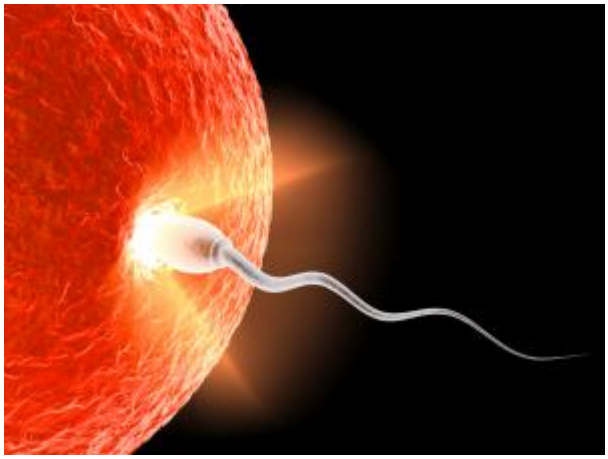
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Royal Holloway London**.

Journal Reference:

1. Mathieu Lihoreau, Lars Chittka, Nigel E. Raine. **Travel optimization by foraging bumblebees through readjustments of traplines after discovery of new feeding locations**. *The American Naturalist*, 2010; DOI: 10.1086/657042

http://www.sciencedaily.com/releases/2010/10/101025090020.htm

Study Raises Concern About Ability of Tests to Predict Fertility



The method used to assess infertility in at-home tests might not be the best for identifying which women will have trouble getting pregnant. (Credit: iStockphoto/David Marchal)

ScienceDaily (Oct. 26, 2010) — The method used to assess infertility in at-home tests might not be the best for identifying which women will have trouble getting pregnant, according to new research from the University of North Carolina at Chapel Hill School of Medicine.

The study found that the cutoffs used by such infertility tests, which measure levels of a molecule called follicle stimulating hormone or FSH, label many women as infertile who actually go on to have children naturally.

It also suggests that another hormone, called antimullerian hormone or AMH, could prove to be a much better harbinger of infertility.

"That is not to say that these tests are useless, but they certainly warrant further investigation," said lead study author Anne Z. Steiner, MD, MPH, assistant professor of obstetrics and gynecology at UNC. "Our findings may mean that we need to go back to the drawing board and change the potential cutoff for infertility in the current tests, or perhaps we need to explore other tests altogether."

Steiner presented her research on Oct. 26, 2010 at the annual meeting of the American Society for Reproductive Medicine in Denver, Colorado. Steiner is also a member of the North Carolina Translational and Clinical Sciences (NC TraCS) Institute, the academic home of the Clinical and Translational Science Awards (CTSA) at UNC.

Many women have been waiting until later in life to start a family, driving up the demand for a simple pee stick or blood draw that can predict how many reproductive years they have left. Since a major cause of reproductive aging is the aging of the ovary, most of the focus has been on looking at markers of ovarian aging -- such as FSH or AMH -- as a potential fertility test.

Levels of FSH have been proven to predict the timing of menopause and the probability of conceiving following assisted reproductive technology, but it is not clear if they can also predict natural fertility (or infertility) in the general population.

Through the pilot phase of a project called Time to Conceive, Steiner and her colleagues looked at 100 women who were at risk of reproductive aging, defined as being between the ages of 30 and 45. As soon as these women came off birth control, the researchers began to measure levels of the hormones estrogen, FSH, and AMH. They then used statistical modeling to adjust for intercourse patterns and see if the hormone levels correlated with how long it took to get pregnant. The premise was relatively simple: people who take longer to get pregnant are less fertile than people who get pregnant very quickly.

In recreating the conditions used in the current fertility tests, they found that a quarter of the women had abnormal FSH levels and would be deemed infertile. But when the researchers followed these women for six months, they found that they did not have more difficulty getting pregnant than the others in the study.

However, when they raised the threshold of these tests to a higher value of the hormone, they did find an association with infertility.
"So it may be that this test can pinpoint infertility, but we need to uniquely define where that cutoff is going to be," said Steiner.
The researchers also found that AMH, FSH's sister hormone, was vastly superior at predicting fertility. Unfortunately, AMH can only be measured in the blood and not the urine, and even the blood test has not been approved for clinical use. But Steiner says with further study the use of this other hormone may provide a more accurate infertility test.
Steiner continues to enroll women in the Time to Conceive study, which will eventually follow a total of 750 women for up to twelve months.
"Hopefully we can find a better way of predicting infertility so we can provide women with more reproductive control," said Steiner.
The research was funded by the National Institutes of Health. Study co-authors include Amy H. Herring, PhD and Steven Hoberman, MPH, UNC; Frank Z. Stanczyk, PhD, University of Southern California; and Donna D. Baird, PhD, National Institute of Environmental Health Sciences.
Editor's Note: *This article is not intended to provide medical advice, diagnosis or treatment.*

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

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Key Molecules in Multiple Myeloma Identified

ScienceDaily (Oct. 26, 2010) — New research links three molecules to a critical tumor suppressor gene that is often turned off in multiple myeloma, a presently incurable cancer of the blood.

The findings might offer a new strategy for treating this disease and other blood cancers, according to researchers at The Ohio State University Comprehensive Cancer Center-Arthur G. James Cancer Hospital and Richard J. Solove Research Institute (OSUCCC -- James) who led the study.

The silenced molecules are called miR-192, miR-194 and miR-215. All of them are microRNAs, a large class of molecules that are master regulators of many important cell processes.

The study, published in the Oct. 19 issue of Cancer Cell, suggests that re-activating these three molecules triggers expression of the P53 tumor suppressor gene. This, in turn, slows the growth and leads to the death of myeloma cells and could provide a new strategy for treating the disease.

"These findings provide a rationale for the further exploration of these microRNAs as a treatment for multiple myeloma, which has few therapeutic options," says principal investigator Dr. Carlo Croce, professor and chair of Molecular Virology, Immunology and Medical Genetics, and director of the Human Cancer Genetics program at the OSUCCC -- James.

Multiple myeloma is a disorder of white blood cells called plasma cells. More than 20,100 Americans are expected to develop the disease this year and some 10,600 are expected to die from it. Myeloma begins as a benign condition called monoclonal gammopathy of undetermined significance (MGUS). Individuals with MGUS can live for many years without treatment. Then, for unknown reasons, this benign condition can evolve into multiple myeloma.

Studies investigating the molecular causes of the disease have shown a relationship between P53 and another gene called MDM2. They have also shown that myeloma cells often have healthy (i.e., unmutated) P53 genes but very little P53 protein. P53 protein levels are restored, however, when MDM2 expression is blocked. The study by Croce and his collaborators, which examines the role of microRNA in regulating the P53 pathway in myeloma cells, shows the following:

- Expression of miR-192, miR-194 and miR-215 in multiple myeloma cells slows their growth and causes their death by activating the P53 gene;
- Multiple myeloma cells from patients show high MDM2 expression compared with MGUS cells and normal plasma cells;
- Expression of the three microRNAs dramatically lowers MDM2 expression levels and significantly increases P53 levels;
- Treating myeloma cells with the three microRNAs plus an MDM2 inhibitor caused a two-fold rise in P53 expression and a three-fold drop in MDM2 expression;
- Treating a myeloma mouse model with the three microRNAs caused a 50 percent reduction in tumor size compared with controls; treating the mice with the microRNAs plus an MDM2 inhibitor brought a five-fold reduction in tumor size.
- Expression of the three microRNAs reduced the ability of myeloma cells to migrate and metastasize.

Overall, Croce says, "our results provide the basis for developing a microRNA-based therapy for multiple myeloma."

Funding from the Kimmel Foundation helped support this research.

Other researchers involved in this study were Flavia Pichiorri, Sung-Suk Suh, Cristian Taccioli, Ramasamy Santhanam, Wenchao Zhou, Don M. Benson, Jr., Craig Hofmainster, Hansjuerg Alder, Michela Garofalo, Gianpiero Di Leva, Stefano Volinia, Huey-Jen Lin, Danilo Perrotti and Rami I. Aqeilan from Ohio State University; Alberto Rocci, University of Turin, Turin, Italy; Luciana De Luca, Referral Cancer Center of Basilicata-Crob, Rionero in Vulture, Italy; Michael Kuehl, Center for Cancer Research, National Cancer Institute, USA; and Antonio Palumbo, University of Turin, Turin, Italy.

***Editor's Note**: This article is not intended to provide medical advice, diagnosis or treatment.*

Story Source:
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Women's Choices, Not Abilities, Keep Them out of Math-Intensive Fields

ScienceDaily (Oct. 26, 2010) — The question of why women are so underrepresented in math-intensive fields is a controversial one. In 2005, Lawrence Summers, then president of Harvard University, set off a storm of controversy when he suggested it could be due partly to innate differences in ability; others have suggested discrimination or socialization is more to blame. Two psychological scientists have reviewed all of the evidence and concluded that the main factor is women's choices -- both freely made, such as that they'd rather study biology than math, and constrained, such as the fact that the difficult first years as a professor coincide with the time when many women are having children.

Psychological scientists Stephen Ceci and Wendy Williams of Cornell University set out to understand the differences between men and women in math-intensive fields such as physics, electrical engineering, computer science, economics, and chemistry. In the top 100 U.S. universities, only 9% to 16% of tenure-track positions in these kinds of fields are held by women.

But girls' grades in math from grade school through college are as good as or better than boys', and women and men earn comparable average scores on standardized math tests. However, twice as many men as women score in the top 1% on tests such as the SAT-M. Clearly, the picture is complex, Ceci and Williams decided. Their analysis and conclusions appear in *Current Directions in Psychological Science*, a journal of the Association for Psychological Science.

Williams and Ceci also reviewed research on sex discrimination and decided that it is no longer a major factor. In fact, one large-scale national study found that women are actually slightly more likely than men to be invited to interview for and to be offered tenure-track jobs in math-intensive STEM fields.

Instead, Williams and Ceci think the problem is that women actually choose not to go into math-heavy fields, or drop out once they have started. "When you look at surveys of adolescent boys and girls and you say to them, 'What do you want to be when you grow up,' you never see girls saying, 'I want to be a physicist or an engineer,'" Ceci says. That doesn't mean they're rejecting science, but they're more likely to want to be physicians or veterinarians.

And those preferences persist. Studies of college students find that women are more interested in organic and social fields, while men are more interested in systematizing things. And indeed, more than half of new medical doctors and biologists are women today -- and in veterinary medicine, women are more than 75% of new graduates.

Also, women drop out of mathematics-heavy careers paths. Almost half of undergraduate math majors in the U.S. are women. A smaller percentage of women go into graduate school in math, and in 2006, women earned 29.6% of math PhDs. Women are also more likely to drop out after they start a job as a professor, often because they are unable to balance childcare with the huge workload required to get tenure. Young male professors are more likely than their female counterparts to have a stay-at-home spouse or partner who takes care of children.

"You don't see nearly as many men with doctorates in physics saying, 'I won't apply for a tenure-track position because my partner wants to practice environmental law in Wyoming and I'm going to follow her there and help take care of the kids,'" Williams says. Fair or not, women are more likely to prioritize family needs. "I don't think we should try to persuade a woman who's going to be a physician, veterinarian, or biologist to instead be a computer scientist."

On the other hand, women shouldn't have to drop out because the tenure schedule conflicts with their fertility schedule. "Universities can and should do a lot more for women and for those men engaged in comparably-

intensive caretaking," says Williams. Coming up with alternative schedules for parents of young children who are seeking tenure, for example, or finding other ways to ease the burden on parents or young children, could help women stay in academic careers -- and not only in math-intensive fields.

Editor's Note: *This article is not intended to provide medical advice, diagnosis or treatment.*

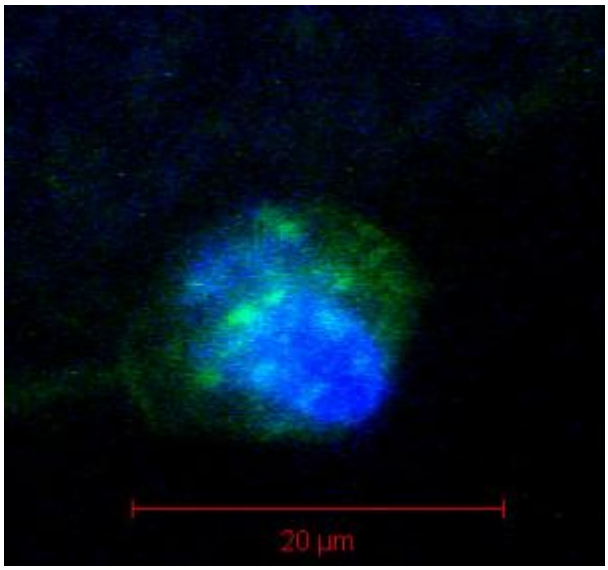
Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Association for Psychological Science**.

Journal Reference:

1. S. J. Ceci, W. M. Williams. **Sex Differences in Math-Intensive Fields**. *Current Directions in Psychological Science*, 2010; 19 (5): 275 DOI: 10.1177/0963721410383241

http://www.sciencedaily.com/releases/2010/10/101026111731.htm

Discovery Opens New Window on Development, and Maybe Potential, of Human Egg Cells



Answers are in the stars To perfect a technique for analyzing mRNA in the polar bodies of egg cells, researchers studied starfish, which produce millions of easily available eggs. The image shows a starfish polar body with stained membrane (green) and DNA (blue). (Credit: Carson Lab / Brown University)

ScienceDaily (Oct. 26, 2010) — Egg cells hold the key to many mysteries about reproduction, and knowing about the genetic makeup of individual eggs is important in fertility treatment. A new method of looking at genetic material egg cells discard offers a way to learn more about individual eggs without destroying them.

Fertility procedures such as in vitro fertilization (IVF) require a couple and the doctor to place the risky bet that the multiple eggs they choose to fertilize will produce an embryo that will thrive in the uterus.

Researchers cannot biopsy eggs directly because that would destroy them, but a new discovery by professors at Brown University and Women & Infants Hospital could lead to new insights about how eggs develop and ultimately inform judgments about how the embryos they produce will fare. The idea is to examine the genetic material the egg cells discarded when they were first forming, to see which genes they were expressing.

"This opens up a whole new time of life for investigation," said Sandra Carson, professor of obstetrics and gynecology at the Warren Alpert Medical School of Brown University and director of reproductive endocrinology and infertility at Women & Infants.

Oocytes, or eggs, carry half as much genetic material as other cells in the body because a sperm is supposed to donate the other half of the needed DNA. When an oocyte is formed, it casts off a copy of its DNA into a cellular byproduct called a "polar body." For years, fertility doctors have looked at the DNA in polar bodies for insight into whether the egg would thrive, but until now, nobody had ever found any copies of the oocyte's messenger RNA (mRNA), the translated messages of genetic code that are tell-tale signs of which genes are active in a cell. Moreover, no one understood how they could detect mRNA if it was there.

"This research gives us a new technique that might prove useful for looking at how genes are being interpreted by the oocyte," said Peter Klatsky, a research fellow in Carson's lab, who will present the research Oct. 25 at the American Society for Reproductive Medicine annual meeting in Denver. "This may in the future allow us to ask questions about whether an egg is healthy and therefore whether or not that egg, once fertilized will develop into a healthy baby."

Along with Gary Wessel, professor of molecular and cellular biology biochemistry at Brown, Klatsky and Carson reasoned that if each polar body did carry mRNA like the oocyte that spawned it, that would be the next best thing to looking for mRNA in the oocyte itself, which is too destrucive. Polar bodies, they

hypothesized, could be a reliable and expendable indicator of gene expression in the egg, at least at one key stage in its development.
"Our hypothesis was that along with the discarded DNA, there is cytoplasm and in that cytoplasm there could be information in the form of mRNA and that information could tell us what's going on in that oocyte," Klatsky said.
In a series of experiments with donated human oocytes and polar bodies, the trio succeeded in becoming the first to detect tiny amounts of mRNA in polar bodies. Furthermore, they were able to show that the abundance of mRNA in each egg cell correlated with their ability to find it in the polar body, suggesting that what's expressed in the egg is present in the polar body.
"Now that we've figured out that you can detect it, the next question is does it tell you something about the health of the egg," Klatsky said.

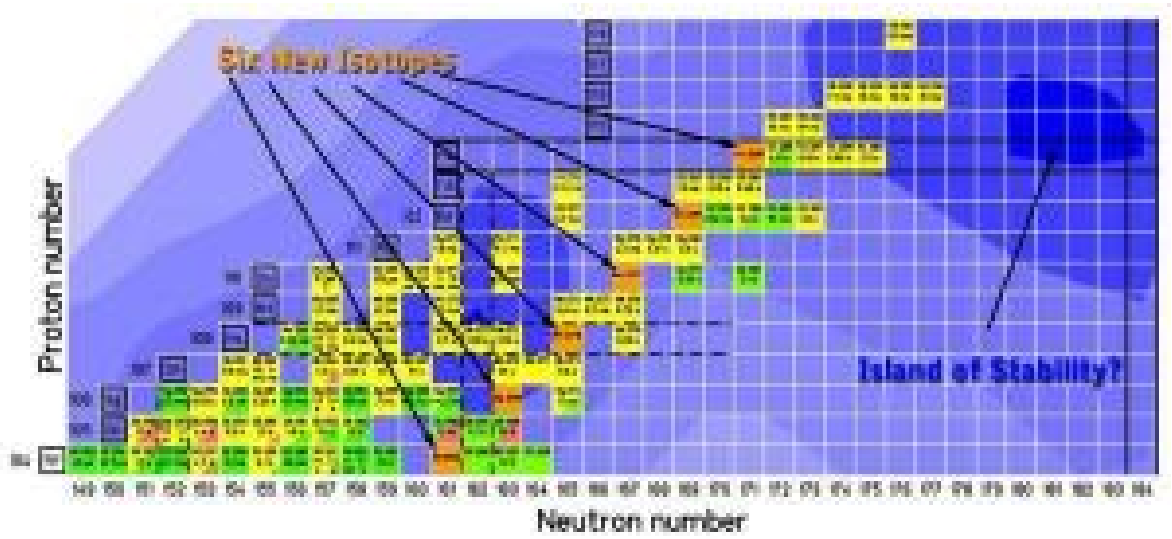
Supporting cast of stars

Achieving these results was no easy task. The amount of mRNA is so small, on the order of quadrillionths of grams, that the team had to develop a new procedure for amplifying it using polymerase chain reaction, a method of making copies of DNA. A key step was to break with tradition and not try to isolate mRNA to amplify it. Instead, Wessel said, they took steps to retool the polymerase chain reaction process to find the mRNA itself.
To perfect the technique, the team practiced on sea stars (also known as starfish) that Wessel has long studied in his basic biological research on fertilization. At the single-cell level of eggs, sea stars work much like people, Wessel said, but they produce a lot more eggs and polar bodies and those are much easier to study.
"Starfish have been amazingly important for understanding how oocytes develop to become fertilizable," Wessel said. "We can get a few or a dozen eggs from people each month but a starfish has about 10 million eggs."
With an interest in fertility, Wessel has long kept in touch with clinicians working with humans at Women & Infants. Carson directs those efforts -- Klatsky is a fellow in her division -- and so they all forged a collaboration.
Administrators backed them up. One measure of how risky their hypothesis was is that all $100,000 of funding for their research came from internal sources: seed grants awarded from the Office of the Provost at Brown University and from the Center of Excellence in Women's Health at Women & Infants Hospital.
Now that the gamble has paid off in mRNA, the team is pushing ahead to find out whether it can inform both the basic understanding of eggs, and the ultimate promise of improving fertility treatment.
***Editor's Note**: This article is not intended to provide medical advice, diagnosis or treatment.*

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

http://www.sciencedaily.com/releases/2010/10/101025123856.htm

Six New Isotopes of the Superheavy Elements Discovered



The six new isotopes placed on the chart of heavy nuclides. (Credit: Image courtesy of DOE/Lawrence Berkeley National Laboratory)

ScienceDaily (Oct. 26, 2010) — A team of scientists at the U.S. Department of Energy's Lawrence Berkeley National Laboratory has detected six isotopes, never seen before, of the superheavy elements 104 through 114. Starting with the creation of a new isotope of the yet-to-be-named element 114, the researchers observed successive emissions of alpha particles that yielded new isotopes of copernicium (element 112), darmstadtium (element 110), hassium (element 108), seaborgium (element 106), and rutherfordium (element 104). Rutherfordium ended the chain when it decayed by spontaneous fission.

Information gained from the new isotopes will contribute to a better understanding of the theory of nuclear shell structure, which underlies predictions of an "Island of Stability," a group of long-lasting isotopes thought to exist amidst a sea of much shorter-lived, intrinsically unstable isotopes of the superheavy elements.

The group that found the new isotopes is led by Heino Nitsche, head of the Heavy Element Nuclear and Radiochemistry Group in Berkeley Lab's Nuclear Science Division (NSD) and professor of chemistry at the University of California at Berkeley. Ken Gregorich, a senior staff scientist in NSD, is responsible for the group's day-to-day research operation at the 88-inch Cyclotron and the Berkeley Gas-filled Separator, the instrument used to isolate and identify the new isotopes. Paul Ellison of NSD, a graduate student in the UC Berkeley Department of Chemistry, formally proposed and managed the experiment and was first author of the paper reporting the results in the 29 October 2010 issue of *Physical Review Letters*.

"We were encouraged to try creating new superheavy isotopes by accelerating calcium 48 projectiles with Berkeley Lab's 88-Inch Cyclotron and bombarding plutonium 242 targets inside the Berkeley Gas-filled Separator here," Nitsche says. "This was much the same set-up we used a year ago to confirm the existence of element 114."

The 20-member team included scientists from Berkeley Lab, UC Berkeley, Lawrence Livermore National Laboratory, Germany's GSI Helmholtz Center for Heavy Ion Research, Oregon State University, and Norway's Institute for Energy Technology. Many of its members were also on the team that first confirmed element 114 in September of 2009. Ten years earlier scientists at the Joint Institute for Nuclear Research in Dubna, Russia, had isolated element 114 but it had not been confirmed until the Berkeley work. (Elements heavier than 114 have been seen but none have been independently confirmed.)

The nuclear shell game

Nuclear stability is thought to be based in part on shell structure -- a model in which protons and neutrons are arranged in increasing energy levels in the atomic nucleus. A nucleus whose outermost shell of either protons

or neutrons is filled is said to be "magic" and therefore stable. The possibility of finding "magic" or "doubly magic" isotopes of superheavy elements (with both proton and neutron outer shells completely filled) led to predictions of a region of enhanced stability in the 1960s.
The challenge is to create such isotopes by bombarding target nuclei rich in protons and neutrons with a beam of projectiles having the right number of protons, and also rich in neutrons, to yield a compound nucleus with the desired properties. The targets used by the Berkeley researchers were small amounts of plutonium 242 (^{242}Pu) mounted on the periphery of a wheel less than 10 centimeters in diameter, which was rotated to disperse the heat of the beam.
Gregorich notes that calcium 48 (^{48}Ca), which has a doubly magic shell structure (20 protons and 28 neutrons), "is extremely rich in neutrons and can combine with plutonium" -- which has 94 protons -- "at relatively low energies to make compound nuclei. It's an excellent projectile for producing compound nuclei of element 114."
Ellison says, "There's only a very low probability that the two isotopes will interact to form a compound nucleus. To make it happen, we need very intense beams of calcium on the target, and then we need a detector that can sift through the many unwanted reaction products to find and identify the nuclei we want by their unique decay patterns." The 88-Inch Cyclotron's intense ion beams and the Berkeley Gas-filled Separator, designed specifically to sweep away unwanted background and identify desired nuclear products, are especially suited to this task.
Element 114 itself was long thought to lie in the Island of Stability. Traditional models predicted that if an isotope of 114 having 184 neutrons (^{298}114) could be made, it would be doubly magic, with both its proton and neutron shells filled, and would be expected to have an extended lifetime. The isotopes of 114 made so far have many fewer neutrons, and their half-lives are measured in seconds or fractions of a second. Moreover, modern models predict the proton magic number to be 120 or 126 protons. Therefore, where ^{298}114 would actually fall inside the region of increased stability is now in question.
"Making ^{298}114 probably won't be possible until we build heavy ion accelerators capable of accelerating beams of rare projectile isotopes more intense than any we are likely to achieve in the near future," says Nitsche. "But in the meantime we can learn much about the nuclear shell model by comparing its theoretical predictions to real observations of the isotopes we *can* make."
The team that confirmed element 114 observed nuclei of two isotopes, ^{286}114 and ^{287}114, which decayed in a tenth of a second and half a second respectively. In a subsequent collaboration with researchers at the GSI Helmholtz Center for Heavy Ion Research, two more isotopes, ^{288}114 and ^{289}114, were made; these decayed in approximately two-thirds of a second and two seconds respectively.
While these times aren't long, they're long enough for spontaneous fission to terminate the series of alpha decays. Alpha particles have two protons and two neutrons -- essentially they are helium nuclei -- and many heavy nuclei commonly decay by emitting alpha particles to form atoms just two protons lighter on the chart of the nuclides. By contrast, spontaneous fission yields much lighter fragments.

A new strategy

So this year the Berkeley group decided to make new isotopes using a unique strategy: instead of trying to add more neutrons to 114, they would look for isotopes with fewer neutrons. Their shorter half-lives should make it possible for new isotopes to be formed by alpha emission before spontaneous fission interrupted the process.
"This was a very deliberate strategy," says Ellison, "because we hoped to track the isotopes that resulted from subsequent alpha decays farther down into the main body of the chart of nuclides, where the relationships among isotope number, shell structure, and stability are better understood. Through this connection, and by observing the energy of the alpha decays, we could hope to learn something about the accuracy of predictions of the shell structure of the heaviest elements."
The sum of protons and neutrons of ^{48}Ca and ^{242}Pu is 114 protons and 176 neutrons. To make the desired "neutron poor" ^{285}114 nucleus, one having only 171 neutrons, first required a beam of ^{48}Ca projectiles whose energy was carefully adjusted to excite the resulting compound nucleus enough for five neutrons to "evaporate."

"The process of identifying what you've made comes down to tracking the time between decays and decay energies," says Ellison. As a check against possible mistakes, the data from the experiment were independently analyzed using separate programs devised by Ellison, Gregorich, and team member Jacklyn Gates of NSD.

In this way, after more than three weeks of running the beam, the researchers observed one chain of decays from the desired neutron-light 114 nucleus. The first two new isotopes, ^{285}114 itself, and copernicium 281 produced by its alpha decay, lived less than a fifth of a second before emitting alpha particles. The third new isotope, darmstadtium 277, lived a mere eight-thousandths of second. Hassium 273 lasted a third of a second. Seaborgium 269 made it to three minutes and five seconds but managed to emit an alpha particle. Finally, after another two and a half minutes, rutherfordium 265 decayed by spontaneous fission.

Ellison says, "In the grand scheme, the theoretical predictions were pretty good" when the actual measurements were compared to the decay properties predicted by modern nuclear models. "But there were small-scale interesting differences."

In particular, the heaviest new isotopes, those of 114 and copernicium, showed smaller energies associated with the alpha decay than theory predicts. These discrepancies can be used to refine the theoretical models used to predict the stability of the superheavy elements.

As Gregorich puts it, "our new isotopes are on the western shore of the Island of Stability" -- the shore that's less stable, not more. Yet the discovery of six new isotopes, reaching in an unbroken chain of decays from element 114 down to rutherfordium, is a major step toward better understanding the theory underlying exploration of the region of enhanced stability that is thought to lie in the vicinity of element 114 -- and possibly beyond.

This research was supported by the DOE Office of Science and the National Nuclear Security Administration.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **DOE/Lawrence Berkeley National Laboratory**.

Journal Reference:

1. Paul Ellison, Kenneth Gregorich, Jill Berryman, Darren Bleuel, Roderick Clark, Irena Dragojević, Jan Dvorak, Paul Fallon, Carolina Fineman-Sotomayor, Jacklyn Gates, Oliver Gothe, I-Yang Lee, Walter Loveland, Joseph McLaughlin, Stefanos Paschalis, Marina-Kalliopi Petri, Ji Qian, Liv Stavsetra, Mathis Wiedeking, and Heino Nitsche. **New superheavy element isotopes: ^{242}Pu(^{48}Ca,5n)^{285}114**. *Physical Review Letters*, 2010; 105 (18) DOI: 10.1103/PhysRevLett.105.182701

http://www.sciencedaily.com/releases/2010/10/101026161251.htm

Scented Consumer Products Shown to Emit Many Unlisted Chemicals

ScienceDaily (Oct. 26, 2010) — The sweet smell of fresh laundry may contain a sour note. Widely used fragranced products -- including those that claim to be "green" -- give off many chemicals that are not listed on the label, including some that are classified as toxic.

A study led by the University of Washington discovered that 25 commonly used scented products emit an average of 17 chemicals each. Of the 133 different chemicals detected, nearly a quarter are classified as toxic or hazardous under at least one federal law. Only one emitted compound was listed on a product label, and only two were publicly disclosed anywhere. The article is published online in the journal *Environmental Impact Assessment Review*.

"We analyzed best-selling products, and about half of them made some claim about being green, organic or natural," said lead author Anne Steinemann, a UW professor of civil and environmental engineering and of public affairs. "Surprisingly, the green products' emissions of hazardous chemicals were not significantly different from the other products."

More than a third of the products emitted at least one chemical classified as a probable carcinogen by the U.S. Environmental Protection Agency, and for which the EPA sets no safe exposure level.

Manufacturers are not required to disclose any ingredients in cleaning supplies, air fresheners or laundry products, all of which are regulated by the Consumer Product Safety Commission. Neither these nor personal care products, which are regulated by the Food and Drug Administration, are required to list ingredients used in fragrances, even though a single "fragrance" in a product can be a mixture of up to several hundred ingredients, Steinemann said.

So Steinemann and colleagues have used chemical sleuthing to discover what is emitted by the scented products commonly used in homes, public spaces and workplaces.

The study analyzed air fresheners including sprays, solids and oils; laundry products including detergents, fabric softeners and dryer sheets; personal care products such as soaps, hand sanitizers, lotions, deodorant and shampoos; and cleaning products including disinfectants, all-purpose sprays and dish detergent. All were widely used brands, with more than half being the top-selling product in its category.

Researchers placed a sample of each product in a closed glass container at room temperature and then analyzed the surrounding air for volatile organic compounds, small molecules that evaporate off a product's surface. They detected chemical concentrations ranging from 100 micrograms per cubic meter (the minimum value reported) to more than 1.6 million micrograms per cubic meter.

The most common emissions included limonene, a compound with a citrus scent; alpha-pinene and beta-pinene, compounds with a pine scent; ethanol; and acetone, a solvent found in nail polish remover.

All products emitted at least one chemical classified as toxic or hazardous. Eleven products emitted at least one probable carcinogen according to the EPA. These included acetaldehyde, 1,4-dioxane, formaldehyde and methylene chloride.

The only chemical listed on any product label was ethanol, and the only additional substance listed on a chemical safety report, known as a material safety data sheet, was 2-butoxyethanol.

"The products emitted more than 420 chemicals, collectively, but virtually none of them were disclosed to consumers, anywhere," Steinemann said.

Because product formulations are confidential, it was impossible to determine whether a chemical came from the product base, the fragrance added to the product, or both.

Tables included with the article list all chemicals emitted by each product and the associated concentrations, although they do not disclose the products' brand names.

"We don't want to give people the impression that if we reported on product 'A' and they buy product 'B,' that they're safe," Steinemann said. "We found potentially hazardous chemicals in all of the fragranced products we tested."

The study establishes the presence of various chemicals but makes no claims about the possible health effects. Two national surveys published by Steinemann and a colleague in 2009 found that about 20 percent of the population reported adverse health effects from air fresheners, and about 10 percent complained of adverse

effects from laundry products vented to the outdoors. Among asthmatics, such complaints were roughly twice as common.

The Household Product Labeling Act, currently being reviewed by the U.S. Senate, would require manufacturers to list ingredients in air fresheners, soaps, laundry supplies and other consumer products. Steinemann says she is interested in fragrance mixtures, which are included in the proposed labeling act, because of the potential for unwanted exposure, or what she calls "secondhand scents."

As for what consumers who want to avoid such chemicals should do in the meantime, Steinemann suggests using simpler options such as cleaning with vinegar and baking soda, opening windows for ventilation and using products without any fragrance.

"In the past two years, I've received more than 1,000 e-mails, messages, and telephone calls from people saying: 'Thank you for doing this research, these products are making me sick, and now I can start to understand why,'" Steinemann said.

Steinemann is currently a visiting professor in civil and environmental engineering at Stanford University. Co-authors are Ian MacGregor and Sydney Gordon at Battelle Memorial Institute in Columbus, Ohio; Lisa Gallagher, Amy Davis and Daniel Ribeiro at the UW; and Lance Wallace, retired from the U.S. Environmental Protection Agency. The research was partially funded by Seattle Public Utilities.

Editor's Note: *This article is not intended to provide medical advice, diagnosis or treatment.*

Story Source:

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

Journal Reference:

1. Steinemann AC, MacGregor IM, Gordon SM, Gallagher LG, Davis AL, Ribeiro DS, and Wallace LA. **Fragranced Consumer Products: Chemicals Emitted, Ingredients Unlisted**. *Environmental Impact Assessment Review*, 2010; DOI: 10.1016/j.eiar.2010.08.002

http://www.sciencedaily.com/releases/2010/10/101026091559.htm

Older People Advised That Taking an Afternoon Nap Can Lead to More Active Lives

ScienceDaily (Oct. 26, 2010) — Experts at the University of Surrey discovered that many older people felt that they may be branded lazy for taking afternoon naps so they tried hard to avoid nodding off.

But the occasional nap can make older people more able to lead a fully active life by giving them enough energy to take part in recreational and social activities.

Susan Venn, of the Department of Sociology said: "Sleep is central to health and well-being, but as people get older, the quality of their sleep can deteriorate. They shouldn't feel guilty or think themselves lazy for having a nap."

The new research also found that as older people often have more disturbed sleep patterns at night they try to avoid taking a nap during the day only to fall asleep watching television during the early evening. As a result they may end up feeling exhausted..

Another finding was that older men and women lose sleep because of having to get up several times a night to go to the toilet, so they may cut down on drinking fluids during the day believing this will help, even though they may become dehydrated.

One interviewee, called Anne, aged 71, from Berkshire, said "My main sleep problem is waking up in the early hours of the morning and not being able to get back to sleep.

"I sometimes find on a particularly bad night that I'm awake for three or four hours. I don't want to disturb my husband by tossing and turning, and trying to get back to sleep, so I tend to get up and do the housework, watch DVDs or use the computer.

"Sleep at the moment is a disappointment I suppose, because I feel I've improved my life style by doing all the things, diet, exercise and all this, and I'd hoped that the sleep would improve more than it has."
Susan Venn, of the Department of Sociology, a researcher on the project, explained: "Many of the older people we talked to described how disturbed their sleep was, especially in terms of waking up a lot in the night.

"Anne was like many of the older people we spoke to in that being active during the day was very important to them, and if they slept badly, it impacted on how much could be achieved.

"Many older people are prescribed medications to help them sleep, but research has shown that sleeping medication may impact on the lives of older people, such as increasing the risk of falls."

The new research called "Understanding poor sleep in the community" is linked to an academic conference on sleep issues among older people, based on the SomnIA (Sleep in Ageing) project (www.somnia.surrey.ac.uk). The research by academics at the University of Surrey, along with colleagues at other institutions, tried to find ways of improving the sleep patterns of older people.

Researchers talked to 62 older men and women who are living in their own homes about their poor sleep patterns and three key findings emerged:

- Whilst many older people do not sleep well and feel tired during the day, they often do not want to take a nap because they believe daytime sleeping is a sign of laziness.

- Older people often get up in the night to go to the toilet, sometimes even several times a night. So, counter to current advice to drink plenty of fluids during the day, they may often severely restrict how much they drink.

- Older men and women would rather not visit their doctor for problems with their sleep, largely because of a concern they will be prescribed some form of sleeping medication. Keeping busy and active is important to many older people and they are concerned that sleeping medication may take away that control. Women, more than men, tended to explore alternative treatments and remedies for poor sleep, such as over the counter remedies and herbal medicines.

The research is linked to a conference called 'Sleep, Well-Being and Active Ageing: New Evidence for Policy and Practice' to be held on Thursday 28th October 2010, Church House Conference Centre, Westminster, London.

Editor's Note: *This article is not intended to provide medical advice, diagnosis or treatment.*

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

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Controlling Individual Cortical Nerve Cells by Human Thought

Two neurons -- one corresponding to the concept of Marilyn Monroe, and another corresponding to Michael Jackson -- are pitted against each other. The subject is asked to fade in one image on the expense of another. (Credit: Created by Moran Cerf and Maria Moon/Caltech)

ScienceDaily (Oct. 27, 2010) — Five years ago, neuroscientist Christof Koch of the California Institute of Technology (Caltech), neurosurgeon Itzhak Fried of UCLA, and their colleagues discovered that a single neuron in the human brain can function much like a sophisticated computer and recognize people, landmarks, and objects, suggesting that a consistent and explicit code may help transform complex visual representations into long-term and more abstract memories.

Now Koch and Fried, along with former Caltech graduate student and current postdoctoral fellow Moran Cerf, have found that individuals can exert conscious control over the firing of these single neurons -- despite the neurons' location in an area of the brain previously thought inaccessible to conscious control -- and, in doing so, manipulate the behavior of an image on a computer screen.

The work, which appears in a paper in the October 28 issue of the journal *Nature*, shows that "individuals can rapidly, consciously, and voluntarily control neurons deep inside their head," says Koch, the Lois and Victor Troendle Professor of Cognitive and Behavioral Biology and professor of computation and neural systems at Caltech.

The study was conducted on 12 epilepsy patients at the David Geffen School of Medicine at UCLA, where Fried directs the Epilepsy Surgery Program. All of the patients suffered from seizures that could not be controlled by medication. To help localize where their seizures were originating in preparation for possible later surgery, the patients were surgically implanted with electrodes deep within the centers of their brains. Cerf used these electrodes to record the activity, as indicated by spikes on a computer screen, of individual neurons in parts of the medial temporal lobe -- a brain region that plays a major role in human memory and emotion.

Prior to recording the activity of the neurons, Cerf interviewed each of the patients to learn about their interests. "I wanted to see what they like -- say, the band Guns N' Roses, the TV show House, and the Red Sox," he says. Using that information, he created for each patient a data set of around 100 images reflecting the things he or she cares about. The patients then viewed those images, one after another, as Cerf monitored their brain activity to look for the targeted firing of single neurons. "Of 100 pictures, maybe 10 will have a strong correlation to a neuron," he says. "Those images might represent cached memories -- things the patient has recently seen."

The four most strongly responding neurons, representing four different images, were selected for further investigation. "The goal was to get patients to control things with their minds," Cerf says. By thinking about

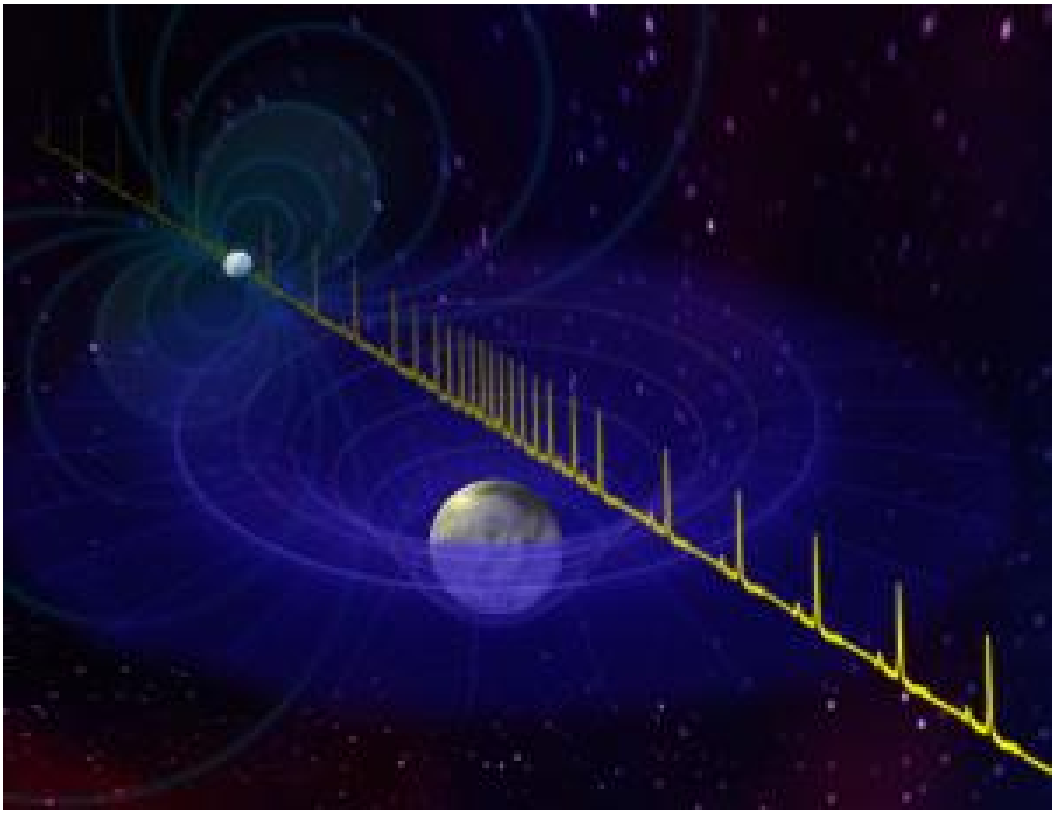
the individual images -- a picture of Marilyn Monroe, for example -- the patients triggered the activity of their corresponding neurons, which was translated first into the movement of a cursor on a computer screen. In this way, patients trained themselves to move that cursor up and down, or even play a computer game.
But, says Cerf, "we wanted to take it one step further than just brain-machine interfaces and tap into the competition for attention between thoughts that race through our mind."
To do that, the team arranged for a situation in which two concepts competed for dominance in the mind of the patient. "We had patients sit in front of a blank screen and asked them to think of one of the target images," Cerf explains. As they thought of the image, and the related neuron fired, "we made the image appear on the screen," he says. That image is the "target." Then one of the other three images is introduced, to serve as the "distractor."
"The patient starts with a 50/50 image, a hybrid, representing the 'marriage' of the two images," Cerf says, and then has to make the target image fade in -- just using his or her mind -- and the distractor fade out. During the tests, the patients came up with their own personal strategies for making the right images appear; some simply thought of the picture, while others repeated the name of the image out loud or focused their gaze on a particular aspect of the image. Regardless of their tactics, the subjects quickly got the hang of the task, and they were successful in around 70 percent of trials.
"The patients clearly found this task to be incredibly fun as they started to feel that they control things in the environment purely with their thought," says Cerf. "They were highly enthusiastic to try new things and see the boundaries of 'thoughts' that still allow them to activate things in the environment."
Notably, even in cases where the patients were on the verge of failure -- with, say, the distractor image representing 90 percent of the composite picture, so that it was essentially all the patients saw -- "they were able to pull it back," Cerf says. Imagine, for example, that the target image is Bill Clinton and the distractor George Bush. When the patient is "failing" the task, the George Bush image will dominate. "The patient will see George Bush, but they're supposed to be thinking about Bill Clinton. So they shut off Bush -- somehow figuring out how to control the flow of that information in their brain -- and make other information appear. The imagery in their brain," he says, "is stronger than the hybrid image on the screen."
According to Koch, what is most exciting "is the discovery that the part of the brain that stores the instruction 'think of Clinton' reaches into the medial temporal lobe and excites the set of neurons responding to Clinton, simultaneously suppressing the population of neurons representing Bush, while leaving the vast majority of cells representing other concepts or familiar person untouched."
This work was funded by the National Institute of Neurological Disorders and Stroke, the National Institute of Mental Health, the G. Harold & Leila Y. Mathers Charitable Foundation, and Korea's World Class University program.
***Editor's Note**: This article is not intended to provide medical advice, diagnosis or treatment.*
Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **California Institute of Technology**.

Journal Reference:

1. Moran Cerf, Nikhil Thiruvengadam, Florian Mormann, Alexander Kraskov, Rodrigo Quian Quiroga, Christof Koch, Itzhak Fried. **On-line, voluntary control of human temporal lobe neurons**. *Nature*, 2010; 467 (7319): 1104 DOI: 10.1038/nature09510

http://www.sciencedaily.com/releases/2010/10/101027133158.htm

Astronomers Discover Most Massive Neutron Star Yet Known; Discovery Has Broad Implications for Astrophysics, Nuclear Physics



Pulses from neutron star (rear) are slowed as they pass near foreground white dwarf. This effect allowed astronomers to measure masses of the system. (Credit: Bill Saxton, NRAO/AUI/NSF)

ScienceDaily (Oct. 27, 2010) — Astronomers using the National Science Foundation's Green Bank Telescope (GBT) have discovered the most massive neutron star yet found, a discovery with strong and wide-ranging impacts across several fields of physics and astrophysics.

"This neutron star is twice as massive as our Sun. This is surprising, and that much mass means that several theoretical models for the internal composition of neutron stars now are ruled out," said Paul Demorest, of the National Radio Astronomy Observatory (NRAO). "This mass measurement also has implications for our understanding of all matter at extremely high densities and many details of nuclear physics," he added.

Neutron stars are the superdense "corpses" of massive stars that have exploded as supernovae. With all their mass packed into a sphere the size of a small city, their protons and electrons are crushed together into neutrons. A neutron star can be several times more dense than an atomic nucleus, and a thimbleful of neutron-star material would weigh more than 500 million tons. This tremendous density makes neutron stars an ideal natural "laboratory" for studying the most dense and exotic states of matter known to physics.

The scientists used an effect of Albert Einstein's theory of General Relativity to measure the mass of the neutron star and its orbiting companion, a white dwarf star. The neutron star is a pulsar, emitting lighthouse-like beams of radio waves that sweep through space as it rotates. This pulsar, called PSR J1614-2230, spins 317 times per second, and the companion completes an orbit in just under nine days. The pair, some 3,000 light-years distant, are in an orbit seen almost exactly edge-on from Earth. That orientation was the key to making the mass measurement.

As the orbit carries the white dwarf directly in front of the pulsar, the radio waves from the pulsar that reach Earth must travel very close to the white dwarf. This close passage causes them to be delayed in their arrival

by the distortion of spacetime produced by the white dwarf's gravitation. This effect, called the Shapiro Delay, allowed the scientists to precisely measure the masses of both stars.
"We got very lucky with this system. The rapidly-rotating pulsar gives us a signal to follow throughout the orbit, and the orbit is almost perfectly edge-on. In addition, the white dwarf is particularly massive for a star of that type. This unique combination made the Shapiro Delay much stronger and thus easier to measure," said Scott Ransom, also of NRAO.
The astronomers used a newly-built digital instrument called the Green Bank Ultimate Pulsar Processing Instrument (GUPPI), attached to the GBT, to follow the binary stars through one complete orbit earlier this year. Using GUPPI improved the astronomers' ability to time signals from the pulsar severalfold.
The researchers expected the neutron star to have roughly one and a half times the mass of the Sun. Instead, their observations revealed it to be twice as massive as the Sun. That much mass, they say, changes their understanding of a neutron star's composition. Some theoretical models postulated that, in addition to neutrons, such stars also would contain certain other exotic subatomic particles called hyperons or condensates of kaons.
"Our results rule out those ideas," Ransom said.
Demorest and Ransom, along with Tim Pennucci of the University of Virginia, Mallory Roberts of Eureka Scientific, and Jason Hessels of the Netherlands Institute for Radio Astronomy and the University of Amsterdam, reported their results in the October 28 issue of the scientific journal *Nature*.
Their result has further implications, outlined in a companion paper, scheduled for publication in the *Astrophysical Journal Letters*. "This measurement tells us that if any quarks are present in a neutron star core, they cannot be 'free,' but rather must be strongly interacting with each other as they do in normal atomic nuclei," said Feryal Ozel of the University of Arizona, lead author of the second paper.
There remain several viable hypotheses for the internal composition of neutron stars, but the new results put limits on those, as well as on the maximum possible density of cold matter.
The scientific impact of the new GBT observations also extends to other fields beyond characterizing matter at extreme densities. A leading explanation for the cause of one type of gamma-ray burst -- the "short-duration" bursts -- is that they are caused by colliding neutron stars. The fact that neutron stars can be as massive as PSR J1614-2230 makes this a viable mechanism for these gamma-ray bursts.
Such neutron-star collisions also are expected to produce gravitational waves that are the targets of a number of observatories operating in the United States and Europe. These waves, the scientists say, will carry additional valuable information about the composition of neutron stars.
"Pulsars in general give us a great opportunity to study exotic physics, and this system is a fantastic laboratory sitting out there, giving us valuable information with wide-ranging implications," Ransom explained. "It is amazing to me that one simple number -- the mass of this neutron star -- can tell us so much about so many different aspects of physics and astronomy," he added.
The National Radio Astronomy Observatory is a facility of the National Science Foundation, operated under cooperative agreement by Associated Universities, Inc.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **National Radio Astronomy Observatory**.

Journal Reference:

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http://www.sciencedaily.com/releases/2010/10/101027133142.htm

Tale of the Headless Dragonfly: Ancient Struggle, Preserved in Amber

Headless dragonfly. This ancient species of dragonfly is seen largely intact in amber, missing only a few feet and its head - presumable in the mouth of the lizard seen fleeing at the left. (Credit: Photo by George Poinar)

ScienceDaily (Oct. 26, 2010) — In a short, violent battle that could have happened somewhere this afternoon, the lizard made a fast lunge at the dragonfly, bit its head off and turned to run away. Lunch was served.

But the battle didn't happen today, it happened about 100 million years ago, probably with dinosaurs strolling nearby. And the lizard didn't get away, it was trapped in the same oozing, sticky tree sap that also entombed the now-headless dragonfly for perpetuity.

This ancient struggle, preserved in the miracle of amber, was just described by researchers from Oregon State University in *Paleodiversity*, a professional journal. It announced the discovery of a new sub-family of dragonflies in the oldest specimen of this insect ever found in amber.

More importantly, the study and others like it continue to reveal the similarities of behaviors and ecosystems separated by many millions of years, said George Poinar, a professor emeritus at Oregon State University. Poinar is one of the world's leading experts on life forms found preserved in this semi-precious stone that acts as a natural embalming agent.

"Dragonflies are still eaten by small lizards every day, it's a routine predator/prey interaction," Poinar said. "This shows once again how behaviors of various life forms are retained over vast amounts of time, and continues to give us insights into the ecology of ancient ecosystems."

Dragonflies are one of the world's more colorful, interesting and successful insects, Poinar said, having managed to survive for a very long time. This is the oldest fossil ever found in amber, but other stone fossil specimens of dragonflies date back as much as 300 million years, including some that were huge, with wingspans up to three feet.

Amber is a semi-precious stone that originates as the sap from certain trees. Later fossilized through millions of years of pressure, it's unique for the ability to capture and preserve in near-lifelike form small plant, animal or insect specimens that provide data on ancient ecosystems.

"Dragonflies are now, and probably were then, very quick, evasive, and greedy predators," Poinar said. "They feed on other larvae and insects, mosquitoes, gnats, lots of things. Some are quite beautiful, very popular with insect collectors. And some modern populations like to migrate regionally, going south to mate."

But as the new amber specimen shows, dragonflies are now and for a long time have also been prey, particularly of small lizards. Young and hatchling dinosaurs also probably dined on them, Poinar said.

The quick and merciless battle preserved in this stone took place in the Early Cretaceous somewhere between 97 million to 110 million years ago in the jungles of the Hukawng Valley of Burma, now known as Myanmar. The dragonfly -- with one notably missing part -- is preserved almost perfectly. Only the foot and tail of a small lizard remains in the stone, presumably as the animal was trying to flee.

"It's unfortunate we don't have the entire specimen of the lizard, because it probably had the dragonfly's head in its mouth," Poinar said. "Both died when they were trapped in the tree sap in the middle of this duel."

Like a never-ending feud, these battles are still going on today. Scientists have documented in some sites near waterfalls in Costa Rica that there are many dragonflies of a certain species. But if lizards are present, there are no dragonflies -- it appears they all get eaten.

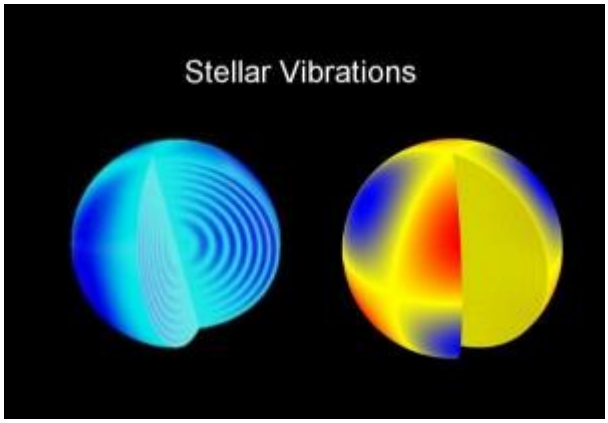
Sometimes things change. Sometimes they don't.

Story Source:

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

http://www.sciencedaily.com/releases/2010/10/101026161257.htm

Kepler Spacecraft Takes Pulse of Distant Stars: 'Starquakes' Yield New Insights About the Size, Age and Evolution of Stars



The variations in brightness can be interpreted as vibrations, or oscillations within the stars, using a technique called asteroseismology. The oscillations reveal information about the internal structure of the stars, in much the same way that seismologists use earthquakes to probe the Earth's interior. (Credit: Courtesy of Kepler Asteroseismic Science Consortium, via Aarhus University)

ScienceDaily (Oct. 27, 2010) — An international cadre of scientists that used data from NASA's Kepler spacecraft announced Tuesday the detection of stellar oscillations, or "starquakes," that yield new insights about the size, age and evolution of stars.

The results were presented at a news conference at Aarhus University in Denmark by scientists representing the Kepler Asteroseismic Science Consortium (KASC). The team studied thousands of stars observed by Kepler, releasing what amounts to a roster of some of humanity's most well-characterized stars.

Analysis of stellar oscillations is similar to how seismologists study earthquakes to probe the Earth's interior. This branch of science, called astroseismology, produces measurements of stars the Kepler science team is anxious to have.

"Using the unparalleled data provided by Kepler, KASC scientists are quite literally revolutionizing our understanding of stars and their structures," said Douglas Hudgins, Kepler Program Scientist at NASA Headquarters in Washington. "What's more, they are doing so at no cost to the American taxpayer. All the KASC scientists are supported by research funding from their home countries. It is a perfect illustration of the tremendous value that our international partners bring to NASA missions."

In the results presented Tuesday, one oscillating star took center stage: KIC 11026764 has the most accurately known properties of any star in the Kepler field. In fact, few stars in the universe are known to similar accuracy. At an age of 5.94 billion years, it has grown to a little over twice the diameter of the sun and will continue to do so as it transforms into a red giant. The oscillations reveal that this star is powered by hydrogen fusion in a thin shell around a helium-rich core.

"We are just about to enter a new area in stellar astrophysics," said Thomas Kallinger, lead author on a study of red giant stars and postdoctoral fellow at the Universities of British Columbia and Vienna. "Kepler provides us with data of such good quality that they will change our view of how stars work in detail."

KASC scientists also reported on the star RR Lyrae. It has been studied for more than 100 years as the first member of an important class of stars used to measure cosmological distances. The brightness, or light wave amplitude, of the star oscillates within a well-known period of about 13.5 hours. Yet during that period, other small cyclic changes in amplitude occur -- behavior known as the Blazhko effect. The effect has puzzled astronomers for decades, but thanks to Kepler data, scientists may have a clue as to its origin. Kepler observations revealed an additional oscillation period that had never been previously detected. The oscillation occurs with a time scale twice as long as the 13.5-hour period. The Kepler data indicates the doubling is linked to the Blazhko effect.

"Kepler data ultimately will give us a better understanding of the future of our sun and the evolution of our galaxy as a whole," said Daniel Huber, lead author on one of the KASC studies.
Launched in March 2009, Kepler was designed to discover Earth-size planets orbiting other stars. The spacecraft uses a huge digital camera, known as a photometer, to continuously monitor the brightness of more than 150,000 stars in its field of view as it orbits around the sun. Kepler searches for distant worlds by looking for "transits," when a planet passes in front of a star, briefly causing it to dim. The amount of dimming reveals the size of the planet compared to the size of the star.
For more information about the findings by the KASC scientists, visit: http://astro.phys.au.dk/KASC/
For more information about the Kepler mission, visit: http://www.nasa.gov/kepler

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Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **NASA/Ames Research Center**.

http://www.sciencedaily.com/releases/2010/10/101026124036.htm

Risk of Cancer Due to Radiation

Exposure in Middle Age May Be Higher Than Previously Estimated

New research suggests that the risk of cancer associated with radiation exposure in middle age may not be lower than the risk associated with exposure at younger ages. (Credit: iStockphoto)

ScienceDaily (Oct. 27, 2010) — Contrary to common assumptions, the risk of cancer associated with radiation exposure in middle age may not be lower than the risk associated with exposure at younger ages, according to a study published online October 25 in the *Journal of the National Cancer Institute*.

It is well known that children are more sensitive than adults to the effects of radiation and that they have a greater risk of developing radiation-induced cancer than adults. Some data also suggest that, in general, the older a person is when exposed to radiation, the lower their risk of developing a radiation-induced cancer. On the other hand, statistical evidence from long-term studies of atomic bomb survivors in Japan indicates that for radiation exposure after about age 30, the risk of developing radiation-induced cancer does not continue to decline.

To explore this issue, David J. Brenner, Ph.D., D.Sc., at Columbia University in New York, and colleagues reanalyzed the Japanese atomic bomb survivor data assuming two different pathways through which radiation exposure can ultimately lead to cancer. The first is initiation of gene mutations that convert normal stem cells to premalignant cells that could eventually lead to cancer. The second is radiation induced promotion, or expansion, of the number of existing premalignant cells in the body. The initiation effect is more likely to play a role in children than in adults, they reason, because cells initiated at an early age have a longer time available to expand in number and progress on the pathway to cancer. The promotion effect, on the other hand, is more likely to be important for radiation exposures in middle age, because the adult body already contains larger numbers of premalignant cells.

The researchers developed a model based on these biological effects and applied the model to the Japanese atomic bomb survivor data. They found that the model was able to reproduce the cancer risk patterns associated with age at radiation exposure observed in these survivors. They then applied the same model to

predict cancer risks as a function of age in the U.S. population and found that the cancer risks predicted by the model were consistent with the data in the age range from about 30 to 60.
The authors conclude that cancer risk after exposure in middle age may increase for some tumor types contrary to conventional wisdom. They add that these findings could have practical implications regarding x-ray diagnostic tests, which are predominantly performed on middle aged adults, as well as for occupations that involve radiation exposures, again where most exposures are in middle age.
"Overall, the weight of the epidemiological evidence suggests that for adult exposures, radiation risks do not generally decrease with increasing age at exposure," they write, "and the mechanistic underpinning described here provides this conclusion with some biological plausibility."
In an accompanying editorial, John D. Boice, Sc.D., of the International Epidemiology Institute, Rockville, Md., and Vanderbilt University, Nashville, notes that there are uncertainties in generalizing the Japanese data to a U.S. population. He also notes that other data and other models contradict the results of this study. However, he concludes that this biology-based model "raises provocative hypotheses and conclusions that, although preliminary, draw attention to the continued importance of low-dose radiation exposures in our society."
Editor's Note: *This article is not intended to provide medical advice, diagnosis or treatment.*
Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Journal of the National Cancer Institute**, via EurekAlert!, a service of AAAS.

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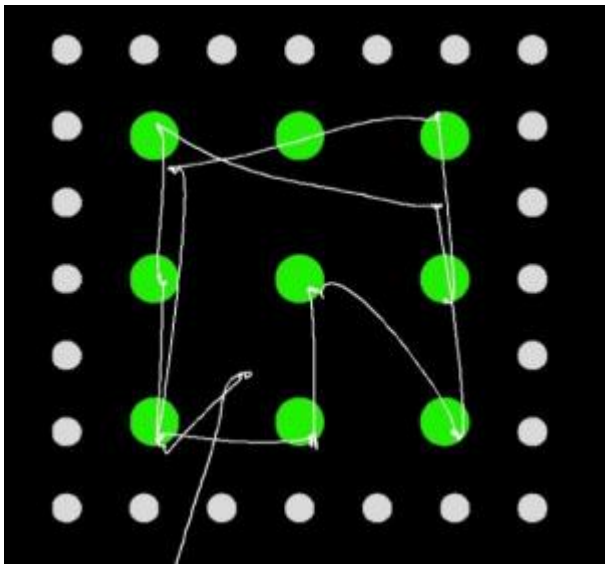
http://www.sciencedaily.com/releases/2010/10/101025161028.htm

Habit Formation Appears to Be an Innate Ability, Fine-Tuned by Experience



Pathways that monkeys used to look at a grid of dots. They received a reward when their gaze landed on one of the dots. (Credit: Theresa Desrochers and Daniel Gibson, Image courtesy of McGovern Institute for Brain Research, MIT)

ScienceDaily (Oct. 27, 2010) — Most people have habits that guide them through daily life -- for example, their path to work in the morning, or their bedtime routine. The brain patterns that drive this behavior are not well-understood, but a new study from MIT's McGovern Institute for Brain Research shows that habit formation appears to be an innate ability that is fine-tuned by experience -- specifically, the costs and rewards of certain choices.

Neuroscientists led by Institute Professor Ann Graybiel found that untrained monkeys performing a simple visual scanning task gradually developed efficient patterns that allowed them to minimize the time it took to receive their reward.

The task was designed to mimic natural scenarios -- a nearly infinite number of choices for the monkeys to make and an unpredictable reward structure. "We wanted to create an environment that would be similar to the world we walk around in every day -- an environment where there are lots of choices the animal can make," says Theresa Desrochers, an MIT graduate student and lead author of a paper describing the work in the *Proceedings of the National Academy of Sciences* the week of Oct. 25.

The findings not only help reveal how the brain forms habits, but also could shed light on neurological disorders where amplified habit-formation results in highly repetitive behavior, such as Tourette's syndrome, obsessive-compulsive disorder and schizophrenia, says Graybiel.

Graybiel and Desrochers took an unusual approach to their study. In most behavioral studies of monkeys, the researchers first train the animals to perform a task, then begin experiments. In this case, Graybiel and Desrochers wanted to see if the monkeys could learn a simple visual free-scanning task with no training at all. The researchers measured the monkeys' eye movements and brain activity as they looked at a grid of either four or nine dots. In each trial, after a period of time when the monkey just looked around, a different dot was randomly chosen to be "baited," meaning that the monkey succeeded in the trial when its gaze landed on that dot. After a successful trial ended, the monkey received a food reward.

While the task itself is simple, it is capable of generating a rich variety of behavior, due to the number of choices available to the animals. The monkeys performed such trials about 1,000 times a day, and over several months, they developed ways to look at all of the different dots in sequences that were more and more cost-effective -- meaning that they reached the target dot faster.

The changes were gradual: The animals would use one pattern for five to 10 days, then shift to a slightly different pattern. When looking at the entire mass of data, the researchers couldn't tell what was driving these changes. However, a trial-by-trial analysis revealed that very small variations in the scanning patterns could reduce the overall time to receive the reward, which would then reinforce that behavior and lead the monkey to adopt the new pattern.

"The upshot was that tiny little changes in cost -- how far they moved the eyes -- seemed to be driving these shifts until they did it as optimally as they could, despite the fact that they had never been instructed," says Graybiel.

This suggests that primates have an "inborn tendency to maximize reward and minimize cost," says Graybiel. She and Desrochers believe the same kind of phenomenon, known as reinforcement learning, may also guide human habit formation.

"When you drive to work, it's never going to take exactly the same amount of time. You might try one different street to avoid a stoplight, or some other subtle variation. At some point, you may completely shift," says Desrochers.

Desrochers and Graybiel plan to design studies that will test whether humans show the same kind of habit-forming behavior in an eye-scanning task similar to the one the monkeys learned. They also hope to discover which parts of the brain control habit formation. They believe that the basal ganglia, which play a role in learning, and the prefrontal cortex, which is involved in planning, are likely candidates.

Funding: National Eye Institute Grant, the Office of Naval Research Grant, National Defense Science and Engineering Graduate Fellowship, Friends of the McGovern Fellowship and a Sloan Research Fellowship.

Editor's Note: *This article is not intended to provide medical advice, diagnosis or treatment.*

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **McGovern Institute for Brain Research, Massachusetts Institute of Technology (MIT)**. The original article was written by Anne Trafton.

Journal Reference:

1. T. M. Desrochers, D. Z. Jin, N. D. Goodman, A. M. Graybiel. **Optimal habits can develop spontaneously through sensitivity to local cost**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.1013470107

http://www.sciencedaily.com/releases/2010/10/101027152609.htm

Into Africa? Fossils Suggest Earliest Anthropoids Colonized Africa

A new discovery described by a team of international scientists, including Carnegie Museum of Natural History paleontologist Christopher Beard, suggests that anthropoids -- the primate group that includes humans, apes, and monkeys -- "colonized" Africa, rather than originally evolving in Africa as has been widely accepted. According to this paper, what is exceptional about these new fossils -- discovered at the Dur At-Talah escarpment in central Libya -- is the diversity of species present: the site includes three distinct families of anthropoid primates that lived in North Africa at approximately the same time. This suggests that anthropoids underwent diversification, through evolution, previous to the time of these newly discovered fossils, which date to 39 million years ago. (Credit: Mark A. Klingler/Carnegie Museum of Natural History, Pittsburgh, Pa.)

ScienceDaily (Oct. 27, 2010) — A new discovery described by a team of international scientists, including Carnegie Museum of Natural History paleontologist Christopher Beard, suggests that anthropoids -- the primate group that includes humans, apes, and monkeys -- "colonized" Africa, rather than originally evolving in Africa as has been widely accepted. According to the paper published in the journal *Nature*, what is exceptional about these new fossils -- discovered at the Dur At-Talah escarpment in central Libya -- is the diversity of species present: the site includes three distinct families of anthropoid primates that lived in North Africa at approximately the same time.

This suggests that anthropoids underwent diversification, through evolution, previous to the time of these newly discovered fossils, which date to 39 million years ago. The sudden appearance in the African fossil record of diverse anthropoid families can be answered in one of two ways, the paper's authors say. It could be the result of a striking gap in the African fossil record prior to this period. This is unlikely to be the case as Northern Africa's Eocene sites have been well sampled over the past century, and no diversity of anthropoid fossils has yet been discovered that predates the new Libyan specimens. Therefore, the paleontologists suggest, it is more likely that several anthropoid species "colonized" Africa from another continent 39 million years ago -- the middle of the Eocene epoch. Since diversification would have occurred over extreme lengths of time, and likely leave fossil evidence, the new fossils combined with previous sampling in North Africa leads the paper's authors to surmise an Asian origin for anthropoids, as proposed by Beard and his colleagues in earlier work, rather than a gap in the fossil record.

"If our ideas are correct, this early colonization of Africa by anthropoids was a truly pivotal event -- one of the key points in our evolutionary history," says Christopher Beard, Curator of Vertebrate Paleontology at Carnegie Museum of Natural History and an author on the paper. "At the time, Africa was an island continent; when these anthropoids appeared, there was nothing on that island that could compete with them. It led to a period of flourishing evolutionary divergence amongst anthropoids, and one of those lineages resulted in humans. If our early anthropoid ancestors had not succeeded in migrating from Asia to Africa, we simply wouldn't exist."

Beard has done extensive research on anthropoid origins, including his work on the primate *Eosimias*. His book, The Hunt for the Dawn Monkey, has been critical in positing Asia, not Africa, as the place of origin for anthropoids. The search for information regarding the origins of man's earliest anthropoid ancestors remains one of the most hotly pursued subjects in paleontology.

"This extraordinary new fossil site in Libya shows us that in the middle Eocene, 39 million years ago, there was a surprising diversity of anthropoids living in Africa, whereas few if any anthropoids are known from Africa before this time," says Beard. "This sudden appearance of such diversity suggests that these anthropoids probably colonized Africa from somewhere else. Without earlier fossil evidence in Africa, we're currently looking to Asia as the place where these animals first evolved.

Story Source:

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

Journal Reference:

1. Jean-Jacques Jaeger, K. Christopher Beard, Yaowalak Chaimanee, Mustafa Salem, Mouloud Benammi, Osama Hlal, Pauline Coster, Awad A. Bilal, Philippe Duringer, Mathieu Schuster, Xavier Valentin, Bernard Marandat, Laurent Marivaux, Eddy Métais, Omar Hammuda, Michel Brunet. **Late middle Eocene epoch of Libya yields earliest known radiation of African anthropoids**. *Nature*, 2010; 467 (7319): 1095 DOI: 10.1038/nature09425

http://www.sciencedaily.com/releases/2010/10/101027133144.htm

Gene mapping project offers new clues about humans

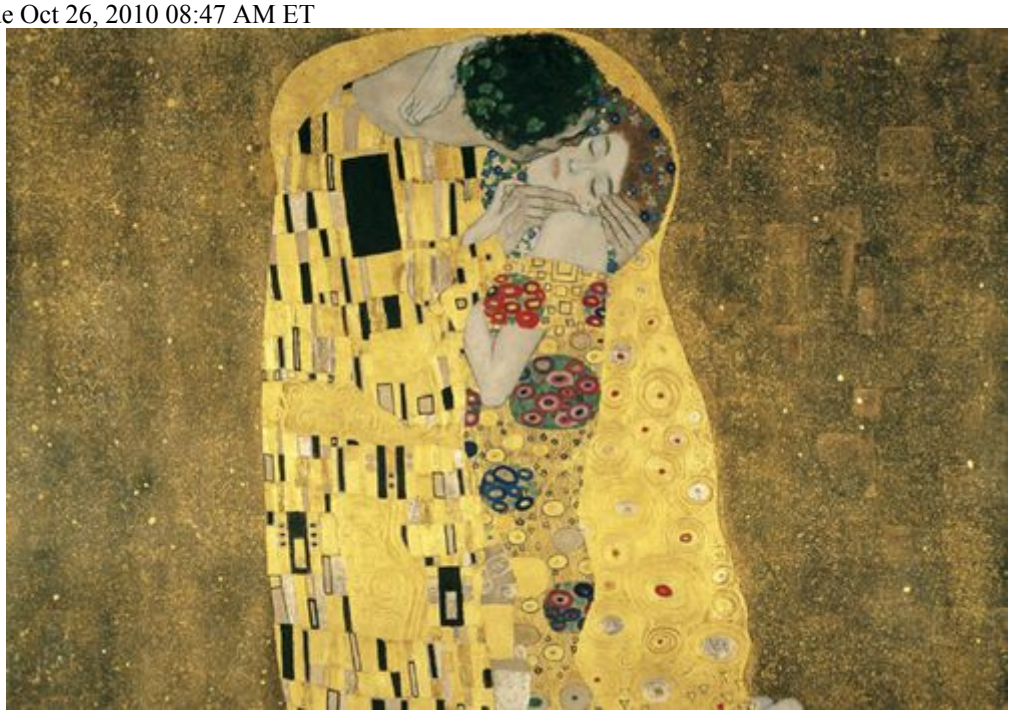
By Julie SteenhuysenPosted 2010/10/27 at 1:52 pm EDT
CHICAGO, Oct. 27, 2010 (Reuters) — Early data from the 1,000 Genomes Project, an international effort to build a detailed map of human genetic variation, is already offering new clues about human disease, including why some people are more severely affected by disease than others.

Dr. Evan Eichler of the University of Washington in Seattle and colleagues used findings from the pilot phase of the project to identify subtle differences among people in areas of the genome where DNA sequences are often repeated many times.
"I believe this is where we will make huge inroads in understanding the genetic basis of human disease," Eichler said.
His findings were released online on Wednesday in the journal Science to coincide with publication in Nature of the first data from the 1000 Genomes Project -- a public-private effort that aims to map to sequence and compare the genomes of 2,500 people from several different regions of the globe.
The data is expected to offer researchers a new set of tools to help understand the genetic causes of disease.
Eichler said differences in DNA sequences, known as copy number variation, have traditionally been difficult to compare, but they may explain why some people have certain diseases but not others.
And they may also explain why some people are more severely affected by disease than others.
Duplications of segments of the genome appear to have led to many of the qualities that distinguish human beings from other primate species, Eichler told a press briefing.
And they also may be linked with diseases like schizophrenia and autism, he said.
RAPID GAINS
The findings are possible because of advances in machines that sequence genetic information made by companies such as Illumina and Roche.
These are allowing researchers to make rapid gains in their understanding of all of the different variations in human genes, researchers from the 1000 Genomes Project team said on Wednesday.
"Already, just in the pilot phase, we've identified over 15 million genetic differences by looking at 179 people. Over half of those differences haven't been seen before," said Dr. Richard Durbin, group leader of the Wellcome Trust Sanger Institute and co-chair of the 1000 Genomes Project.
"This is the largest catalog of its kind, and having it in the public domain will help maximize the efficiency of human genetics research," Durbin told a news briefing.
The pilot includes data from more than 800 people, highlighting around 16 million variations in the genetic code that were previously unknown.
Durbin said researchers now know 95 percent of the genetic variants in any individual, which will help as teams try to assess the genetic causes of both rare and common genetic diseases.
The team found that each individual carries a significant number of potentially dangerous genetic mutations, with maybe 250 to 300 genes that have defective copies.
And they said the new map will allow researchers to look at the effects of recent evolution on the human genome.
(Edited by David Storey)

http://www.newsdaily.com/stories/tre69q4nt-us-genome-map/#

Brain Takes Less Than Second to Fall in Love

By Liz Day | Tue Oct 26, 2010 08:47 AM ET



A recent study used functional magnetic resonance imaging to see how love affects the brain. Its calculations of love has attracted plenty of attention.

For example, the time taken to "fall in love" clocks in at about one-fifth of a second, not the six months of romantic dinners and sharing secrets some might expect.

Also, 12 areas of the brain work together during the love process, releasing euphoria-inducing chemicals like dopamine, oxytocin, adrenaline and vasopressin. Love's high is similar to cocaine's rush.

Love influences sophisticated intellectual processes of the brain too. When a person feels in love, their mental representation, metaphors and even body image are also affected.

Researchers from Syracuse University, West Virginia University and the Geneva University Psychiatric Center retrospectively reviewed pertinent neuroimaging literature. They published their findings in a recent issue of the *Journal of Sexual Medicine*.

Overall, they found, love is really good for you.

Couples who had just fallen in love had significantly higher levels of nerve growth factor, or NGF. NGF is crucial to the survival of sympathetic and sensory neurons. Some believe NGF can reduce neural degeneration. Not a bad side effect.

Just as love is diverse, the part of the brain affected is also different.

Unconditional love, the type often seen between a mother and child, lights up the common and different brain areas, including the middle of the brain.

Not surprisingly, passionate love fires the reward part of the brain, but it also affects the higher-order cognitive function seen in body image.

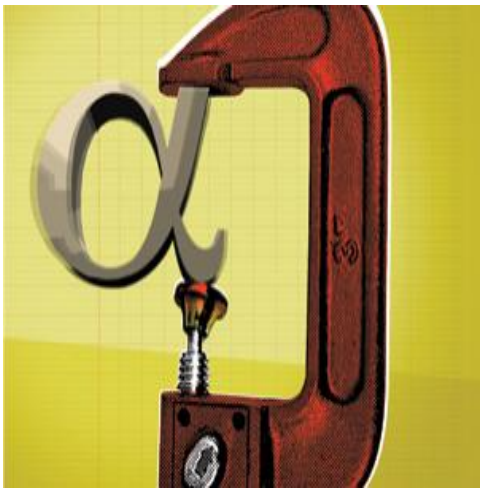
A follow-up study about the speed of love in the human brain is expected to follow soon.

Photo: Gustav Klimt's "The Kiss" (1908) credit: AP Photo/Belvedere Vienna

http://news.discovery.com/human/brain-takes-less-than-second-to-fall-in-love.html#mkcpgn=rssnws1

Constant change: Are there no universal laws?

- 25 October 2010 by **Michael Brooks**
- Magazine issue 2783.



Change is in the air (Image: Andy Martin)

It looks like physics works differently in different places. If so, everything we think we know about the cosmos may be wrong

IT'S not easy being John Webb. Sometimes, when he gives a talk about his work, he gets comments like, "I'm surprised you had the guts to say that."

Webb, who is an astronomer, doesn't really understand what else he is supposed to do. "I'm just reporting what's there in the data," he says. The trouble is, Webb's data says we should rewrite the laws of physics. Quite how, we don't yet know. According to his team's analysis of the light from distant galaxies, the way physics works may depend on the direction you're facing. That might mean resurrecting the ether, the substance once thought to permeate all of space before Einstein abolished it over a century ago, or even invoking extra dimensions.

Either way, the implications of Webb's result are huge. If his team is right, the work strikes at the heart of Einstein's special theory of relativity and our understanding of the cosmos.

With so much at stake, it's not surprising there is opposition. "This would be sensational if it were real," says cosmologist Max Tegmark of the Massachusetts Institute of Technology, "but I'm still not completely convinced." Lennox Cowie, an astronomer at the University of Hawaii in Manoa, puts it more bluntly. "I don't believe it," he says.

Webb, who is at the University of New South Wales (UNSW) in Sydney, Australia, first raised physicists' hackles about a decade ago, when he found some strange results after using the Keck telescope in Hawaii. He had been looking at quasars, which are extremely bright galaxies in the far reaches of the cosmos. As the quasar light passed through clouds of magnesium and iron atoms on its 12-billion-year journey to Earth, some of the light had been absorbed by the metal atoms.

Oddly, though, Webb's analysis said the atoms had taken up the wrong kind of light. The wavelengths of light absorbed by magnesium and iron can be predicted using the equations of quantum electrodynamics, but the ones Webb recorded were different. Twelve billion years ago, it seems, iron and magnesium absorbed photons of different energies than the ones they absorb today.

Webb did have an explanation, though. The observations fitted perfectly if he changed one of the fundamental constants of nature, known as the fine-structure constant, or alpha. This is a central pillar in quantum electrodynamics and dictates, among many other things, which photons certain atoms will absorb.

Today's value of alpha is approximately 1/137. But Webb's work showed that, billions of years ago, it must have been around one part in a million smaller.
Nobody believed the result was right, but neither could they find any flaws in Webb's analysis (*Physical Review Letters*, vol 82, p 884). The only other explanation was that something peculiar to the Keck telescope was to blame. So Webb turned to the Very Large Telescope (VLT) in Chile, and analysed the quasar light that it picked up.
Webb's PhD student, Julian King, has just completed the analysis. "When I started I quietly hoped we'd find the same thing Keck found," says King. "The worst case would have been no effect; then we would have had to start searching for the flaw at Keck."
King's worries were unfounded. There was an effect: as with the Keck observations, the VLT found a slightly different alpha from the accepted value. But the big surprise was that this time the constant was bigger, not smaller (arxiv.org/abs/1008.3907).
Webb thinks he knows why: alpha definitely varies, but in space not time. This startling conclusion comes from the fact that the Keck telescope and the VLT look out on different parts of the sky. Imagine drawing a straight line from the gas clouds used for the Keck observations to those that absorbed light on its way to the VLT (see diagram). According to King's results, the value of alpha grows as you move along that line. "The further 'south' you go, the more positive the change in alpha becomes," he says.

Broken symmetry

In other words, alpha seems to be small on one side of the universe and large on the other. Earth sits somewhere in the middle. "If we didn't violate the laws of physics in our previous results, we're certainly violating them now," says Michael Murphy at Swinburne University of Technology in Hawthorn, Australia, who works with Webb.
Murphy is only half joking. Back in 2002, Alan Kostelecky, Ralph Lehnert and Malcolm Perry showed that any spatial variation in alpha would break Lorentz symmetry. This is a golden rule of Einstein's special theory of relativity. It says that the laws of physics apply in the same way in all directions in the universe, and are not sensitive to the speed at which you are moving. So someone carrying out an experiment while travelling close to the speed of light from Earth to Alpha Centauri would get the same result as someone travelling the other way, and they would both agree with someone carrying out the same experiment in a lab back home (*Physical Review D*, vol 68, p 123511).
So it's a real problem, even though the spatial variation in the laws of physics would be tiny from here to Alpha Centauri. "It's the principle of the thing," says Craig Hogan of Fermilab in Batavia, Illinois. "You can extrapolate to larger distances and expect physics to look entirely different far away."
That is unacceptable. For a start, our models of the universe are built on the assumption that everything works in the same way everywhere in space and time. If the laws of physics are a moveable feast, our carefully constructed history of the universe starts to fall apart. In its place all we have are, as the late great physicist John Wheeler put it, "cosmic by-laws". The only comfort is that this scenario might provide some support for string theory (see "It came from another dimension", below).

Cosmic alignment

The violations of Lorentz symmetry have other implications, too. If the laws of physics depend on your orientation in the universe, it takes physics back more than a century - to the age of the ether.
The concept of the ether was developed by physicists in the 19th century because they thought there must be a medium through which light travelled, in the same way that sound requires air. They hypothesised that its presence could be detected by the movement of the Earth through it, which would create an "ether wind". This would mean that experiments designed to measure the speed of light would find different results depending on which direction they faced.
However, a landmark experiment in 1887 by Albert Michelson and Edward Morley failed to find any evidence for such effects. Einstein concluded that the absence of the ether meant that the speed of light must be constant everywhere and he used this as the framework for special relativity.
That didn't put an end to the search for evidence of Lorentz violation, however. We know that Einstein's theories of relativity are not the final word, and Kostelecky and others have studied many things, such as the

behaviour of neutrinos and the way neutrons spin, looking for where they break down. So far, they have drawn a blank. That's what makes Webb's result so intriguing.

So what should we do about it? One answer is to do nothing until we find another result that corroborates its claims.

Physicists are an extremely cautious breed. Even Wim Ubachs, an atomic physicist at the Free University in Amsterdam in the Netherlands, who has called Webb's result the "physics news of the year", urges care. "It is exciting because it is a glimpse of new physics, something entirely different," he says. "But it has to be verified and reproduced."

One of the best ways to do that might lie in comparing Webb's results with other heresies we have noticed. Just as magnetic north provides a "this way up" orientation for anyone on Earth, the line along which alpha grows can be considered as an "axis", or dipole, that defines a direction through the cosmos. And there are other axes to consider. For example, analysis of the cosmic microwave background radiation has revealed what João Magueijo and Kate Land of Imperial College London dubbed the "axis of evil". If the universe is the same whichever way you look at it, hot and cold spots of radiation will be randomly scattered across the sky. Yet the hot and cold spots seem to run in a particular direction through the cosmos, though this is very different to the axis of alpha.

The axis of alpha does line up with another cosmic anomaly, though. In 2008, Sasha Kashlinsky of NASA's Goddard Space Flight Center in Greenbelt, Maryland, noticed a huge phalanx of galaxies streaming across the universe. The galaxies are heading, for no obvious reason, towards a gap in the sky between the constellations of Centaurus and Vela (*New Scientist*, 24 January 2009, p 50). Subsequent observations have confirmed the motion: they seem to be moving at around 1000 kilometres per second, perhaps under the gravitational influence of some gargantuan structure beyond the cosmic horizon, in a similar direction to the alpha axis. "It looks as if our dipole is not very far away from theirs," Webb says.

A couple of other possibilities have arisen. There is a dipole in the abundance of deuterium in the early universe - and it runs parallel to the axis of alpha. Another dipole comes from the intensity of light emitted by supernovae, which King says is "vaguely near" the axis of alpha. "It's far from conclusive proof, but people have run simulations of the statistical chance of all these dipoles aligning and it's actually quite small," King says.

There are more options to be explored. Look at the way clouds of hydrogen molecules absorb quasar light, for example, and you'll find suggestive evidence of another axis.

Alignments aren't the only source of corroboration. Further examinations of the amounts of helium and lithium in the early universe may reveal evidence of variation in other constants, such as those associated with the strong force that holds nuclei together.

In fact, evidence of variation in any of the dozens of constants of physics could help explain a varying alpha; it is generally agreed that if one constant varies, they all will. "I couldn't imagine a unified theory of the universe where alpha varies and other constants don't," says Victor Flambaum, one of Webb's colleagues at UNSW.

Not all the evidence is to be found in space, though. Working with Julian Berengut, also at UNSW, Flambaum has drawn up a list of ways that alpha and other constants might be checked on Earth. A variation in alpha would, for instance, show up in atomic clocks as the Earth moves through space. Unfortunately, our best atomic clocks are not yet sensitive enough to detect a change of the level that Webb's team find. However more sensitive clocks are in the pipeline (arxiv.org/abs/1008.3957).

A variation in alpha would show up in atomic clocks as we move through space

Meanwhile, Kostelecky suggests, the fact that varying alpha breaks Lorentz symmetry might provide another way to test it. "This could lead to signals in lab experiments," he says.

Still, most physicists remain convinced that all this would be wasted effort. "These anomalies come and go," says Pedro Ferreira at the University of Oxford.

So what will it take for the world to believe in varying constants? The chance of Webb's result not being due to chance is 99.9937 per cent. Though that sounds reliable, a scientific discovery traditionally has to be at 99.99994 per cent to count. "I don't believe that people will take it seriously even then," Ferreira says. It still

wouldn't be enough for anyone to consider rewriting the laws of physics, he reckons, not when the stakes are so high.

Webb is sanguine about this. "What we've got here is the most precise measurement of physics that has ever been made over a large volume of the universe," he says. "Nobody has said, 'here is a problem with your analysis', or 'here's a systematic error that can explain your results'. The only tool they've got is to say, 'I don't believe it'. People are clutching at straws."

No one can point to a flaw in our analysis or an error explaining the results. They just say 'I don't believe it'

There are plenty of precedents for anomalies seeding scientific revolutions. Unfortunately for Webb, the process usually takes decades for evidence to pile up, and vindication often comes after everyone involved in the original discovery has shuffled off this mortal coil. It might be hard being John Webb now, but perhaps he can draw comfort that his name might live on long after he is gone.

Combo for life

If the fundamental constants do vary across the universe, there can be only a few places that are in perfect sync for life to arise.

Alpha, which determines the details of various processes in atoms and their nuclei, could only become around 4 per cent bigger before stars would be unable to produce carbon atoms. If the ratio between the strength of gravity and the strength of electromagnetism was just one-sixth smaller, stars would burn out too quickly for complex life to evolve and we wouldn't be here.

Altering the force that holds atomic nuclei together by around 15 per cent would also do us in. Make it that much smaller and the only element around would be hydrogen because protons and neutrons couldn't bind together. That much larger and there wouldn't even be hydrogen.

It came from another dimension

If there is any variation in alpha, or any of the other so-called constants, it might be taken as evidence for string theory, our best candidate for a theory of everything.

According to string theory, the three dimensions of space that we inhabit are only the tip of the iceberg. There might be another six or seven "hidden" dimensions, and the constants of physics should only be constant when you take all of them into account. Just as a sphere moving through a two-dimensional plane looks like a circle of varying size from above, alpha could well look like it varies when viewed from just three of its dimensions.

Other worlds

Though it sounds crazy, this scenario is also the best explanation we have for why gravity is so much weaker than the other forces, such as electromagnetism. Gravity is thought to "leak" out of higher dimensions into our own, while other forces are more firmly anchored to our familiar reality.

The strange world of strings offers further corroboration for a variable alpha. One of the problems string theorists face is that their equations have multiple solutions, leading to numerous kinds of worlds. According to this view, our universe is part of a "landscape" with many different regions, each with its own physical laws and constants.

There's even a good tie-in with mainstream cosmology to explain why changes in the constants would be gradual and difficult to detect. In the first moments after the big bang, the universe went through a super-fast expansion that would have smoothed out the variations in physics in different regions, just as smoothing out a crumpled piece of paper gets rid of all its sharp folds and spikes. "Some will say alpha would change very gradually because the scale of the structure was blown up to huge size by cosmic inflation," says Craig Hogan of Fermilab in Batavia, Illinois.

Michael Brooks is a consultant for New Scientist and author of 13 Things that Don't Make Sense (Profile)

http://www.newscientist.com/article/mg20827830.900-constant-change-are-there-no-universal-laws.html

Solar power could crash Germany's grid

- 27 October 2010
- Magazine issue 2784.

Too much of a good thing? (Image Patrik Stollarz/AFP/Getty)

HARNESSING the sun's energy could save the planet from climate change, an approach that Germany has readily adopted. Unfortunately, this enthusiasm for solar panels could overload the country's ageing electricity grid.

Solar power is intermittent and can arrive in huge surges when the sun comes out. These most often happen near midday rather than when demand for power is high, such as in the evenings. A small surge can be accommodated by switching off conventional power station generators, to keep the overall supply to the grid the same. But if the solar power input is too large it will exceed demand even with all the generators switched off. Stephan Köhler, head of Germany's energy agency, DENA, warned in an interview with the *Berliner Zeitung* on 17 October that at current rates of installation, solar capacity will soon reach those levels, and could trigger blackouts.

Subsidies have encouraged German citizens and businesses to install solar panels and sell surplus electricity to the grid at a premium. Uptake has been so rapid that solar capacity could reach 30 gigawatts, equal to the country's weekend power consumption, by the end of next year. "We need to cap installation of new panels," a spokesperson for DENA told *New Scientist*.

However, the German Solar Industry Federation rejects DENA's concerns, claiming that extra solar energy takes the pressure off high-voltage power lines because it tends to be generated close to where it is used. The federation adds that the grid only needs to be strengthened in some rural areas where solar supply can exceed demand.

Germany's problems highlight the perils of moving to renewables without adequate preparation. "You lose flexibility on the supply side, so you need to gain some on the demand side," says Tim Green of Imperial College London, perhaps by encouraging people to charge their electric cars when the sun shines.

The best long-term solution is to install region-wide grids, says Tim Nuthall of the European Climate Foundation in Brussels, Belgium. "In Europe, you need a grid that balances the sun in the south with the wind in the north."

http://www.newscientist.com/article/mg20827842.800-solar-power-could-crash-germanys-grid.html

Ten years to save the touchscreen

- 27 October 2010 by **James Mitchell Crow**
- Magazine issue 2783.

What material will keep our touch dreams alive? (Image: Etienne Ansotte/Rex Features)

A wonder material makes your smartphone screen work. But with the world's stocks running out fast, the hunt is on for new stuff to keep us in touch

A TAP and a flick, and a new world is at your fingertips. Email, social networks, the digital version of *New Scientist*: surfing the web has never been easier thanks to the touchscreen technology built into the latest smart mobile devices. Proud owners need little excuse to demonstrate their new darling's superior, sexy features. Touch is fast, touch is fun - touch is the future.

Yet touch could soon be history, if we are not careful. Today's mobile touchscreen gadgets, along with all liquid crystal displays, rely on the unusual properties of a single material - a metallic crossbreed whose sources could be exhausted within the decade. It is not just our displays that are under threat. Solar cells and low-power LEDs, both central planks of a low-carbon energy strategy, could feel the squeeze too. No surprise, then, that companies and laboratories across the world are scrambling to find a replacement.

If this is all news to you, chances are you have never heard of the material causing all the fuss. A mixture of two metallic oxides called indium tin oxide (ITO), it is the material electronic engineers love to hate. Its principal component, indium, is a by-product of lead and zinc mining; it is difficult to come by and expensive. Once through the factory gates, ITO's brittleness and inflexibility make it a pain to work with.

And yet it has qualities that make us forgive its defects. Specifically, it is a rare example of a material that is both electrically conducting and optically transparent, which means it does not absorb photons of light.

Absorption occurs when a photon's energy matches that needed to knock an electron into an excited state. In a metallic conductor, where there is a free-flowing "sea" of electrons with many different energy states, ths almost always happens. Accordingly, almost all metals are highly absorbing - and entirely opaque.
Not so ITO. It is transparent like glass, but also conducts - not as much as most metals, to be sure, but enough. That makes it ubiquitous in modern electronic devices that manipulate light. In flatscreen televisions, each display pixel is switched on and off by a pair of transparent ITO electrodes. In thin-film solar cells, the light-absorbing layer needs an electrode front and back to form a circuit and so convert sunlight to electricity.

Sexy touch

Touchscreens are just the latest innovation to depend on ITO. Some old touchscreens do without it, for example using infrared LEDs ranged around the screen to fire beams that are blocked by a touch. But this bulky, power-hungry set-up is ill-suited to a small device. The first mobile touchscreen gadgets came equipped with a stylus and two layers of ITO separated by a slight gap. Tapping this "analogue resistive" screen with the stylus brought the two layers into contact, allowing a current to pass that the device detected. The sexy new handset in your pocket exploits the fact that your finger is conductive to do away even with the stylus. Touching the screen changes its capacitance at that location, a change picked up by a single layer of ITO. That innovation was the real breakthrough, says Lawrence Gasman of analysts NanoMarkets in Glen Allen, Virginia. "Multi-touch really changes the smartphone environment, almost like a mouse did for computing," he says. "Without it to expand the text, you'd probably go blind trying to read the web on such a small screen."
But how much longer can we count on the material behind that wonder? No one is quite sure how much or little indium there is left, says Thomas Graedel of Yale University, who heads the United Nations Environment Programme's working group on global metal flows. In part, that is because it is only a mining by-product and not all mines go to the trouble of recovering it. The US Geological Survey estimates that known reserves of indium worldwide amount to some 16,000 tonnes, overwhelmingly in China. Dividing that by the rate at which we are currently using the stuff suggests those reserves will be exhausted by 2020.
New sources of indium are almost certain to be found, but they are unlikely to satisfy the skyrocketing demand for ITO. This year, according to Gasman's figures, the touchscreen market alone is worth $1.47 billion, and will balloon to $2.5 billion by 2017. Even if the exact extent of indium supplies is hazy, ITO is set to become increasingly rare, and so increasingly expensive. This bald economic fact - and the fact that China is already curbing exports - is driving companies to search for alternative, indium-free touchscreen technologies.
Barring a fundamental shift in technology (see "Inside job"), the obvious place to start looking is among chemically similar materials. One pretender is zinc oxide, which is readily available for a fraction of ITO's cost. It is not as conductive, transparent or physically resilient as ITO, however. That is problematic, especially given that conductivity determines the responsiveness of the screen, and ITO's conductivity is already about as low as it can be and still be useful. "A little more or less makes a huge difference," says Gasman. "All that these replacements are is cheap."

Toxic stop-gap

Perhaps the answer is not to cut out indium altogether, but make what we have go further. Tobin Marks and his colleagues at Northwestern University in Evanston, Illinois, have developed a material based on cadmium oxide with just a sprinkling of indium that is just as transparent as ITO and three to four times as conductive. The material is prone to corrosion, so needs to be sealed under a thin layer of ITO, but ends up being just 20 per cent indium compared with 90 per cent for ITO (*Thin Solid Films*, vol 518, p 3694).
That has the sound of a stop-gap solution. Unfortunately, it's not that simple. First, cadmium is a highly toxic metal, requiring careful handling and disposal. Second, materials such as cadmium oxide are prone to cracking, a decidedly inconvenient property in a screen that is designed to be repeatedly prodded and poked. ITO suffers from a similar brittleness itself. This has been less of an issue as long as the technology has been used principally in smartphones, which have a typical lifetime in our pockets of just 18 months; within such a timeframe a screen is highly unlikely to degrade to the point of becoming unusable. But as touch technology migrates to longer-lived tablet computers and e-readers, the problem is becoming more pressing. And the

impending arrival of flexible, foldable - or at least rollable - displays is giving manufacturers yet another reason to look for a radically different solution to ITO.
The impending arrival of flexible, foldable displays is yet another reason to look for a radically different touchscreen technology
Conducting polymers, perhaps? These long-chain organic molecules, discovered in the 1970s, act like molecular wires and beat ITO hands down when it comes to bending and flexing. But they are about as easy to manipulate as brick dust, says Yueh-Lin Loo of Princeton University. They can't be melted without changing their properties and they won't dissolve either, so making coatings of pure conducting polymer is just about impossible. Additives intended to make them soluble, so that they can be applied like ink, have had the annoying effect of wrecking their conductivity.
Until now, that is. In February this year, Loo and her colleagues found an additive that not only dissolves the polymer, but also disrupts the interactions between individual polymer chains, allowing them to "relax". That irons out kinks in the chains that hinder the flow of electrical current (*Proceedings of the National Academy of Sciences*, vol 107, p 5712).
It's hardly an ideal solution, though. Conducting polymers might not be brittle like the metal oxides, but they have their own degradation problems. Prone to attack by ultraviolet light and oxygen in the air, polymers are not the perfect solution for an oft-wielded touchscreen device. So is there any material that can tick all the performance boxes? Yes, says Mark Hersam, also at Northwestern University: carbon nanomaterials.
Carbon is a chemical chameleon. In some particularly black guises, it is the most light-absorbing material known. Pare it down to nanoscale structures, however, and it becomes transparent. In June this year, for example, a team led by Jong-Hyun Ahn and Byung Hee Hong of Sungkyunkwan University in Suwon, South Korea, developed a film consisting of four layers of graphene on a plastic backing. Graphene, the wonder material behind the award of this year's Nobel prize in physics, consists of sheets of graphite just a single atom thick. The graphene-plastic combination allowed 90 per cent of visible light to pass through and had a conductivity not far behind that of the highest quality commercial ITO (*Nature Nanotechnology*, vol 5, p 574).
Carbon nanotubes, which are essentially graphene sheets rolled up into tiny cylinders, look promising, too. They are rough, tough, transparent and increasingly available on a commercial scale. They would even work for flexible displays, says Hersam. "You can flex them, stretch them, with little to no degradation in their performance," he says.
The problem is making a conducting network out of them. Individual nanotubes are highly conductive, but the electrons racing across their surface stop dead when they get to the end of a nanotube and have to jump to the next. Hersam has a few ideas for improving contact between the tubes, for example by soldering them together with a good conductor that wouldn't affect the optical properties too much. But it is still early days. "We've been working in the area much less time than ITO has been in development for, which gives me hope that there are further improvements to be had," he says.
Others are less sanguine. Jonathan Coleman of Trinity College Dublin in Ireland researches transparent conductors in collaboration with electronics giant Hewlett-Packard. "When we started, industry thought that carbon nanotube films would be it - but no longer," he says. After trying various ideas to get around the problem of high resistance between the tubes, he and his colleagues decided that a rethink was needed. "We realised that, if instead of nanotubes you had metal nanowires, then where they touch you might get some bonding, giving electron transfer between them," he says.
Experimenting with silver nanowires, his team discovered that they could achieve transparency of 85 per cent and a conductivity only a fraction behind that of ITO (*ACS Nano*, vol 3, p 1767). "Optically and electrically, the silver was almost identical to high quality commercially available ITO, but totally flexible," says Coleman. Another team led by Peter Peumans at Stanford University in California achieved similar results (*Nano Letters*, vol 8, p 689).
Unfortunately, this bling comes at a price: silver nanowires are 10 times as expensive to produce as the already pricey top-grade ITO. Cheaper metals just don't seem to cut it, though. With copper nanowires, for example, the conductivity is good, but the transparency is low, at 60 per cent.

But even if silver's magic properties cannot be replicated with other materials, all is not lost. As production ramps up, prices will fall - and with indium only becoming more expensive, the costs will cross over at some point. "It's just a question of when," says Coleman. "Hewlett-Packard are now looking at silver nanowires as a material of choice."

So roll up, ladies and gentlemen, place your bets. Silver, carbon, zinc, cadmium, polymer... which will become the triumphant successor to dwindling ITO? None has yet shown a clear advantage, but the soaring demand for touchscreens and the breakneck rate of innovation means one must step into the breach. After all, we all want to stay in touch.

Inside job

Could big screens be the saviour of the smartphone? As supplies of vital indium tin oxide (ITO) for touchscreen applications dwindle (see main story), the expansion of the technology into bigger devices such as tablet PCs has piqued the interest of manufacturers of liquid crystal displays.

Touchscreens are currently made simply by sticking a touch-sensitive ITO surface onto an LCD from a big manufacturer such as Samsung or Sony. But these companies could build touch sensitivity into the display itself, integrating it into each pixel, says Lawrence Gasman, principal analyst at NanoMarkets in Glen Allen, Virginia.

One such system would simply move the indium-based technology used by today's multi-touch smartphones to within the pixel layer. Two other techniques are indium-free. The first of these employs a mechanical switch behind every pixel, registering the force as the screen is touched. But using pressure-sensing technology means doing away with the protective glass cover that usually fronts a touchscreen device, leaving it vulnerable to damage.

The second possibility is an optical technology that incorporates a light-detecting element into each pixel. These light sensors turn the screen into a kind of scanner that can detect and follow a finger as it strokes the screen. That too has its problems: optical touch needs significant processing power to continually analyse the screen surface for touch inputs, and works only at about a quarter of the speed of a traditional laptop touchpad. But that needn't be a deal-breaker. "As processing power gets ever faster, that is a problem that will solve itself," says Gasman.

Indeed, the first optical touch devices have already hit the market. Last year the electronics company Sharp released a laptop in Japan fitted with a touch-sensitive second screen where the touchpad would usually be. The fact that the product hasn't been rolled out outside Japan, however, makes Gasman wonder if the technology is experiencing teething problems.

In any case, such innovations do not address the more fundamental problem that, touch or no touch, the electrodes that supply power to the pixels of LCD displays themselves depend on ITO. That will be solved only by the development of new materials that mimic ITO's intensely desirable combination of transparency and conductivity.

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http://www.newscientist.com/article/mg20827831.000-ten-years-to-save-the-touchscreen.html

Device gives parents their child's eye view

- 15:36 26 October 2010 by **Yuriko Nagano**, Tsukuba

Child monitoring reaches a new level (Image: Yuriko Nagano)

Yoko Ihara is watching her 5-year-old son Yoshinobu playing at a nursery in Tsukuba, Japan. She works full-time, and wonders how Yoshinobu gets on when they are apart. In this way, she's like many other mothers. Yet for the next five weeks, Ihara will gain insights into her child's life that few parents have before.

She and Yoshinobu are taking part in an experiment to test a unique child safety device. The technology builds on existing devices that can track the location of a child, but this gadget also monitors what the child is seeing, and even their pulse. If a child's heart rate is faster than usual, it snaps a photo of their point-of-view and alerts parents via email.

The device's makers, a team led by Seung-Hee Lee at the University of Tsukuba, say carers could use it to identify bullying, for instance. It could also reveal if a child is separated from other device-wearing children for a given stretch of time. A password-protected website allows parents to access an activity log and photos taken during the day.

During the trial, 10 children aged 2 to 6 will wear the 97-gram device for several hours a week. As well as a camera, it holds an accelerometer with gyroscope, a GPS receiver and a digital compass. The heart rate monitor sits under clothing.

Light play

When *New Scientist* visited, the children were showing off their colourful devices to each other. "The devices have been sturdy and have endured kids falling off of play equipment and accidentally hitting them," says Lee. "It was important for us to make sure these were light and children's activities wouldn't be hindered by the device, and it was equally important they would want to wear it."

To minimize possible effects from exposure to electromagnetic waves, the units are set to emit signals that are only a hundredth of what an average cellphone emits. "The signals are weak, but we set it up that way to make it safe," says team-member Masatoshi Hamanaka. The weak signals mean that 30 relay points and 18 transmitters needed to be planted around the nursery.

Right now, each device costs roughly 100,000 yen (£800) to make. But with cheaper sensors, the team aims to manufacture the devices for half that price. Lee also sees the device being used in the care of people with dementia.

Privacy concern

Future experiments are planned for school children aged 6 to 11 in Japan, with an additional microphone that can pick up and store the wearer's conversations.

Kenji Kiyonaga, who researches child safety at Japan Women's University in Tama, Kawasaki, says the technology is intrusive, but would be tolerated in Japan, at least in the near future. "Standards of privacy are low here," he says. "In the US or Europe, there would be much more controversy surrounding such child-tracking devices." Even if it's lightweight, the strap would feel oppressive for the child, he adds.

Lee brushes off such criticism. "I'm a mother and I'd say that if it's a parent's choice between a child's privacy and keeping them safe, most would choose the latter," she says. The strap has been carefully designed to be comfortable, she adds.

http://www.newscientist.com/article/dn19639-device-gives-parents-their-childs-eye-view.html?full=true&print=true

All-electric spintronic semiconductor devices created

- 12:32 20 October 2010 by **Kate McAlpine**

In a world where time means money, computers waste both by processing data in one format and storing it in another. Now physicists have taken another step towards making electron spin the universal language of computation.The magnetic memory inside computers exploits an intrinsic property of electrons – their spin. But computer processing relies on a different fundamental property – electric charge. Spintronics devices could use electron spin to perform both operations, promising to speed up a computer's load and boot times, says Paul Crowell of the University of Minnesota in Minneapolis.

His team has brought those exotic-sounding devices a step nearer by grounding them in a reassuringly familiar landscape: they are the first to develop a simple, all-electric method to both generate and detect spin currents within a standard semiconductor.

Electrons spin in one of two directions – left or right – and a spin current can be generated by separating out the two classes of electrons and sending each on a different route through a material. Some methods for generating spin currents require super-pure exotic materials – any impurities disrupt the orderly flow. But Crowell's team is pinning its spintronic hopes on the humble semiconductor instead.

Veering electrons

Impurities, a disadvantage inside the exotic materials, are critical for the generation of spin currents inside semiconductors. As electrons bounce off the impurities, they tend to veer right or left depending on whether their spin is right or left-handed – a phenomenon known as the spin Hall effect.

In their recent experiment, Crowell and colleagues sent a current through a gallium arsenide semiconductor, doped with silicon impurities and indium to enhance the spin-splitting effect. The impurities were contained within a 2.5-micrometre-deep, 30-micrometre-wide channel: as electrons pinged off the impurities to right or left, they gathered at the channel's edges, where they passed one of two iron electrodes bordering each side of the channel.The electron's spin gives it a tiny magnetic moment, and the moments of the right and left-spinning electrons point in opposite directions. The electrons spinning inside the two iron electrodes only "see" the electrons in the semiconductor that share their alignment – in this case, the right-spinning electrons. Because many of those right-spinning electrons gathered at one side of the semiconductor channel – while left-spinning electrons gather at the other side – one of the iron electrodes sees more negative charge than the other, establishing a voltage between the two and giving the first electrical measurement of the spin Hall effect."You can actually just hook up wires" to the semiconductor, says Crowell. "That makes things a lot more flexible."

Long road ahead

Vanessa Sih of the University of Michigan in Ann Arbor says that optical techniques were previously the best way to measure the spin Hall effect. "Electrical [techniques] allow for a more direct measurement of the spin Hall conductivity and would also be more practical for device applications," she says.

However, a long road still lies ahead before spintronic PCs hit the marketplace. These spin currents arise at room temperature, but Crowell's group's approach needs cold temperatures to keep the spin-divided electrons at the side of the channel long enough to be measured. A perhaps greater challenge will be to divide the electron spins more efficiently – in the present study, only a few of every hundred electrons separated according to their spin.

Those inefficiencies could be improved by identifying materials better suited for generating and maintaining spin currents – and the new technique could help. The electrical detection of separated spins is "liberating", says Crowell, because it widens the search space to include opaque semiconductor devices, previously impossible to study with the alternative laser-based methods of measuring electron spin.

Journal reference: *Physical Review Letters*, DOI: 10.1103/PhysRevLett.105.156602

http://www.newscientist.com/article/dn19601-allelectric-spintronic-semiconductor-devices-created.html

Bisphenol A is everywhere – is it safe?

- 25 October 2010 by **David Melzer** and **Tamara Galloway**
- Magazine issue 2783.

Contains more than just water (Image: Image Source/Rex Features)

Mounting evidence against a chemical we are exposed to daily is being ignored. What more do regulators need, ask ***David Melzer*** *and* ***Tamara Galloway***

THREE letters lie at the heart of our modern world: BPA. Short for bisphenol A, a synthetic oestrogen, a staggering 3 billion kilograms of the stuff is produced annually, with an estimated value of $500,000 per hour to the global economy.

BPA is used in the production of a hard and transparent form of polycarbonate plastic used to create food and drink containers and other consumer goods. It is also used in the epoxy resins that line metal food cans, and as an ingredient in dental sealants.

In fact, we are so consistently exposed to BPA that over 90 per cent of us excrete BPA metabolites in our urine at any given time. How exactly BPA enters the human body is not yet clear, although eating food kept in BPA-containing packaging, breathing household dust and handling plastics that contain BPA may all contribute to our daily exposure. Currently, BPA is not listed on food or drink labels so millions of people have no way of knowing their daily exposure.

BPA was first reported in the scientific literature in the 1930s as a synthetic oestrogen, and it is this property that has led to most of the subsequent controversy. Laboratory studies show that, at the right dose, BPA can act as a hormone mimic, binding not only to oestrogen receptors but to other related receptors, too. However, this "active" dose has been furiously contested in what has become an intense scientific dispute.

The active dose of BPA has been furiously contested in what has become an intense scientific dispute

A large number of lab studies using rats and mice exposed to high doses of BPA failed to show measurable effects on key aspects of reproductive development, function and behaviour. But other studies of rodents continue to be published that do show developmental and functional abnormalities at low doses, including at doses significantly below those found in humans.

Given the near ubiquitous presence of BPA in our bodies and its recognised activity as a hormone disrupter, you might expect regulators to take a precautionary approach. The European Food Standards Agency (EFSA) has just had a chance to revise its safety level for BPA, or its Tolerable Daily Intake (TDI). However, in its latest opinion paper, published at the end of last month, the EFSA wrote that "no new study could be identified, which would call for a revision of the current TDI", seemingly discounting much recent science.

Current recommendations by the EFSA and the US Food and Drug Administration (FDA) have remained unchanged for several years, with the TDI set at 50 micrograms of BPA per kilogram of body weight per day. This equates to a "safe" dose for an average person weighing 70 kilograms of 3.5 milligrams of BPA per day. For comparison, the daily contraceptive pill contains around 50 micrograms of oestrogen, though the synthetic oestrogens in most modern pills are much more potent than BPA.

Why the apparent generosity of the TDI limit? Some regulators have argued that since BPA appears to have a very short half-life in humans, it has little time to circulate in the body and cause any effects. Also, they point to the fact that BPA is just one compound with weak oestrogenic activity. By contrast, soya products may be ingested in far higher amounts and typically contain a whole array of plant-derived "natural" oestrogens. Not only that, but average exposure to BPA is thought to be well below 100 micrograms per day, orders of magnitude lower than the level required to exceed the TDI.

Despite these arguments, doubts remain about BPA's safety. BPA is a synthetic chemical not found in nature. It doesn't just bind to the main oestrogen receptor, but also to poorly understood variants of it, and has an anti-androgen effect. Most reports of low-dose effects have come from animal studies. The focus is now beginning to shift to looking for direct evidence of BPA effects in humans. Our own human epidemiological studies have reported associations with cardiovascular disease, liver enzyme abnormalities and, recently, raised testosterone concentrations in men (*Environmental Health Perspective*, DOI: 10.1289/ehp.1002367).

If these associations turn out to be causal, then BPA may be anything but inert at everyday exposure levels. However, while epidemiological studies are excellent at identifying things worth investigating, hard proof can only come from a controlled experiment. In 2009, the US National Institute for Environmental Health Sciences set out a $30 million research programme to look into the effects of BPA. Most of this effort has been concentrated on lab studies. We believe this will not be enough, and that human studies are also required to settle the argument.

Of course we can't just give people BPA and wait for them to develop disease. Instead, we should harness the power of modern molecular biology to establish whether BPA at everyday exposure levels is biologically active in humans. A controlled experiment where subjects would avoid known sources of BPA, followed by measured exposures at realistic everyday intakes - far below the official safe limit - for a limited period should be practicable. Such a study could only be done with the consent of well-informed volunteers.

This approach could also help us discover what BPA does to sex hormones and other potential molecular targets. These crucial questions are currently being ignored. While experimental exposure of humans to BPA raises ethical concerns, we should consider that it could be profoundly unethical to forcibly expose millions to a chemical that we cannot yet say with certainty causes no harm - as we may be doing right now.

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http://www.newscientist.com/article/mg20827834.600-bisphenol-a-is-everywhere--is-it-safe.html

Anti-obesity drug dulls brain response to 'food porn'

- 22:00 26 October 2010 by **Catherine de Lange**

It's a familiar feeling. After a large meal you feel full, but a glimpse of a slice of gooey, rich chocolate cake is enough to get you salivating again.

Could it be possible to prevent our brains from responding so strongly to the sight of tantalising treats? The answer is yes, according to new research which suggests that some anti-obesity drugs work by dulling this brain response to the sight of appetising, high-calorie food.

Paul Fletcher from the University of Cambridge and colleagues wanted to understand how drugs that help people lose weight affect the brain. To find out, they gave 24 obese people either the anti-obesity drug Sibutramine or a placebo for two weeks and then scanned their brains while showing them pictures of high- or low-calorie foods, such as chocolate cake or broccoli.

Not only did volunteers taking the drug eat less and lose weight during the two weeks of the study, their hypothalamus and amygdala – areas of the brain involved in reward – also responded more weakly to the sight of high-calorie foods than those given the placebo.

"This is the first evidence that an anti-obesity drug changes brain function," says Ed Bullmore, who is also at the University of Cambridge and also worked on the study. More importantly, says Bullmore, it shows how these brain changes are correlated with a change in eating behaviour, and ultimately weight loss.

Hooked on fat

In the same way that some people respond more strongly than others to addictive drugs, the study could help explain why some seem more prone to obesity than others, says Bullmore. "You might imagine that some people that are obese are predisposed by their brain circuitry to experience stronger rewards when they eat these highly fatty foods."

Sponsored by pharmaceutical company GlaxoSmithKline (which does not manufacture Sibutramine), the research also shows how useful brain scans might be in testing the potential of new anti-obesity drugs before going to large-scale clinical trials.

Previous research has shown that reward pathways in the brain become less active as people gain weight, causing them to eat more. Longer studies will be needed to determine whether the brain changes seen in this study will persist or adapt to the drug over time.

Journal reference: *The Journal of Neuroscience*, DOI: 10.1523/jneurosci.3323-10.2010

http://www.newscientist.com/article/dn19645-antiobesity-drug-dulls-brain-response-to-food-porn.html

Suicide-by-pesticide study ranks compound toxicity

- 21:00 26 October 2010 by **Miriam Frankel**

Some pesticides are more toxic to humans than previously thought and the World Health Organization should adjust its figures accordingly to reduce self-poisoning.
So says Andrew Dawson at the University of Peradeniya in Sri Lanka, who studied 7461 pesticide-suicides and attempted suicides.
Agricultural pesticides are the most common means of suicide worldwide, resulting in more than 250,000 deaths each year. In their 6-year study, Dawson's team found that, depending on the pesticide taken, fatality of cases arriving at two Sri Lankan hospitals varied between 0 and 42 per cent.
They found certain pesticides were far more toxic to humans than the WHO ranks them based on animal studies. They also discovered pesticides that are similarly effective in agricultural practice but vary in their toxicity to humans.
The WHO should incorporate the new data into their pesticide-toxicity classification, which informs policy decisions, to better address the public health problem of suicide, says Dawson.
Journal reference: *PLoS Medicine*, DOI: 10.1371/journal.pmed.1000357

http://www.newscientist.com/article/dn19640-suicidebypesticide-study-ranks-compound-toxicity.html?full=true&print=true

Early Sauropod Dinosaur: First Complete Skeleton Found

Skull and lower jaw of Yizhousaurus, an early sauropod dinosaur from the Lower Jurassic (~200-million-years-old) of southern China. (Credit: Bill Mueller)

ScienceDaily (Oct. 28, 2010) — Scientists have discovered in China the first complete skeleton of a pivotal ancestor of Earth's largest land animals -- the sauropod dinosaurs. The new species, tentatively dubbed *Yizhousaurus sunae*, lived on the flood plains around Lufeng in the Yunnan Province of South China about 200 million years ago. The species helps explain how the iconic four-footed, long-necked sauropod dinosaurs evolved.

Unlike the 120-foot-long, 100-ton sauropod giants that came later, *Yizhousaurus* was about 30 feet in length, but it shows all of the hallmarks of later sauropods: the beginning of a long neck, a robust skeleton and four-legged posture. It also comes with an intact fossilized skull -- which is very rare and crucial for understanding its place in the evolution of sauropods.

"Sauropods have these big bones but their skulls are very lightly constructed and also very small," said paleontologist Sankar Chatterjee of Texas Tech University. Chatterjee presents the discovery on Oct. 31 at the annual meeting of the Geological Society of America in Denver.

Yizhousaurus's skull is broad, high and domed, less than a foot long with a short snout, eye sockets on the sides for scanning enemies. It has an unusually wide and U-shaped jaw, in top view, like that seen in later *Camarasaurus*, said Chatterjee. Numerous serrated and spoon-shaped teeth of the upper and lower jaws would shear and slide past each other for cutting plant material during feeding. The sturdy teeth and raised neck let the animal very easily nip small branches from treetops and then chew the plant material.

"Once the plant food was ingested, a gastric mill in the stomach probably provided further mechanical breakdown of the plant," Chatterjee explained. Apparently the animal was well adapted to a life of eating plants to support its large body.

Besides its telltale physical features, *Yizhousaurus* was also found in revealing company. A half century ago spectacular specimens of prosauropod dinosaurs such as *Lufengosaurus* were discovered at the same location. This makes sense, since most paleontologists are of the opinion that prosauropods gave rise to sauropods, despite the fact that the transition has been very vague, Chatterjee said.

"This is why this new one (*Yizhousaurus*), may bridge this gap," he said.

Abstract is available at http://gsa.confex.com/gsa/2010AM/finalprogram/abstract_175675.htm

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http://www.sciencedaily.com/releases/2010/10/101028121106.htm

Trapped Mars Rover Finds Evidence of Subsurface Water

This mosaic of images shows the soil in front of NASA's Mars Exploration Rover Spirit after a series of short backward drives during attempts to extricate the rover from a sand trap in January and early February 2010. (Credit: NASA/JPL-Caltech/Cornell University)

ScienceDaily (Oct. 28, 2010) — The ground where NASA's Mars Exploration Rover Spirit became stuck last year holds evidence that water, perhaps as snow melt, trickled into the subsurface fairly recently and on a continuing basis.

Stratified soil layers with different compositions close to the surface led the rover science team to propose that thin films of water may have entered the ground from frost or snow. The seepage could have happened during cyclical climate changes in periods when Mars tilted farther on its axis. The water may have moved down into the sand, carrying soluble minerals deeper than less soluble ones. Spin-axis tilt varies over timescales of hundreds of thousands of years.

The relatively insoluble minerals near the surface include what is thought to be hematite, silica and gypsum. Ferric sulfates, which are more soluble, appear to have been dissolved and carried down by water. None of these minerals are exposed at the surface, which is covered by wind-blown sand and dust.

"The lack of exposures at the surface indicates the preferential dissolution of ferric sulfates must be a relatively recent and ongoing process since wind has been systematically stripping soil and altering landscapes in the region Spirit has been examining," said Ray Arvidson of Washington University in St. Louis, deputy principal investigator for the twin rovers Spirit and Opportunity.

Analysis of these findings appears in a report in the *Journal of Geophysical Research* published by Arvidson and 36 co-authors about Spirit's operations from late 2007 until just before the rover stopped communicating in March.

The twin Mars rovers finished their three-month prime missions in April 2004, then kept exploring in bonus missions. One of Spirit's six wheels quit working in 2006.

In April 2009, Spirit's left wheels broke through a crust at a site called "Troy" and churned into soft sand. A second wheel stopped working seven months later. Spirit could not obtain a position slanting its solar panels toward the sun for the winter, as it had for previous winters. Engineers anticipated it would enter a low-power, silent hibernation mode, and the rover stopped communicating March 22. Spring begins next month at Spirit's site, and NASA is using the Deep Space Network and the Mars Odyssey orbiter to listen if the rover reawakens.

Researchers took advantage of Spirit's months at Troy last year to examine in great detail soil layers the wheels had exposed, and also neighboring surfaces. Spirit made 13 inches of progress in its last 10 backward drives before energy levels fell too low for further driving in February. Those drives exposed a new area of soil for possible examination if Spirit does awaken and its robotic arm is still usable.

"With insufficient solar energy during the winter, Spirit goes into a deep-sleep hibernation mode where all rover systems are turned off, including the radio and survival heaters," said John Callas, project manager for Spirit and Opportunity at NASA's Jet Propulsion Laboratory in Pasadena, Calif. "All available solar array energy goes into charging the batteries and keeping the mission clock running."

The rover is expected to have experienced temperatures colder than it has ever before, and it may not survive. If Spirit does get back to work, the top priority is a multi-month study that can be done without driving the rover. The study would measure the rotation of Mars through the Doppler signature of the stationary rover's radio signal with enough precision to gain new information about the planet's core. The rover Opportunity has been making steady progress toward a large crater, Endeavour, which is now approximately 8 kilometers (5 miles) away.

Spirit, Opportunity, and other NASA Mars missions have found evidence of wet Martian environments billions of years ago that were possibly favorable for life. The Phoenix Mars Lander in 2008 and observations by orbiters since 2002 have identified buried layers of water ice at high and middle latitudes and frozen water in polar ice caps. These newest Spirit findings contribute to an accumulating set of clues that Mars may still have small amounts of liquid water at some periods during ongoing climate cycles.

JPL, a division of the California Institute of Technology in Pasadena, manages the rovers for the agency's Science Mission Directorate in Washington.
More information about the rovers is online at: http://www.nasa.gov/rovers

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **NASA/Jet Propulsion Laboratory**.

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Modern Humans Emerged Far Earlier Than Previously Thought, Fossils from China Suggest

Scientists have discovered early modern human fossil remains in the Zhirendong (Zhiren Cave) in south China that are at least 100,000 years old. (Credit: Institute of Vertebrate Paleontology and Paleoanthropology)

ScienceDaily (Oct. 28, 2010) — An international team of researchers, including a physical anthropology professor at Washington University in St. Louis, has discovered well-dated human fossils in southern China that markedly change anthropologists perceptions of the emergence of modern humans in the eastern Old World.

The research, based at the Institute of Vertebrate Paleontology and Paleoanthropology in Beijing, was published Oct. 25 in the online early edition of the *Proceedings of the National Academy of Sciences*.

The discovery of early modern human fossil remains in the Zhirendong (Zhiren Cave) in south China that are at least 100,000 years old provides the earliest evidence for the emergence of modern humans in eastern Asia, at least 60,000 years older than the previously known modern humans in the region.

"These fossils are helping to redefine our perceptions of modern human emergence in eastern Eurasia, and across the Old World more generally," says Eric Trinkaus, PhD, the Mary Tileston Hemenway Professor in Arts & Sciences and professor of physical anthropology.

The Zhirendong fossils have a mixture of modern and archaic features that contrasts with earlier modern humans in east Africa and southwest Asia, indicating some degree of human population continuity in Asia with the emergence of modern humans.

The Zhirendong humans indicate that the spread of modern human biology long preceded the cultural and technological innovations of the Upper Paleolithic and that early modern humans co-existed for many tens of millennia with late archaic humans further north and west across Eurasia.

Story Source:

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

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Space Buckyballs Thrive, Finds NASA's Spitzer Space Telescope

An infrared photo of the Small Magellanic Cloud taken by Spitzer is shown here in this artist's illustration, with two callouts. The middle callout shows a magnified view of an example of a planetary nebula, and the right callout shows an even further magnified depiction of buckyballs, which consist of 60 carbon atoms arranged like soccer balls. (Credit: NASA/JPL-Caltech)

ScienceDaily (Oct. 28, 2010) — Astronomers have discovered bucket loads of buckyballs in space. They used NASA's Spitzer Space Telescope to find the little carbon spheres throughout our Milky Way galaxy -- in the space between stars and around three dying stars. What's more, Spitzer detected buckyballs around a fourth dying star in a nearby galaxy in staggering quantities -- the equivalent in mass to about 15 of our moons.

Buckyballs, also known as fullerenes, are soccer-ball-shaped molecules consisting of 60 linked carbon atoms. They are named for their resemblance to the architect Buckminster Fuller's geodesic domes, an example of which is found at the entrance to Disney's Epcot theme park in Orlando, Fla. The miniature spheres were first discovered in a lab on Earth 25 years ago, but it wasn't until this past July that Spitzer was able to provide the first confirmed proof of their existence in space. At that time, scientists weren't sure if they had been lucky to find a rare supply, or if perhaps the cosmic balls were all around.

"It turns out that buckyballs are much more common and abundant in the universe than initially thought," said astronomer Letizia Stanghellini of the National Optical Astronomy Observatory in Tucson, Ariz. "Spitzer had recently found them in one specific location, but now we see them in other environments. This has implications for the chemistry of life. It's possible that buckyballs from outer space provided seeds for life on Earth."

Stanghellini is co-author of a new study appearing online Oct. 28 in the Astrophysical Journal Letters. Anibal García-Hernández of the Instituto de Astrofísica de Canarias, Spain, is the lead author of the paper. Another Spitzer study about the discovery of buckyballs in space was also recently published in the Astrophysical Journal Letters. It was led by Kris Sellgren of Ohio State University, Columbus.

The García-Hernández team found the buckyballs around three dying sun-like stars, called planetary nebulae, in our own Milky Way galaxy. These cloudy objects, made up of material shed from the dying stars, are similar to the one where Spitzer found the first evidence for their existence.

The new research shows that all the planetary nebulae in which buckyballs have been detected are rich in hydrogen. This goes against what researchers thought for decades -- they had assumed that, as is the case with making buckyballs in the lab, hydrogen could not be present. The hydrogen, they theorized, would contaminate the carbon, causing it to form chains and other structures rather than the spheres, which contain no hydrogen at all. "We now know that fullerenes and hydrogen coexist in planetary nebulae, which is really important for telling us how they form in space," said García-Hernández.

García-Hernández and his colleagues also located buckyballs in a planetary nebula within a nearby galaxy called the Small Magellanic Cloud. This was particularly exciting to the researchers, because, in contrast to the planetary nebulae in the Milky Way, the distance to this galaxy is known. Knowing the distance to the source of the buckyballs meant that the astronomers could calculate their quantity -- two percent of Earth's mass, or the mass of 15 of our moons.

The other new study, from Sellgren and her team, demonstrates that buckyballs are also present in the space between stars, but not too far away from young solar systems. The cosmic balls may have been formed in a planetary nebula, or perhaps between stars. A feature story about this research is online at http://www.spitzer.caltech.edu/news/1212-feature10-18 .

"It's exciting to find buckyballs in between stars that are still forming their solar systems, just a comet's throw away," Sellgren said. "This could be the link between fullerenes in space and fullerenes in meteorites."

The implications are far-reaching. Scientists have speculated in the past that buckyballs, which can act like cages for other molecules and atoms, might have carried substances to Earth that kick-started life. Evidence for this theory comes from the fact that buckyballs have been found in meteorites carrying extraterrestial gases.

"Buckyballs are sort of like diamonds with holes in the middle," said Stanghellini. "They are incredibly stable molecules that are hard to destroy, and they could carry other interesting molecules inside them. We hope to

learn more about the important role they likely play in the death and birth of stars and planets, and maybe even life itself."
The little carbon balls are important in technology research too. They have potential applications in superconducting materials, optical devices, medicines, water purification, armor and more.
Other authors of the García-Hernández study are Arturo Manchado, the Instituto de Astrofísica de Canarias; Pedro García-Lario, European Space Agency Centre, Spain; Eva Villaver, Universidad Autónoma de Madrid, Spain; Richard Shaw, National Optical Astronomy Observatory; Ryszard Szczerba, Nicolaus Copernicus Astronomical Center, Poland; and José V. Perea-Calderon, European Space Astronomy Centre, Ingeniería y Servicios Aerospaciales, Spain.
Other authors of the Sellgren study are Michael Werner, Spitzer project scientist, NASA's Jet Propulsion Laboratory, Pasadena, Calif.; James Ingalls, NASA's Spitzer Science Center at the California Institute of Technology in Pasadena.; J.D.T. Smith, University of Toledo, Ohio; T.M. Carleton, University of Arizona, Tucson; and Christine Joblin, Université de Toulouse, France.

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A New Take on Political Ideology

An evolutionary psychologist proposes a new framework for understanding the root causes of our political beliefs.

What is it about our biology and/or psychology that propels us toward a liberal or conservative mindset? (eurobanks/istockphoto)

With another contentious U.S. election approaching, opinions predictably have hardened as voters gravitate toward candidates who best embody their particular political position. Partisans — that is, nearly everyone aside from the handful of genuine independents, who tend to be disengaged from the process — habitually divide the world between right-thinking, like-minded people and those fools who just don't get it.

As much as we stake our identity on such core beliefs, it's unlikely we emerged from the womb as little liberals or libertarians. This raises a fundamental question: At what point in our development did such predispositions begin to form, to coalesce and to harden? What is it about our biology and/or psychology that propels us toward a liberal or conservative mindset?

The question has long intrigued social psychologists such as John Jost of New York University. In a 2003 meta-analysis of 50 years of research, he summarizes the overwhelming evidence that political ideologies, "like virtually all other belief systems, are adopted in part because they satisfy various psychological needs." Jost quickly adds that this "is not to say they are unprincipled, unwarranted, or unresponsive to reason or evidence" — only that the underlying motivation to believe in them emerges from somewhere other than the rational, conscious mind.

"Most of the research literature … suggests that conservatives are more easily threatened, more likely to perceive the world as dangerous, and less trusting in comparison with liberals," he notes. This is fairly self-evident. If you perceive the world as a threatening place, you're more likely to cling tightly to those you trust (i.e., your in-group, however you define it), and to warily eye those you don't.

It's easy to see how this translates into strongly held positions on subjects ranging from immigration to foreign wars. A lack of trust in others also presumably leads to wariness regarding social-aid programs, since there's an assumption many people will freeload off those who are doing the work.

While that framework is generally accepted, some conservative scholars bristle at the way it is often interpreted. In his new book *On Second Thought*, veteran science writer Wray Herbert addresses the topic in these terms: "People who are the most fearful seek safety in stability and hierarchy, where more emotionally secure people can tolerate some chaos and unpredictability in their lives."

The implication — presumably unintentional, but still stinging to some — is that conservatives are somehow emotionally impaired, and vaguely inferior to the more open-minded people on the left.

Is there a way of explaining these differences that doesn't suggest one side or the other is wrong or aberrant? Perhaps so. Jacob Vigil, an evolutionary psychologist based at the University of New Mexico, has come up with a fresh framework that links political orientation with the way we seek to fulfill our most fundamental human needs.

"A lot of the literature is morally loaded," he says. "It's easy for people to gravitate to language that fits into their predisposition. [In my framework] nobody's right or wrong. It's just that we're using different behavioral strategies, all of which exist for a reason."

His thesis, in a nutshell: Conservatives, being more oriented toward dominance, tend to acquire a larger group of friends and associates than liberals. They are more sensitive to potential threats because there are more people in their orbit, and thus the danger of their being hurt by a duplicitous person is greater. Liberals, being more inward-oriented, have smaller, tighter social groups and thus feel less threatened, which in turn allows them to be more open to unfamiliar experiences.

To Vigil, conservatives' outward orientation and liberals' inward stance reflect a basic duality of human nature. "Humans are highly dependent upon one another biologically," he notes. To foster the good will of others, he argues, we "advertise" either trustworthiness or competence.

From an evolutionary perspective, "A basic question to ask is: How does another person have significance in our life?" Vigil notes. "My answer is it comes down to whether they have the ability to either harm or help us, and the probability of them actually doing so.

"Someone may be very competent, but if they have no intention of influencing your life in any way, they mean nothing to you. Likewise, if they're motivated to help or hurt you but have no ability to do so, they have zero value to you.

"From that vantage point, it looks as though social perceptual systems should be rooted in the ability to evaluate basic constructs of competency and trust in others. That's what the human brain does: It targets basic levels of trust and competency."

Vigil contends people who go through childhood, adolescence and early adulthood without serious obstacles are more competency-oriented; they've discovered they have the ability to influence the lives of others. They advertise this capacity, which makes them desirable not only as potential mates, but also as potential friends or business associates. Thus they acquire a larger social sphere.

On the other hand, those who have experienced numerous setbacks (illness, injury, an unstable home environment, etc.) are less likely to work their way into such a dominating position. To advertise their desirability as friends or associates, they take a different route, emphasizing their ability to care for, and about, others.

"The size of our social network limits the amount of time we can spend with folk," Vigil points out. "If we have a big social network, it limits our interactions to short-term relationships. We have finite time and resources. If we have fewer social partners, it frees up our time to establish more continuous types of relationships.

"The basic idea is that folks who have small social spheres are going to be demonstrating more trust cues, and those who have bigger social spheres, more capacity cues." Liberals, in other words, are demonstrating trustworthiness as a way of attracting the social support they need, while conservatives are demonstrating power for the exact same reason.

The political arena is where much of this dynamic plays out. "If you're saying, 'I'm not going to put up with the Iranians' or 'Let's sit down and talk with them,' you're expressing either dominance or submissiveness," he says.

Vigil is quick to note these two fundamental ways of creating and maintaining relationships are equally valuable. "A demonstration of trust and a demonstration of capacity are equally plausible ways of manipulating other folks," he says — and from an evolutionary perspective, manipulating others into giving us the support we need to thrive is our most basic impulse.

He believes much, if not most, of this calculation takes place on an unconscious level. He also suspects we shift from one mode to the other depending upon our life circumstances.

"When we experience an increase in our capacities, we demonstrate that," he says. "When we experience hardships, we take advantage of them by using them as an opportunity to more effectively demonstrate our trustworthiness. We can do that better when we're truly vulnerable."

He notes this suggests people should move more to the left as they become older, and therefore more physically vulnerable. That notion contradicts another recently published study, which suggests the elderly may become more culturally conservative for reasons of psychological comfort.

Of course, an older person who has accumulated a lot of wealth can presumably still demonstrate capacity to influence others — say, in the form of giving big donations to favorite causes. In Vigil's framework, this would keep him or her on the conservative side of the divide. It also raises the intriguing question of whether Medicare and Social Security, in removing much of the vulnerability from old age, has disrupted what would otherwise be an expected movement to the left.

Jost, one of the leading researchers in this field, is intrigued but skeptical by Vigil's ideas. For him, this evolutionary framework is "too general for me to be able to evaluate empirically." He adds that "I have not seen any data indicating that conservatives acquire a larger group of friends and associates than liberals. That may be true, but I am doubtful of that general claim, and I haven't seen the evidence."

While it's hardly definitive, Vigil provides some data to back up his ideas in a paper recently published in the journal *Group Processes and Intergroup Relations.* In a study of 838 college students in Florida, he found that

self-described Democrats had an average of 9.46 good friends, compared to 12.91 good friends for self-described Republicans.

Confirming earlier research, he found Republicans "have a lower threshold for processing threatening stimuli from ambiguous social information." Democrats, on the other hand, "showed greater emotional distress, including higher rates of crying behaviors, trait aggression, emotional pain and lower life satisfaction."

This is arguably at odds with other recent research in the field, including that of Louisiana State University political scientist Christopher Weber. In a 2007 paper, he finds early-in-life emotional difficulties are likely to lead to political conservatism. To oversimplify his findings: If you grow up believing others can't be relied upon, you're likely to develop a more individualistic orientation, and/or a sense that the world is a threatening place. Either of these would tend to push one to the right (to a libertarian stance in the first case, or an authoritarian one in the second).

A clear contradiction to Vigil's thesis can be found in an intriguing 2005 paper by the late University of California, Berkeley, psychologist Jack Block. He compared personality attributes of nursery school children with their political orientation 20 years later, and found kids considered "self-reliant, energetic, somewhat dominating" grew up to be liberals, while those described as "easily victimized, easily offended, rigid" grew up to be conservatives.

Vigil suspects some level of liberal bias crept into that study. He insists no ideology is inherently superior to another; rather, they simply reflect different means of attracting needed comfort and support.

"Both sizes of social spheres, big and small, provide benefits, and those benefits are probably optimized under different life conditions," he says. "Under hardship, a smaller social circle is more protective. It allows more time to strengthen relationships with reliable social partners, and limits our interactions with risky folks. You can make the inverse argument for having a big social sphere when things are going really well."

Vigil suspect this dynamic operates on a group as well as an individual level. This helps explain why the Depression years led to a period of Democratic dominance, while post-war prosperity led to the Reagan era. If the current recession continues for years to come, Vigil predicts a societal shift to the left, although he adds that the "natural balance of demonstrating dominance and submissiveness" will inevitably mean another shift to the right after that.

Time — and a lot more research — will determine whether his approach is valid, and just how much it explains. (In addition to these adaptive behaviors, genetic makeup also undoubtedly plays a role in ideology, in ways that are not yet clear.) While Jost takes issues with many aspects of Vigil's work, he calls it "very interesting and thought-provoking," adding, "I would encourage him to keep working on these topics."

Vigil plans to do just that. "I'm a new guy on the scene," he notes. "These are some new ideas to think about."

http://www.miller-mccune.com/politics/a-new-take-on-political-ideology-24683/

Top Ten Bacteria Working in the Shadows
As Valerie Brown has shown, bacteria are indeed us. But while we know who we are, who are these microscopic allies (and enemies)?

By Jessica Hilo

(MBPhoto, Inc./istockphoto.com)

Childhood was a hazy mix of lace and mud — an age of cookie time, horseplay and the occasional cootie shot. It seems like a far cry from the fettered world of adulthood.
But there were darker forces at play, infiltrators that showed up everywhere we were — near us, on us, in us. Some working for the forces of good, some for evil, some on both sides. These secret agents were bacteria.
It shouldn't be a surprise, then, that we adults have endowed bacteria with all our possessive and neurotic qualities. (See Valerie Brown's "Bacteria 'R' Us" in *Miller-McCune* magazine.) What were once extraordinary and bizarre are now measured on a microbial threat level and sanitized with gallons of antiseptic.
Join us for a sticky-fingered journey through bacteria's lesser-known work in the shadows. Powerful, haunting and mysterious, these 10 microbes promise a return to the slimy delight of childhood discovery.

http://www.miller-mccune.com/science/top-ten-bacteria-working-in-the-shadows-24403/

Little L
Bacteria Working in the Shadows: LactobacillusBy Jessica Hilo

Lactobacillus is native to the mouth and digestive track and found in the production of yogurt, cheese, chocolate, pickles and other fermented foods. (Amphotora Images / istockphoto.com)

If the probiotic movement is a shiny discotheque, *Lactobacillus*, or Little L, would be the glamorous VIP whose celebrity moves velvet ropes.
Lactobacillus is a gram-positive, rod-shaped bacterium native to the mouth and digestive track and found in the production of yogurt, cheese, chocolate, pickles and other fermented foods. In the body, Little L converts lactose and other sugars to lactic acid, which inhibits the growth of harmful bacteria and aids in regulation and digestion. Lactic acid produced from *Lactobacillus* is also used in detergents as a soap-scum remover and antibacterial agent. While working to break down bile in the gut, Little L inhibits absorption of harmful microbes in blood, lowering the body's cholesterol levels.
Certain strains of *Lactobacillus* prove a powerful force in maintaining a healthy immune system. *Lactobacillus acidophilus*, for example, produces a carbohydrate-digesting enzyme, amylase, that serves as an anti-inflammatory, aids digestion and helps in the conversion of sugar into energy. *Lactobacillus bulgaricus*, commonly found in yogurt, serves as an anti-mutagenic in the prevention of colon cancer.
Little L loves the ladies, as the consumption of *Lactobacillus rhamnosus*, a dairy preserve, by pregnant women helps protect babies' immune systems to stave off the effects of asthma, eczema and other allergies. *Lactobacillus casei*, used the processing of some cheeses, reduces lactose intolerance. High levels of casei detected during pregnancy may indicate heavier birth weight, as the strain helps to create a more hospitable in utero environment.
Too much of one thing can be bad, and as is the case with overindulgent celebrities, too much opulence can cause Little L to go all Lindsay Lohan on a person's stomach. Heavy intake of *Lactobacillus* can cause discomfort, nausea, diarrhea and tooth decay. Too much Little L turns the afterglow of a night on the town to one helluva mid-morning headache.

http://www.miller-mccune.com/science-environment/little-l-24438/

The Vibrio Family
Bacteria Working in the Shadows: VibrioBy Jessica Hilo

Through quorum sensing, the Vibrios enhance symbiotic relationships they have with bioluminescent marine animals like the Hawaiian Bobtail Squid. (Wikipedia.org)

The world is cold, bitter place for the unfortunate few who have not seen Francis Ford Coppola's *Godfather* trilogy. Parodies don't quite make sense; quotations from the film echo in lost cause; and the color orange carries little significance beyond its failure to rhyme with anything.
For those who haven't absorbed the tribulations of the Corleones, we offer a microbial placeholder: the Vibrio family.
This gram-negative, rod-shaped bacterium found in sea water carries both a sheathed flagella and a whopping reputation. First isolated from cholera patients, this highly pathogenic bacterium was found to enter the body through contaminated foods and open, untreated wounds. *Vibrio cholerae* and his cousins *Vibrio vulnificus* and *Vibrio parahaemolyticus* are downright deadly; at best, consorting with them takes you to the mattresses, suffering from a foul case of food poisoning. Their most recent outbreak in 2005 saw cases of illness and death in post-Hurricane Katrina evacuees.
Off land, the Vibrio family is a spritely bunch. They are one of few bacteria that can communicate through quorum sensing — a family summit, if you will. Through quorum sensing, the Vibrios enhance symbiotic relationships they have with bioluminescent marine animals — feeding off decayed organic matter on the animal while assisting in reproduction, metabolism and camouflage. *Vibrio fischeri*, the Fredo of the group, is by far the family's least potent. With bioluminescent properties itself, you can find low quantities of *V. fischeri* on his own in the ocean's subtropical waters and in the normal gut flora of aquatic hosts, like the Hawaiian Bobtail Squid.
Vibrios found in the ocean's photic zone contain a light-harvesting pigment that aids in photosynthesis. Some researchers believe study into this pigment may aid in our understanding and harnessing of clean energy. But for now, when not reaping death and destruction to hapless bystanders, the Vibrio family continues to sleep with the fishes.

http://www.miller-mccune.com/science-environment/the-vibrio-family-24484/

Greener Battlefields Would Be Safer for Troops

Allied troops would be much safer if they could cut the petroleum tether, according to a chorus of military leaders and planners.

By John Perlin

Getting all that gasoline to demand points not only makes convoys easy targets to road-side bombings and ambushes, but they also face many grave dangers traversing poor roads in harsh terrain. (defense.gov)

The experience of Lt. Gen. Richard Zilmer, who in 2006 became the commander of the coalition forces in the Al Anbar province of Iraq, exemplifies the changing strategy of fighting insurgencies in Afghanistan and Iraq. Before coming to Iraq, Zilmer focused on the importance of space-related warfighting technologies and capabilities. In Iraq, his concerns were often a little more down to earth — his command's dependence on oil. Seventy percent of all convoys carried liquid fossil fuels, and attacks on convoys, the general learned, account for about half of all the casualties. Generators consumed more of the fuel brought in than did combat vehicles and air support.

So the Marine became a staunch supporter of energy efficiency and renewables, like solar and wind, to reduce the demand for oil at forward bases such as those in Al Anbar. In turn, he urged efforts to "reduce the frequency of logistics convoys on the road," the general wrote to the Pentagon in a top-priority note, and thereby lessening the danger "to our Marines, soldiers and sailors." A 2009 Department of the Army study reported one allied casualty in Afghanistan for every 24 convoys.

On the other hand, Zilmer warned, without "a self-sustainable energy solution, the military will continue to accrue preventable, serious and grave casualties and have the potential to jeopardize mission success." (Or "unleash us from the tether of fuel," as another Marine general, James T. Mattis, has been quoted during the Iraq invasion.)

Zilmer opened the eyes of those in charge of acquisitions and technology in the Department of Defense to the challenge field commanders and soldiers face in moving fuel from supply sites to forward bases in Afghanistan and Iraq.

Pipelines can't be used, and combat activity is widely dispersed in both theaters.

In these new conflicts, fuel consumption has increased tenfold from previous engagements, exacerbating the tough logistics problem. Getting all that gasoline to demand points — a Marine combat brigade uses a half million gallons of fuel a day — not only makes convoys easy targets to road-side bombings and ambushes, but they also face many grave dangers traversing poor roads in harsh terrain.

That fuel is the Achilles heel of the war efforts has been made especially salient by attacks on NATO fuel trucks in Pakistan.

"I would say with the recent issues on the Pakistani border, our logistics tail and our convoys are becoming bigger and bigger issues," Katherine Hammack, the new assistant secretary of the Army for installations, energy and environment, said earlier this month. "I believe our soldiers are well aware of the issues and are looking for ways they can use energy wiser."

But you don't need militants to create a crisis. Under such conditions, traffic accidents happen more frequently, bringing about the destruction of people and equipment. Just in June 2008, for example, coalition forces lost 44 fuel tankers and 220,000 gallons of fuel. In addition, the military must divert combat forces both on land and in the air from battle to protect the convoys as they travel. Providing such cover costs the Department of Defense 15 times or more than the actual purchase price of the fuel itself.

For the above reasons, the Department of Defense's Acquisitions and Technology Group argues that the military can no longer regard energy as a cheap and reliably supplied commodity as it has had in times past. A true accounting has to include all the factors previously mentioned.

The Pentagon calls the new concept the "fully burdened cost of fuel." A study recently commissioned by the Department of Defense (PDF here) suggest by reckoning the "fully burdened cost of fuel" in both blood and

money, alternative sources of power, including energy efficiency, "rank on par with the business case for development of even more effective offensive weapons, sophisticated fuel transport tankers, mine resistant armored vehicles and net-centric technologies."

The report, produced by Deloitte LLP, could mimic an environmentalist's talking points, including discussions of "a more sustainable planet" (but perhaps minus the suggestion of nuclear power). "Game-changing strategies for reducing this casualty rate … include widespread and aggressive conservation techniques; the use of renewable resources, in particular, solar and wind energy within the theater; renewable carbon-based fuels generated in theater, such as algae, biomass, and other alternative fuels; the use of highly efficient electric vehicles; nuclear fission; hot/cold fusion; fuel cell technology, and other innovations currently being experimented within labs around the world."

In 2006, the top brass at the Pentagon denied Zilmer's request for solar panels and wind turbines. The reason given was that the technologies were not mature enough. The Defense Science Board berated the decision in its March 2008 report "More Fight — Less Fuel." That report, in turn, referenced another Pentagon report, "More Capable Warfighting Through Reduced Fuel Burden," from 2001.

One reporter asked, "How much time — and how many more lost lives — before the top brass at the Pentagon responds seriously to pleas for efficiency and energy self-sufficiency?"

While there's lots of examples of energy conservation and renewables stateside, the first significant response in a combat zone came with the investment of almost $100 million for insulating thousands of tents in the two war zones. Before, air conditioners in summer and heaters in winter powered by generators controlled the climate inside the tents used as barracks, dining halls and offices. Now they spray foam so it covers the exterior of the tents like shaving cream. Foaming the tents saves the military $2 million a day in avoided energy costs. This translates into a payback of less than two months. It saves 100,000 gallons of fuel per day, taking 4,000 trucks off the road each year. The success of the program in Iraq has led to similar projects in Afghanistan, where supply routes pose a far greater challenge.

Next on the battlefield came photovoltaic systems called "Ground Renewable Expeditionary Energy System," or GREENS, as the answer to Zilmer's rejected request for a sustainable solution to the ever-growing need for electricity in remote, hard-to-reach areas where much of the fighting goes on.

A Humvee can rush a unit out to the battlefield. The panels fold out of frames that look like metal suitcases. Then the Marines plug in the wires from the modules to their electronics. No need for liquid fuel as there's no dearth of sunshine. When the sun sets power comes from stored sunlight in batteries. Last year, the Marines saw the scorching desert sun as just another of many obstacles. Today, they see it as their most reliable fuel source to power field equipment.

The military has pursued renewable in other ways, too, such as bringing solar power to Falljah's civilians or algae-based biodiesel to Afghanistan.

Brig. Gen. Steven Anderson, director of operations and logistics, couldn't be happier. No need to talk about global warming or peak oil, according to the general. "The most compelling reason to do [these things]," in Anderson's opinion, "is [they] save lives. It takes drivers off the road."

http://www.miller-mccune.com/science-environment/greener-battlefields-would-be-safer-for-troops-24716/

Native Environmentalism and the Alberta Oil Boom

Is Canada's use of "traditional ecological knowledge" in resource planning an environmental advance or just a political sop to native tribes?

By Chris Wood

A Syncrude oil sands mine in Alberta, Canada. (The Pembina Institute)

In May, with a runaway well belching thousands of barrels of oil a day into the Gulf of Mexico, congressional leaders received a delegation from the opposite side of the country eager to exploit the contrast between the BP disaster and fossil fuels sourced from Canada. Crude extracted from Canada's oil sands, Canadian Environment Minister Jim Prentice assured U.S. consumers, is "a safe, stable, secure supply of energy." And, he noted, it was being developed "to the highest possible environmental standards."

That's not how it looks to many Cree, Chipewyan and Metis people living downstream from oil production in northeastern Alberta. Where the Athabasca River — tapped for millions of gallons of water daily to steam-clean the oil out of sand — flows into a vast freshwater delta at Lake Athabasca, the 1,000 residents of Fort Chipewyan have seen populations of muskrat, lake fish and migratory ducks plummet — and their own cancer rates soar — in a quarter-century of oil extraction. "Years ago, nobody died from cancer," 68-year-old Metis elder Ray Ladouceur observed over tea in his kitchen. "If they died, it was TB, accidental drowning, a gun accident or old age." Out on the once lush delta, he said, "many things that used to be there are gone. Bugs on the water. The birds that used to sing. It's silent out there now. Even the quality of the fish has changed, from hard meat to mushy. When you boil it, it falls apart."

The starkly different takes on how much damage oil extraction in Canada is doing to the environment have cast into sharp relief a policy in which the country and its top oil-producing province claim to be eco-friendly world leaders. Enshrined in Canada's federal Environmental Assessment Act and splashed across Alberta government websites are repeated commitments to give the experience of people like Ladouceur more weight in resource development. Alberta, the Canadian federal government and resource companies have paid intermediaries and interpreters millions of dollars to engage native-Canadian communities — called First Nations — and record their "traditional ecological knowledge," or TEK, so it can be used in projecting and mitigating environmental impacts.

But as the stakes rise — Alberta is now the United States' top foreign source for oil — some critics question the very premise of that "progressive" policy.

"A lot of so-called 'traditional knowledge' is bunk," says Tom Flanagan, a political scientist at the University of Calgary and occasional adviser to Canada's conservative government. "It's what anthropologists used to call 'folklore.'" Others question the sincerity of Canada's commitment to let traditional knowledge — even when factual and relevant — stand in big oil's way.

Although enshrined in Canadian law and part of official policy, traditional ecological knowledge is having only a minor impact so far on a massive rush for Alberta's oil sands that is making the sparsely populated province wealthy but also denuding hundreds of square miles of its forest wilderness. This reality raises two questions about the development of Alberta: 1) Will native environmental knowledge ever be more than a political sideshow to the oil rush? 2) Given the nonscientific nature of much traditional knowledge, should it be?

Claims that traditional ecological knowledge should have a place in environmental policy start with an assertion that is hard to dispute: Indigenous peoples living in what is now Canada have survived in close relationship with their landscape and its plants and wildlife for thousands of years. "How can you doubt that they have huge reserves of applicable knowledge?" wonders Anne Gunn, a wildlife biologist who has worked closely with First Nations while studying northern caribou.

Canada's lead federal agency for environmental oversight echoes Gunn's sentiment. "Aboriginal peoples have a unique knowledge about the local environment, how it functions and its characteristic ecological relationships," the Canadian Environmental Assessment Agency asserts on its website. "This aboriginal

traditional knowledge (ATK) is increasingly recognized as an important part of project planning, resource management, and environmental assessment."
That official view is in step with a field of study endorsed internationally by UNESCO and the International Union for Conservation of Nature and increasingly influential in the decisions of Canadian courts. Tellingly though, the same federal Canadian agency that underscores the value of indigenous knowledge makes a point of sidestepping what exactly it is. "Although there are many different definitions in the literature," the Environmental Assessment Agency's Web page notes, "there is no one universally accepted definition."
Clearly, the traditional beliefs of Canada's First Nations differ from the mechanistic, human-centered and strongly individualistic ethos that dominates North American society — and that difference is especially clear in the oil patch. By traditional First Nations' wisdom, *Homo sapiens* are neither the creator's pet nor evolution's alpha species — humans are merely one thread in a richly woven nature.
"TEK is about sustaining a creative reciprocal relationship with all of creation," writes Deborah McGregor, a geography professor at the University of Toronto who studies traditional knowledge, "and about fulfilling our lives as human beings in relation to creation." More than that, she adds, "traditional knowledge is an authority system. To be sustainable means to take responsibility and be spiritually connected to all of creation, all of the time. Everyone and everything carries this responsibility and has duties to perform."
In the Athabasca oil region, those traditional duties to creation stand in stark contrast to the giant machinery stripping away huge tracts of boreal forest for the oily bitumen beneath it. Mine operators have felled an area of virgin pine and spruce forest as large as Chicago, draining beaver ponds and evicting bear and endangered wood caribou along with smaller wildlife, and then bulldozed the underlying peat to expose the tarry grit below. Sprawling complexes of pipes and boilers, as gargantuan as everything else about the $13.8 billion industry, wash out the usable oil and pump the grit and dirty wash-water into miles-wide "tailing" ponds. With America as thirsty as ever for fuel and a new, deep-pocketed bidder in China, development is under way to triple the scale of output from the area.
The industry's expanding footprint and growing international pressure from environmentalists have spurred Alberta to establish a process to make decisions on further resource development. The province has promised any eventual plan will protect "aboriginal traditional use activities." Its government publicizes a desire to include traditional knowledge in other resource decisions as well, ranging from the allocation of water in its arid south to signing off on industry's effort to restore mined landscapes to a near-natural state. The province has subsidized 42 First Nations to collect and record their "traditional use" observations.

The Athabasca River near Fort McMurray, Alberta. (The Pembina Institute / David Dodge)

The Cumulative Environmental Management Association — an agency jointly funded by government and the oil industry to research environmentally acceptable limits to oil sand development — has also sought out traditional knowledge. But as Alberta's assistant deputy environment minister, Bev Yee, notes, the province faces a central question: "How do we bridge Western science to traditional knowledge?" It's a hard question to answer. Although advocates of traditional knowledge like to posit an alternative "way of knowing" that stands as a peer to Western science, specifics often prove elusive.
"The problem from a scientific perspective is that [TEK] allows answers that are not necessarily based on data, at least insofar as you can see data," says Alan Emery, a wildlife biologist who has worked with native elders. "To compound it, science in general feels that it is a superior way of finding out about the universe, so it tests all other knowledge bases against itself.
"And if the other knowledge base doesn't agree with the science, then it has to be wrong."
In substance, what's meant by traditional knowledge or its derivatives typically comes as a combination of stories — oral accounts passed down through generations — and judgments rendered by a tribal community's eldest members on the basis of lifelong observation, augmented by younger members of the community who are still active "out on the land."
Contrary to connotations of the term, traditional knowledge isn't stagnant, asserts Joanne Barnaby, a Cree consultant who was Emery's research partner in efforts to interpret between TEK and science. "To be a responsible Dene," she says, citing one example of a tribe, "you must share your observations with the

community as a whole, and give elders in particular an opportunity to analyze your observation and determine whether it's important to retain."

Though government and industry give every sign of bending over backward in pursuit of traditional ecological knowledge, there are critics of TEK, some quite harsh. The most outspoken may be two political theorists and avowed Marxists who have denounced traditional knowledge in academic essays and presentations as "junk science." In one paper for the Canadian Political Science Association pointedly titled, "Aboriginal 'Traditional Knowledge' and Canadian Public Policy: Ten Years of Listening to the Silence," Frances Widdowson, a professor at Calgary's Mount Royal College, and co-author Albert Howard accused TEK of being a collection of "simplistic hypotheses, vague and unsubstantiated opinions and unsystematic data, [as well as] other unacceptable, unscientific premises … based on unverifiable beliefs in the supernatural." Giving it weight in resource management, the pair charged, posed "a threat to environmental assessment wherever it was applied."

Their critique provoked scholarly outrage from advocates for indigenous knowledge. "A dog's breakfast of outmoded communist ideology and rotten anthropological theories washed down with strong racial prejudices inherited from their own unexamined colonial upbringings," thundered Taiaiake Alfred, a professor of aboriginal governance at the University of Victoria, British Columbia.

But other Canadian academics say that fear of being labeled racist deters many from agreeing with at least some of Widdowson's criticism of the use of traditional ecological knowledge alongside science. "I think she is largely right," says Rod Clifton, an education professor at the University of Manitoba who has had experience in First Nations communities and is married to a Blackfoot woman. "What's myth and what's true [in traditional knowledge] is hard to sort out. There are many in the white community and in the aboriginal community that, below the surface, think this way, and they're afraid to say so."

The University of Calgary's Flanagan criticizes native leaders who invoke TEK as a hard-to-challenge cudgel in legal and policy debates. "It's a wonderful weapon for aboriginal spokesmen," he says, "if they claim to be in possession of special knowledge that by definition you're not able to share."

I relayed the criticism that some, and possibly a great deal, of what is presented as TEK might be hokum to Barnaby, the Cree consultant. She sighed before conceding, "That's probably true."

Canada's governments, Barnaby complains, have failed to match rhetorical enthusiasm for the use of traditional native knowledge with support for rigorous tests of its factuality. As a result, she says "there's no way to address quality. There should be verification standards in place and standards to determine that the traditional-knowledge holder is in full support of the analysis, based on his knowledge."

Other factors add to TEK's credibility problem. Much of what is often considered the purest traditional knowledge — insights based on years of integrating personal observation with oral history — resides in the memory of elders in remote communities. Many are reluctant to share their knowledge with outsiders. Those who are willing to speak face the disadvantage of deep linguistic differences between native tongues and English. "Indigenous language tends not to be object-based, like ours," Emery observes. "It tends to be relationship-based. If you ask for a direct translation of 'a rock' in some Athabascan languages, they'll say, 'Well, in our language, we say "pressing down."'"

More dispiriting still to those who believe in the underlying value of traditional knowledge, many of the languages in which it is encoded are disappearing. More than 100 native North American languages have been lost over the last five centuries. Many that remain are becoming hybridized with English or face extinction as speakers dwindle in number. With the passing of elders and erosion of indigenous languages, says Don Harron, a Manitoba biologist who has worked with industry and First Nations to assess development impacts, "the knowledge itself is disappearing; it's degrading."

Syncrude, the oldest and largest oil sand producer in Canada, meets with one or another of the dozen First Nation communities in its operating area almost daily, spokeswoman Cheryl Robb says. The company sent its environmental affairs manager camping with elders and sought their advice on how to restore mined landscapes. In one lesson learned from traditional ecological knowledge, Robb says, Syncrude changed its practice of indiscriminately clearing away everything above the target layer of bitumen. On the advice of local elders, equipment operators now separate the top layer of forest "duff," which is full of seeds, roots and organic matter, and use it to top-coat the bare sand and clay of areas being reclaimed.

A Syncrude oil sands extraction plant in Alberta. (The Pembina Institute / David Dodge)
Oklahoma-based Devon Energy uses a less intrusive in-situ process to extract Alberta oil, forcing high-pressure steam into deep deposits of bitumen to liquify its hydrocarbons, then pumping the liquid oil up to an adjoining well. Devon has hired archaeological and other consultants to acquire local traditional knowledge before deciding where to locate well pad sites. “We’ll try to avoid certain areas depending on what they’re telling us,” says Pete Millman, an environmental adviser in Devon’s Calgary office. “If there’s an area that’s identified as a blueberry-picking area, we’ll put a pad off to the side.”
On larger questions — like when to call “when” on the large-scale transformation of the boreal wilderness into a maze of well pads, pipelines and unearthly strip mines — the influence of traditional ecological knowledge is more doubtful. One measure of the uncertainty: Observers on both sides of the debate question how deep their governments’ embrace of traditional knowledge goes.
In many cases, TEK consultant Harron alleges, indigenous knowledge is included as lip service in development plans, but functionally ignored. Putting it only a little differently, Flanagan says governments find it expedient to accommodate TEK in advisory arenas, “where it won’t gum up the works.”
Those descriptions seem about right to Jumbo Fraser. A neighbor of Ray Ladouceur’s in Fort Chipewyan, Fraser has participated in traditional-knowledge studies conducted by Alberta’s Cumulative Effects Management Association, and, he says, he’s brought dramatic changes in wildlife populations on the Athabasca delta to the agency’s attention. “Government does what it was going to do anyway,” he says. “I guess they figure if they’re talking about [traditional knowledge], they’re using it. They’re not.”

http://www.miller-mccune.com/politics/native-environmentalism-and-the-alberta-oil-boom-24740/

Baby Faces, Product Design and Evolutionary Theory

Cars that share the general traits of a baby's face trigger the 'Isn't it cute' response in consumers.

By Sally Augustin

Of course, being cute isn't the only key to sales success. (Photo by Matthew Brown)

Linda Miesler and Helmut Leder decided to put evolutionary theory to the test in the product design world. At the 7th International Design and Emotion Conference in Chicago, Miesler, a doctoral student, presented the lessons that she and Leder, a psychology professor, learned about baby faces and responses to designed objects.

There's a body of research indicating that humans think human baby faces are cute and respond positively to them — this is where the evolutionary theory comes in. It's good for us to respond positively to our young. Baby faces share certain attributes — relatively large eyes, and smallish noses and mouths, for example. Humans smile at and have positive emotional reactions to objects they feel are cute.

Another whole set of studies has shown that humans perceive the front end of a car as a human face. The headlights are eyes, the grill a nose, and the air intake a mouth. We infer attributes for the car, such as gender, based on the face that we see.

Miesler and Leder, as detailed in their paper "The Cute Look: Baby-Schema Effects in Product Design," had people look at images of cars that had been altered so that their "faces" were more baby-like and also the original head-on photos of the same cars. In the modified images, the headlights had been made 20 percent larger, the grill 20 percent smaller and the air intake 20 percent narrower but 20 percent higher — babies lips are not as wide laterally as an adults, but fuller. Some of the cars involved were compact and some were mid-size. Cross-sections of the compact cars were rounder than the larger cars, which also has a potential cuteness ramification — comfortably padded babies rank higher on the cuteness meter than scrawny ones.

The altered images of the cars were seen as cuter than the altered ones, and compact cars were cuter than midsized ones.

Although not everyone wants a cute car, at least some car shoppers do, and designers now have some empirical support for making certain models look at us with baby faces. Not all brands are congruent with cuteness. Somehow, a Hummer with a baby face doesn't seem like a very good idea — better to apply these findings to cell phones than vehicles designed by the Defense Department.

http://www.miller-mccune.com/culture-society/baby-faces-product-design-and-evolutionary-theory-24600/

- **The end of the public university in England**

  By James Vernon October 27, 2010 7:15 am EDT

  Editor's note: the entry below was kindly provided to us by James Vernon, a professor of history at the University of California, Berkeley. His entry is posted here on the same day a BBC news story suggested that teaching grants "for degree courses in arts, humanities and social sciences at England's universities are likely to be phased out under government plans." Our thanks to James Vernon (pictured to the right) for these informed reflections regarding an historical transition

unfolding in England; one with significant implications for those in the UK, Europe, as well many other parts of the world. *Kris Olds*

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I graduated from the University of Manchester in 1987 with no debt. I paid no fees and received a maintenance grant to earn a degree in Politics and Modern History. If my seventeen year old son were to follow in my footsteps he would graduate with debts of at least £50,000 and were he to study in London that could rise to £90,000. In the space of a generation we have witnessed the destruction of the public university.

The Browne Report released on 12 October, and effectively rubber stamped in the savage public sector cuts announced yesterday, was simply the final nail in the coffin. Under the beguiling but misleading title *Securing a Sustainable Future for Higher Education* it effectively announced that university degrees are no longer considered a public good but a private investment. Accordingly, it is the individual student, not the public, who will pay its cost. Tuition fees will rise from £3,225 to a minimum of £6,000 rising to a potential ceiling of £12,000. State funding will fall from £3.5bn to just £700m - a total of 80% but a 100% cut in areas like the arts, humanities and social sciences that apparently have no public utility.

The cost of a university education may be charged to the individual student but they will be forced to pay for it through the sort of debt-financing that governments across the world now consider so inappropriate for themselves. The scale of national debt is so ruinous we are told it requires emergency austerity measures (like all state intervention these days couched in the inevitable military metaphor of Osborne's 'war of welfare and waste'). Students, meanwhile, will be encouraged to take on loans based upon an imagined future income. They will effectively gamble that the loan will eventually pay-off by enhancing their future job prospects and earning power. It will be a hedge against their future security. What are effectively sub-prime loans are guaranteed by the state. Higher education is now modeled on the types of financial speculation that has helped get us in to this mess.

It is thankfully still just about inconceivable that primary and secondary education could be treated in this way - indeed, Osborne claimed he would be investing more in these areas. There at least it seems education remains something that serves a public and social function. Clearly something magical occurs when one turns eighteen and your education becomes a matter of personal not public gain.

When education becomes a private investment not a public good the principle of universal provision necessarily falls by the way. It used to be a central pillar of the British higher education system that all institutions offered a similar range of degrees at the same price (if not with the same prestige). A degree in biochemistry at Cambridge cost the same as one in cultural studies at Liverpool John Moores. In making students customers of educational services Browne opens up the English and Welsh university sector (Scotland has it own more sanely run system) to the vagaries of student demand. Different universities will compete with each other charging variable rates for different degrees depending on the quality of their service and the branding of their product. Everyone recognizes that Departments and programs be cut, many will be reduced to teaching factories where the link between teaching and research is severed, and some campuses will close altogether or be sold off in pieces.
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As so often in Britain when business is the model we are told this is how things are done in America. Indeed, it is. Last week the State University of New York cut its programs in Classics, French, Italian, Russian and Theater. In the last two years the University of California has raised its tuition by 32%, introduced furloughs for its workers that represented an effective 8% pay cut and are now seeking to restructure the pension packages of its employees.

There are however real differences between the American system and the model being developed in Britain. The now ailing public universities in America existed in a diverse sector with privates (ranging from the small liberal arts colleges to the Ivy League campuses with their enormous endowments), community colleges and the rapidly expanding for-profits like the online degree factory the University of Phoenix. Private endowments and federal programs like the Pell grant scheme enable both public and private universities to at least be seen to maintain 'access' to a diverse student body. Yet even they seem unable to prevent the fortification of privilege amongst those social and ethnic groups most able to take the loans to gamble on their futures. The rest are likely to be driven in increasing numbers to for-profits who offer a faster, cheaper, denigrated, on-line education.

The lessons to be learnt from the American experience are that fees will continue to rise, unequal access between rich and poor will become structural to the system, and the for-profit sector will grow. Buckingham University, once the only for-profit private in the entire UK, may well become the model. In July, the Minister responsible for higher education, David Willetts, made BPP (now owned by the Apollo Group the parent company of the University of Phoenix, the largest online for-profit in the US) the second for-profit capable of granting degrees in the UK. With Obama's administration accusing Apollo and co of using public funds and federally guaranteed student loans to leverage more private debt from students the for-profits are turning their attentions to the UK. Encouraged by David Willetts the for-profit sector awaits in the wings hungry to buy up or 'rescue' the publics that will surely fail in the years ahead.

Many politicians and university administrators present the Browne report as a reasonable response to the expansion of student numbers at a time of austerity and shrinking public budgets. Quite apart from the falsity of the choice between rising student fees or reduced numbers of students it is an argument that belies the length, depth and scale of the present crisis.

Firstly, it is not unique to England. Across Europe and the Americas students and their teachers have been protesting against the same processes: the public disinvestment of higher education, rising fees and levels of student debt, the expansion of management and administrative systems for measuring efficiency or 'excellence' of services, the quest for new fee-paying consumers online or overseas, the casualization of academic labor, the restructuring of pensions. Yet, the destruction of the public university in England is widely seen as a test-case where these processes are unraveling faster and further than anywhere else.

Secondly, the storm has been brewing for decades. There should be no wistful nostalgia for a once pure public university. In the nineteenth century the great 'redbrick' provincial universities were founded on the alliance between industry and ivy. In the post-war period a good deal of academic research served a decolonizing state uneasily placed in the cold war arms race as the student protests of the late 1960s recognized. It was hardly news then when in 1970 Edward Thompson railed against the erosion of intellectual life and academic governance by the captains of local industry that ran Warwick University, Ltd. And, of course, despite the faux radicalism of the new universities that enabled the system to expand after the Robbins Report of 1963, universities remained the preserve of

a privileged elite charged with running the welfare state with just 457,000 students in 1971 – 14% of the age group.

If the public university had always been a faustian bargain with industry and the state the rules of the game certainly began to change decisively during the 1980s when I was a student. First came the effective freeze on hiring following the Howe budget cuts of 1981. In 1993 when I was appointed to teach at the Department that had taught me it was the first permanent appointment in over a decade. Next came the stripping of the student maintenance grants I had marched unsuccessfully to protect in the mid-1980s. And then there were the infamous administrative systems for auditing the efficient use of public funds at universities by measuring the productivity of academic labor: research outputs by the Research Assessment Exercise from 1989, teaching by the Quality Assurance Agency in 1993 renamed the Teaching Quality Assessment in 1997. One consequence of this, consistent with the merging of the former polytechnic sector in 1992, was the growing incentives on a frequently dwindling and increasingly casualized labor force to admit more students and teach ever larger classes. Inevitably these auditing systems not only greatly increased the amount of time academics spent talking or writing about the research or teaching they would do if they only had the time to do it. It also catalyzed the staggering growth of management personnel.

New Labour only made things worse. Faced with the systematic under-funding of the universities, the expansion of student numbers (funding per student fell 40% from the mid-1970s to the mid-1990s), and the decline in real terms of academic salaries, they answered the call of the last official review of the funding of higher education handed from one government to the other – the Dearing Report. If Dearing enabled the introduction of a £1,000 for tuition (and the final abolition of the maintenance grant in 1999), by 2006 it had increased to a variable rate up to £3,000. The final indignity came with the shift from the RAE measurement of academic's research productivity – which, in the name of generating 'output' had arguably produced a great deal of increasingly specialized and unexciting publications – to a concern with its utility or 'impact' under the absurdly named Research Excellence Framework from 2008. Unsurprisingly, as universities now answered to the Department of Business, Skills and Innovation, impact was measured in increasingly narrow and economistic terms.

Before rushing to join the denunciations of our short-sighted and philistine politicians we have to accept that no-one within the English university sector emerges from this process with much dignity. Administrators have grown fat, plumping up their personnel, enlarging their office and buildings, as well as inflating their salaries. Most damagingly they meekly accepted the economistic logics that drove the auditing of productivity and were naive enough to believe that the introduction of fees would supplement, not replace, state funding. They have turned away from the public they are supposed to serve in the quest for new 'markets': professional schools, overseas students, and creation of empires with institutions that franchise their degrees.

The Last Professors of the public university have hardly fared better. They have been only too content to learn and internalize the new rules of the game in the name of self-advancement. I was one of the new breed of entrepreneurial academics who had only ever worked in this system. I quickly learnt that research grants came to those who spoke whatever language the research councils were speaking in, that one had to recruit postgraduates to generate income, that quantity not quality of publications was the measure of scholarly productivity. Those who went on research leave or won big grants for research projects were happy to hire replacements and assistants on short-term contracts. At the opposite end others seemed content to become stars, to play musical chairs as institutions competed for prestige through big names with long CVs of publications, and to see their professorial salaries climb into the stratosphere in the name of their new market value.

The past twelve months has seen many wake up from this bad dream. As respected individuals, programs and Departments – all festooned in the baubles of research excellence and prestige indicators - have been cut students and their teachers have mobilized. There have been marches, protests, online petitions, teach-ins and occupations. These struggles have been very local – at Sussex, Middlesex, King's College, etc – but those involved were in conversation with or at least virtually connected to protests elsewhere in Berlin, Berkeley and Buenos Aires. It has been on these front-lines that the defense of the public university has begun to be articulated. And it has been the targeting of the arts and humanities in the cuts that has made it possible.

The humanities, along with the arts and even the interpretive social sciences, have become the true test of the public value of higher education. As the recession grips market models of utility and efficiency have surely been exposed as a dangerous fallacy so this is a good moment to re-articulate the purpose and role of humanities and social sciences in ways that justify renewed public investment in them. We could have expected more from those like the British Academy or Arts and Humanities Research Board that institutionally represent the humanities in the UK. Instead, they have effectively caught themselves in arguments about economic impact and the capacity to aid national economic recovery that they are doomed to lose (see the Arts and Humanities Research Council's *Leading the World* and the British Academy's *The Public Value of the Humanities*). We should not be surprised then that the Browne Report recommends the complete withdrawal of public funding for the teaching of the arts, humanities and social sciences in contrast to the STEM subjects that will continue to be supported.

The defense of public universities is intricately tied to arguments that can establish the public value of the humanities. We need to get beyond the hand-wringing of those who believe only philistines require the humanities to be justified just as much as the meek reproduction of the government's own vocabularies of impact and value. We can and should remind the world that it is our classes that students want to take. Despite a decade of the rhetorical marginalization of our disciplines in the UK as not relevant there are more studying in the arts, humanities and social sciences (1,073,465 in 2008/9) than in the STEM subjects (829,115) and they are growing at a faster rate (a 28% increase since 2001/2 as opposed to 20% increase for STEM). Indeed, in all likelihood, the arts, humanities and socials sciences are cross-subsidizing the more expensive STEM fields that teach fewer students in more resource heavy infrastructures and laboratories.

Why then do we face increased demand from students for the arts, humanities and social sciences? There is no one reason why students take these classes and we do not need a one-size fits all justification of their public value. There are for sure those that rightly view these subject areas as helping them prepare for the world of work without necessarily providing a clear career trajectory in the social field or the knowledge and culture industries. Students recognize that even vocational training can not ensure life-long careers any longer. Instead they require a set of skills – of critical thought and analysis, of reading and digesting materials quickly, of making presentations and convincing arguments across a range of media – that equip them for a flexible labor market in which they may work across multiple sectors.

We need, however, not stop at these instrumental ends. We should be gratified to recognize that students are no less concerned with becoming citizens of the world. They realize that the humanities provide them with not just an education in the issues and problems that face our global society but the forms of analysis that allow us to connect our particular local experiences to sometimes global processes. They also provide the language training necessary for us to understand the perspectives of other cultures. No less importantly, given the democratic deficit and seemingly growing disenchantment with our political system, the humanities teach our students the critical skills they

require to become active and valued citizens of our democratic life. Often they teach them that it is possible to think of themselves in new ways, to discover a new identity and to forge around it a politics they share with others that challenges and enriches our democracy.

Finally, the humanities, like the arts and social sciences, offer us the opportunity to think otherwise. In an age in which the financialization of everyday life appears to demand an economic value is attached to everything we need to be reminded that this was not always the case. The humanities speak to different systems of value, different orders of pleasure and enjoyment, that we can all enjoy – of imagination, beauty, laughter and wonder. It is these qualities afterall that make us fully human, that enable us to appreciate what is unique about our own culture as well as what it is we hold in common with the rest of humanity.

A good deal is at stake. We must defend the vision of a publicly funded university able to support classes in subjects that do not generate economic benefits. Economic utility is not the measure of who we are or who we want to become.

http://www.insidehighered.com/blogs/globalhighered/the_end_of_the_public_university_in_england

Kisaalita Engineers Solutions for Africa's Rural Poor

University of Georgia professor William Kisaalita engineers simple, practical solutions — a milk chiller, a nutcracker and an egg incubator — for Africa's rural poor.

By Megan Scudellari

William Kisaalita is slowly revolutionizing the milk market in Uganda, guinea hen breeding in Burkina Faso and nut-oil cooperatives in Morocco. (Flip Chalfant)

For a moment, William Kisaalita is distracted. In a spacious, sunlit office at the University of Georgia, Kisaalita should be focused on the book he just published, or the pile of papers teetering on his desk, or the phone calls and visitors that repeatedly interrupt his afternoon. Instead, Kisaalita, a professor and tissue engineer at the university, leans back in his chair, locking his hands behind his head, his dark eyes narrowing. "When you come here and are successful," he says, gesturing around the large office, "you have this nagging feeling. What have you done for the people at home?"

William Kisaalita was born, raised and educated in Uganda. Now he works by day as a bioengineer, designing three-dimensional cell-based biosensors, a promising new technology that could revolutionize how pharmaceutical companies test new drugs. But for every minute Kisaalita talks about biosensors and microwells, he's apt to spend an hour discussing his true vocation — bringing simple engineering solutions to the rural poor in Africa. "This is not the kind of work you do to get tenure," Kisaalita says in a melodious accent.

Kisaalita is devoted to smallholders, African farmers who cultivate 2 to 10 acres of crops on single-family farms. His passion (obsession, some would call it) has cost him a promotion and recognition. But with perseverance and funding from a surprisingly diverse set of organizations — including the World Bank, the U.S. Department of Agriculture, the Environmental Protection Agency and the National Science Foundation — Kisaalita is slowly revolutionizing the milk market in Uganda, guinea hen breeding in Burkina Faso and nut-oil cooperatives in Morocco.

"What he's doing is absolutely unique," says Vicki McMaken, Kisaalita's colleague and assistant director of the Office of Global Programs at UGA. "He identifies a problem that affects the poorest people in a community and finds a solution that fits the scale of the problem."

Every night along Uganda's "cattle corridor," a 50,000-square-mile dry-land area stretching north to south, farmers pour milk down the drain. There are more than 2.5 million dairy farms in the region, and most have between two and five cows. Milked in the morning and evening, the cattle produce an average of 50 liters of milk per day. During the day, the milk can be sold to local vendors, who test its freshness and transport it to cooling stations. When markets are closed in the evening, though, farmers have no way to cool the milk. They pour some 40 percent of their income down the drain each night.

William Kisaalita received a $200,000 grant from the World Bank to commercialize his milk cooler product. (Flip Chalfant)

When he first attempted to tackle the problem, Kisaalita drew up plans for solar-powered cooling centers scattered across the region. But at $200,000 apiece, the centers were implausible. So in 2002, Kisaalita organized a design team for UGA engineering undergraduates, intended to expose them to Third World engineering challenges. He took his first group of students to Uganda during spring break to introduce them to the milk-cooling problem. Then, thanks to a $100,000 grant from the National Science Foundation, Kisaalita brought a team of students with him to Kampala, Uganda's capital city of 1.5 million, for eight weeks during each summer for three years to work on a prototype cooler.

Together, they fabricated an insulated metal cylinder about the size of a dishwasher, big enough to hold a traditional 50-liter milk can. The design relies on zeolite, a mineral with a remarkable capacity to absorb water. A milk can placed into the container is surrounded by a small amount of water. The container is attached, by a valve, to a vacuum. When the valve is opened, water exposed to the vacuum vaporizes. As it does so, the water sucks heat from the milk, a process called evaporative cooling — like the chill you feel on

your skin when stepping out of a pool. The zeolite — packed into an attached container — absorbs the water vapor, so the vacuum remains and vaporization continues in a loop.

But the system does require an energy input. Each morning, after cooling the milk all night, the zeolite has to be heated to burn away the collected water. Mia Mattioli, an undergraduate who joined Kisaalita during the first summer, remembers that tedious process. “My job was literally to watch rocks dry all summer long,” she says, laughing. They toiled away, but the prototype simply didn’t work well enough to market. “Product development takes a long time,” Kisaalita says, chuckling in hindsight. Then, inspiration came from an unlikely source — a beer company.

In Germany, a company called Cool-System had designed a self-cooling keg for affluent beer drinkers. Kisaalita approached the manufacturers and suggested the design, which also used zeolite, might be suited for rural Africa. “They initially laughed at us,” Kisaalita says. But he was eventually able to convince the executives that there was a market for the cooler in Uganda, and with some redesign, Cool-System produced the “CoolChurn,” a keg-like cooler that chills 15 liters of milk within three to four hours and keeps it cold for a full day. In 2008, Kisaalita received a $200,000 grant from the World Bank to begin commercializing the product. The company made 60 coolers, designed to be recharged each night at a central station where electric heat is used to dry the zeolite. Kisaalita prepared to distribute the coolers but ran up against an obstacle that all his engineering ingenuity couldn’t solve — the smallholder farmers didn’t want them.

Last year, at a town meeting in rural Uganda, Kisaalita welcomed farmers to an informal gathering to introduce the prototype. Just 14 farmers showed up. One warily approached Kisaalita. “Why are you targeting us?” he asked. Kisaalita was floored. He soon learned the farmers were leery of using a technology that richer, neighboring farmers weren’t. The milk cooler was just too small and too cheap: Larger farmers wanted a bigger cooler to store significantly more milk, and poorer farmers wouldn’t invest in a cooler until the larger farmers did. But unlike many aid groups that make their way to Africa, Kisaalita is in the development business for the long run.

If the poor wouldn’t use a milk-chiller until the rich bought it, then William Kisaalita would build a milk-chiller for all men.

Kisaalita grew up on a 2-acre farm 10 miles outside Kampala, where he worked alongside six siblings planting and harvesting seasonal crops — corn, cassava, bananas, peanuts and more — by hand.

When he was 9, Kisaalita became ill. His father brought him to the Kampala hospital; he recovered. As they headed home, his father made a quick stop at the Ministry of Works, where he was a mechanic for the government to provide a supplemental income for his large family. Kisaalita had never been to the workshop before. He stood transfixed in front of a massive machine that shook the ground beneath his feet. The tall metal structure hissed and banged as a giant hammer lifted into the air, then slammed down onto red heated metal below. “I thought, ‘Man, I want to build something like that,’” Kisaalita recalls.

At age 15, Kisaalita was sent to boarding school, then to Makerere University in Kampala, where he studied mechanical engineering and met Rose Mayanja, the woman who would someday be his wife and mother of his four children. As a capstone project at Makerere, Kisaalita constructed a hand-operated mill to squeeze juice from sugar cane. Kisaalita made the mill with Ugandans in mind: They could use it while harvesting sugar cane for subsistence; they couldn’t sell it because the sugar industry in Uganda had collapsed when dictator Idi Amin expelled the country’s Asians, who had controlled the industry.

As Kisaalita prepared to graduate, Amin’s regime was on the brink of collapse. The country was in turmoil, and Kisaalita knew he would need to continue his education abroad. He went to the University of British Columbia in 1978, returning to Uganda in 1982 with a master’s in bioengineering and big plans to solve Uganda’s food challenges. But the political atmosphere was still tumultuous, so Kisaalita went back to Canada to complete his doctorate. He took a string of postdoctoral fellowships across Canada and the U.S., finally landing at the University of Georgia for his first faculty position in 1991. Almost 20 years later, he’s still there. But it hasn’t all been smooth sailing.

Several years after arriving at the University of Georgia, Kisaalita was up for a promotion that he didn’t get. Colleagues attribute the loss to his split interests. “Tissue engineering is sexy, and inquiring about how to move two gallons of milk is not,” says Brahm Verma, a professor of engineering at UGA and Kisaalita’s

mentor. “But the complexity of the second is no less than the first. He’s probably not appreciated as he should be.”
“Professors like William are rare. He doesn’t work because he’s employed,” Verma adds. “He has a passion for the things he does.” These days, that passion has led him to confront the needs of guinea hens and the art of nut cracking.
In 2005, Vicki McMaken, in the Office of Global Programs at UGA, pitched an idea to Kisaalita: Could he find a way to help Moroccan women crack nuts?
The deep roots of the thorny argan tree prevent erosion along the savanna in southwest Morocco. More important to international consumers, the trees produce argan nuts, the source of argan oil, a product rich in vitamin E that is used in cosmetics and as a hazelnut-like ingredient by gourmet chefs. Companies that export the oil employ local women to crack the nuts and harvest the seeds. It is no easy task — the almond-like nuts are some of the toughest in the world. Sitting on the ground, women smash the shell between two rocks without damaging the kernels inside. Producing a liter of oil takes some 20 hours of work, in a labor-intensive process that has mangled many hands.
McMaken and Kisaalita traveled to Morocco, where Kisaalita sat down on a dirt floor, to the laughter of the woman around him, and attempted to crack a nut. “It’s very hard,” he admits with a sheepish grin. As soon as they stepped outside of the hut, Kisaalita turned to McMaken and declared, “We have to help them.”

Argan nuts in teh nutcracker Kisaalita and his students engineered. (Flip Chalfant)

Kisaalita assigned the project to his students: Make a nutcracker that uses some kind of crank shaft requiring human skill (so the women would retain their jobs) and is only three times faster than cracking with stones (because if it is too fast and profitable, men will take it over). Today, Kisaalita and his students have developed three prototypes, simple metal and wood structures that catch and crack a single nut at a time. Kisaalita has declined to patent the technology. “It doesn’t matter to us if someone takes the technology and improves it, if it stays directed at the customer,” he says.
As his students worked on the nut-cracking project, Kisaalita began another, which has taken him to Burkina Faso, a poor, landlocked country just north of Ghana with one of the lowest per capita gross domestic products in the world. In 2005, Salibo Some, founder of Africa’s Sustainable Development Council, or ASUDEC, gave a seminar at UGA, his alma mater, on guinea fowl production. For a variety of reasons, smallholders in Burkina Faso struggle to raise more than 50 guinea fowl — locally called “chickens” — at a

time, Some says. As he described the problem to the crowd, Kisaalita's ears perked up. After the talk, Kisaalita approached Some. "This is something I can help with," he said.
One of the central problems for the farmers is lack of incubators. Incubators failed in the region before, Some says, because they required daily technical adjustments for temperature and humidity, and farmers with little education had difficulty keeping up. Kisaalita and his students designed a simple, automatic, solar-powered incubator that can brood up to 100 eggs at a time. He and Some tested the incubator in the field, where it worked with 85 percent success. Now they are looking for a local manufacturer that will make the unit, reducing the price and bringing industry into the country. "If we succeed in putting these technologies into the countryside, it will really be a revolution," Some says.
But as he's become wrapped up in nuts and chickens, Kisaalita hasn't forgotten about the milk.
Today, 15 Ugandan farmers use the smaller, keg-styled milk cooler Kisaalita built with Cool-System. But he's also changing his product to meet demand, designing a larger cooler with the 70-to-100-liter capacity that wealthier farmers want. Once the new cooler is adopted, he hopes more poor farmers will be interested. And Kisaalita has engineered both the smaller cooler and the new, larger prototype to run on biogas, rather than electricity.
Last May, Kisaalita went back and built the first such biogas system at a farm in western Uganda, outside the city of Mbarara. Flavia Kato, a widow with 10 cows had volunteered her farm as the biogas system test site. In her yard, wooden posts stick up from the ground, marking the beginnings of a cow dung shack. A pipe runs from the shack to a deep trench dug into the red clay, where men build two small brick domes. Kisaalita takes pictures from above. One dome will be an underground dung fermentation reservoir; the other will hold fermented slurry. Gas that emanates from the process, consisting primarily of methane and carbon dioxide, will be collected from the second dome via a pipe and then transported to an oven and burned each night, providing heat to dry out the zeolite.
Kato is thrilled with the progress. A widow, she needs all the extra income she can get, and once the new system is in place, she hopes to expand her herd, Kisaalita says. "I've learned if you bring technology to expand their production, farmers' immediate reaction is to expand and improve as much as possible," he says. Kato ushered the men inside for lunch, demanding they take a break from the African sun. Construction will take days, testing the new system will take months and finding a way to encourage other farmers to adopt it may take years. But it will happen, Kisaalita believes. "We're optimistic," he says. "Besides, the journey is more fun than the destination."

http://www.miller-mccune.com/science-environment/kisaalita-engineers-solutions-for-africas-rural-poor-24895/?utm_source=Newsletter133&utm_medium=email&utm_content=1102&utm_campaign=newsletters

Smart Money and Green Investments

Clean-tech start-ups must look beyond a market of "bourgeois bohemians," women investors say.

By Melinda Burns

Women investors say environmentally friendly start-ups need to get their message beyond the "bourgeois bohemians" of the left coast and into the middle of the country. (Chris Sadowski / istockphoto.com)

There are lots of reasons for going green — 1.5 million of them in California alone. That's the number of jobs that have been created over the past 35 years as a result of the state's energy efficiency policies. Together, they've generated a $45 billion payroll.

California jobs in clean transportation, renewable energy, clean air quality, green building construction, energy efficiency and environmental protection have grown 10 percent since 2005, or 10 times as fast as state jobs overall, research shows.

It's a trend fueled by volatile prices of oil and gas, increased environmental regulation, aging infrastructure and concerns for national energy security — and investors are paying attention. A 2009 survey by the National Venture Capital Association estimated that venture capital investment in clean technologies would grow by 63 percent globally through 2012.

Yet it's not always easy for clean-tech firms to attract investors, even with proven technologies in hand, according to Sandra Itkoff, senior vice president of the Angeleno Group LLC, a Los Angeles-based private equity firm. Itkoff said entrepreneurs must show not only that they are having a positive effect on the environment but also that they are likely to make money. Angeleno focuses on green companies that are starting to build a market for their products.

"We're not the Sierra Club," Itkoff told a large audience at the recent Women in Green Forum, a conference co-sponsored by *Miller-McCune* in Pasadena. "Investors give us money to earn money."

The companies in Angeleno's portfolio manufacture electric cars, energy-efficient appliances, solar panels and wind turbine blades. They retrofit power plants, develop waste-to-energy technologies and manage sustainable forests.

Itkoff noted that only one of the top 10 manufacturers of solar modules and one of the top 10 manufacturers of wind turbines are located in the U.S.
"That's a big opportunity," she said. "People are very interested in supporting these businesses."
At Funk Ventures, headquartered in Santa Monica, investors are willing to take a chance on new technologies in earlier stages of development, said managing director Fran Seegull, who joined Itkoff in a panel discussion at Women in Green. Seegull said her firm invests in new products that will have a positive impact on society, but, she cautioned, "Good intentions and passion are not enough." Funk Ventures is "not shy about taking risks," she said, but it looks for a seasoned management team, defensible intellectual property and a potentially large and accelerating market for new products.
Speaking to businesswomen, activists and students at the Pasadena Convention Center, Seegull said that women entrepreneurs tend to under-promise and over-deliver on their estimates of financial success.
"You need to over-promise and over-deliver," she said.
Seegull also advised would-be entrepreneurs to think beyond a market of "bourgeois bohemians" living in Berkeley and San Francisco and Santa Monica.
"We really need to figure out ways to entice the middle of the country to buy products that make a difference," Seegull said.
Heather McCormick, a board member of Pasadena Angels, said that early-stage clean technologies were a good fit for her group, a nonprofit organization of more than 100 private investors, many of them entrepreneurs and senior corporate executives. The Angels have invested $20 million in 60 start-up companies since the group formed in 2000. The group provides up to $1 million in early financing and seed money to emerging technology-based ventures, and it joins with other venture capital firms to support new companies with up to $10 million.
Angels members do not pool their money: They invest individually and directly, and they act as mentors.
Clean-tech businesses that have been launched with help from Pasadena Angels include firms that develop water-control technologies for agricultural drip irrigation and lawn sprinklers, McCormick said.
"We are often the first round for entrepreneurs," she said. "It's always been about more than the money for us. The more cheerleaders you need, the better."

http://www.miller-mccune.com/environment/smart-money-and-green-investments-24906/

From Farm to Fridge to Garbage Can

By TARA PARKER-POPE

Stuart Bradford

How much food does your family waste?

A lot, if you are typical. By most estimates, a quarter to half of all food produced in the United States goes uneaten — left in fields, spoiled in transport, thrown out at the grocery store, scraped into the garbage or forgotten until it spoils.

A study in Tompkins County, N.Y., showed that 40 percent of food waste occurred in the home. Another study, by the Cornell University Food and Brand Lab, found that 93 percent of respondents acknowledged buying foods they never used.

And worries about food safety prompt many of us to throw away perfectly good food. In a study at Oregon State University, consumers were shown three samples of iceberg lettuce, two of them with varying degrees of light brown on the edges and at the base. Although all three were edible, and the brown edges easily cut away, 40 percent of respondents said they would serve only the pristine lettuce.

In his new book "American Wasteland: How America Throws Away Nearly Half of Its Food" (Da Capo Press), Jonathan Bloom makes the case that curbing food waste isn't just about cleaning your plate.

"The bad news is that we're extremely wasteful," Mr. Bloom said in an interview. "The positive side of it is that we have a real role to play here, and we can effect change. If we all reduce food waste in our homes, we'll have a significant impact."

Why should we care about food waste? For starters, it's expensive. Citing various studies, including one at the University of Arizona called the Garbage Project that tracked home food waste for three decades, Mr. Bloom estimates that as much as 25 percent of the food we bring into our homes is wasted. So a family of four that spends $175 a week on groceries squanders more than $40 worth of food each week and $2,275 a year.

And from a health standpoint, allowing fresh fruits, vegetables and meats to spoil in our refrigerators increases the likelihood that we will turn to less healthful processed foods or restaurant meals. Wasted food also takes an environmental toll. Food scraps make up about 19 percent of the waste dumped in landfills, where it ends up rotting and producing methane, a greenhouse gas.

A major culprit, Mr. Bloom says, is refrigerator clutter. Fresh foods and leftovers languish on crowded shelves and eventually go bad. Mr. Bloom tells the story of discovering basil, mint and a red onion hiding in the fridge of a friend who had just bought all three, forgetting he already had them.

"It gets frustrating when you forget about something and discover it two weeks later," Mr. Bloom said. "So many people these days have these massive refrigerators, and there is this sense that we need to keep them well stocked. But there's no way you can eat all that food before it goes bad."

Then there are chilling and food-storage problems. The ideal refrigerator temperature is 37 degrees Fahrenheit, and the freezer should be zero degrees, says Mark Connelly, deputy technical director for Consumer Reports, which recently conducted extensive testing on a variety of refrigerators. The magazine found that most but not all newer models had good temperature control, although models with digital temperature settings typically were the best.

Vegetables keep best in crisper drawers with separate humidity controls.

If food seems to be spoiling quickly in your refrigerator, check to make sure you're following the manufacturer's care instructions. Look behind the fridge to see if coils have become caked with dust, dirt or pet hair, which can interfere with performance.

"One of the pieces of advice we give is to go to a hardware store and buy a relatively inexpensive thermometer," Mr. Connelly said. "Put it in the refrigerator to check the temperature to make sure it's cold enough."

There's an even easier way: check the ice cream. If it feels soft, that means the temperature is at least 8 degrees Fahrenheit and you need to lower the setting. And if you're investing in a new model, don't just think about space and style, but focus on the refrigerator that has the best sight lines, so you can see what you're storing. Bottom-freezer units put fresh foods at eye level, lowering the chance that they will be forgotten and left to spoil.

Mr. Bloom also suggests "making friends with your freezer," using it to store fresh foods that would otherwise spoil before you have time to eat them.

Or invest in special produce containers with top vents and bottom strainers to keep food fresh. Buy whole heads of lettuce, which stay fresher longer, or add a paper towel to the bottom of bagged lettuce and vegetables to absorb liquids. Finally, plan out meals and create detailed shopping lists so you don't buy more food than you can eat.

Don't be afraid of brown spots or mushy parts that can easily be cut away.

"Consumers want perfect foods," said Shirley Van Garde, the now-retired co-author of the Oregon State study. "They have real difficulty trying to tell the difference in quality changes and safety spoilage. With lettuce, take off a couple of leaves, you can do some cutting and the rest of it is still usable."

And if you do decide to throw away food, give it a second look, Mr. Bloom advises. "The common attitude is 'when in doubt, throw it out,'" he said. "But I try to give the food the benefit of the doubt."

http://well.blogs.nytimes.com/2010/11/01/from-farm-to-fridge-to-garbage-can/?nl=health&emc=healthupdateema2

At the Age of Peekaboo, in Therapy to Fight Autism

By APRIL DEMBOSKY

Peter DaSilva for The New York Times

A camera operator observed Carmen and Saul Aguilar during a therapy session with their son Emilio at 7 months old. Emilio showed signs of autism, and his older brother, Diego, received a diagnosis at age 2.

SACRAMENTO — In the three years since her son Diego was given a diagnosis of autism at age 2, Carmen Aguilar has made countless contributions to research on this perplexing disorder.

She has donated all manner of biological samples and agreed to keep journals of everything she's eaten, inhaled or rubbed on her skin. Researchers attended the birth of her second son, Emilio, looking on as she pushed, leaving with Tupperware containers full of tissue samples, the placenta and the baby's first stool.

Now the family is in yet another study, part of an effort by a network of scientists across North America to look for signs of autism as early as 6 months. (Now, the condition cannot be diagnosed reliably before age 2.)

And here at the MIND Institute at the University of California Davis Medical Center, researchers are watching babies like Emilio in a pioneering effort to determine whether they can benefit from specific treatments.

So when Emilio did show signs of autism risk at his 6-month evaluation — not making eye contact, not smiling at people, not babbling, showing unusual interest in objects — his parents eagerly accepted an offer to enroll him in a treatment program called Infant Start.

The treatment is based on a daily therapy, the Early Start Denver Model, that is based on games and pretend play. It has been shown in randomized trials to significantly improve I.Q., language and social skills in toddlers with autism, and researchers say it has even greater potential if it can be started earlier.

"What you ultimately might be doing is preventing a certain proportion of autism from ever emerging," said David Mandell, the associate director of the Center for Autism Research at the Children's Hospital of Philadelphia. "I'm not saying you're curing these kids, but you may be changing their developmental trajectory enough by intervening early enough that they never go on to meet criteria for the disorder. And you can't do that if you keep waiting for the full disorder to emerge."

Sally Rogers, a MIND Institute researcher who has been working with the Aguilars, said she faced several challenges in adapting the toddler therapy for infants.

Even normally developing babies cannot speak or gesture, let alone pretend. Instead, Ms. Rogers has parents focus on babbling and simple social interactions that occur in the normal routine of feeding, dressing, bathing and changing the baby.

"Patty-cake and peekaboo or tickle games, those are people games," she explained to Carmen and Saul Aguilar during their first session with their son Emilio at 7 months old. Ms. Rogers talked about the next 12 weeks and how they would focus on getting Emilio to exchange smiles, to respond to his name, to babble with them, starting with single syllables ("ma") and moving on to doubles ("gaga") and more complex combinations ("maga").

"Most babies come into the world with a built-in magnet for people," Ms. Rogers said. "One thing we know about autism is that it weakens that magnet. It's not that they're not interested, they have a little less draw to people. So how do we increase our magnetic appeal for his attention?"

Lesson 1 was eye contact. Ms. Rogers had the parents take turns playing with Emilio, encouraging them to get face to face with the baby and stay in his line of vision. Mrs. Aguilar leaned down on the blue blanket and rattled a toy. "Emilio? Where's Emilio?"

On the other side of a two-way mirror, another researcher watched the session and an assistant monitored three video cameras in the room. Sally Ozonoff, a researcher who first identified Emilio as a candidate for the study, stopped by to observe.

"He's just staring at that object even though her face is three inches away," she said. "He has that flat, very sober-looking face."

Mr. Aguilar tried next. He put Emilio in a red beanbag chair and folded the sides together over the baby. "Squish, squish, squish!" he said. No response.

He picked Emilio up over his head and flew him like an airplane. Emilio stared at the ceiling.

Mr. Aguilar put the baby back in the beanbag and picked up a stuffed wolf toy. He put it on his head and let it drop into his hands. "Pschooo! Uh-oh!" Finally, Emilio was watching.

"That was great," Ms. Rogers told the father. "You put that toy on your head and he was drawn to your face. You were using the toy to enhance the social interaction. When you bring it up to your face, he's with you."

While the causes of autism are still a mystery, scientists agree that it has some genetic or biological trigger. Experimental treatments like Infant Start are intended to address the social environment the baby grows up in, and to see whether changes at home might alter the biological development of the condition once triggered.

"Experiences shape babies' brains in a very physical way," Ms. Rogers said. "Experience carves synapses; some are built, some are dissolved."

If a baby starts focusing on objects instead of faces, the theory goes, a "developmental cascade" can begin: brain circuits meant for reading faces are used for something else, like processing light or objects, and babies lose their ability to learn the emotional cues normally taught by watching facial expressions. The longer a baby's brain runs this developmental course, the harder it becomes to intervene.

But the effort to stop autism in its tracks with earlier interventions presents a scientific problem.

Because there is no formal diagnosis for autism before age 2, it is impossible to distinguish between infants who are helped by the intervention and infants who never would have developed autism in the first place. Researchers must see enough improvement with babies like Emilio before they can do a randomized trial, comparing babies who get the treatment and babies who don't.

Emilio's parents are happy to have their son in the first wave of the pilot program. They saw their older son, Diego, make so much progress in behavioral therapy between ages 3 and 5 that they're very hopeful about what might happen with Emilio.

Mr. Aguilar quit his job at a telecommunications company so he could care for Emilio and work on their objectives all day. Mrs. Aguilar had quit her job in social work when their first son received his diagnosis. But the commitment to the future is much revised since Emilio's 6-month evaluation.

"I'm the first in my family to go to college, and grad school," Mrs. Aguilar said. "My thought was, 'Now I've set the bar for my son.' "

But after learning that Emilio too may have autism, "you stop looking that far into the future," she said. "We're forced to think day by day."

http://www.nytimes.com/2010/11/02/health/02autism.html?_r=1&ref=research

Blood Pressure Check With That Haircut?

By RONI CARYN RABIN

Barber shops often serve as a pipeline for health information in African-American communities. Now, a study reports a striking success: when barbers checked their male patrons' blood pressure on every visit, the men were far more likely to see a doctor and get high blood pressure under control. (There was also a financial incentive: a free haircut for those who returned with a prescription.)

The study, published on Monday in Archives of Internal Medicine, was conducted at 17 black-owned barber shops in Dallas County, Tex., over the course of two years, ending in 2008.

Eight shops distributed pamphlets to customers found to have high blood pressure at the start of the study; nine went much further, offering blood pressure checks and urging hypertensive customers to see a doctor.

By the end of the study, more than half of both groups had their blood pressure under control. But the gain was more impressive among those whose barbers checked them at each haircut: 53 percent, from 33 percent at the start of the study, compared with 51 percent, from 40 percent, for those who received pamphlets.

Most customers were regulars who came in every two to four weeks, said the study's lead author, Dr. Ronald G. Victor, now of Cedars-Sinai Heart Institute. "That sure puts the issue on top of your radar screen," he said.

http://www.nytimes.com/2010/11/02/health/research/02awareness.html?ref=research&pagewanted=print

New DNA Tests Aimed at Reducing Colon Cancer

By NICHOLAS WADE
Two new DNA-based tests, one of them described at a meeting in Philadelphia on Thursday, hold the promise of detecting early — and sharply reducing — colon cancer, a disease that afflicts 150,000 people a year in the United States and costs an estimated $14 billion to treat.

The new tests could help most people avoid colonoscopies, which are routinely prescribed for people over age 50. Instead of screening the entire population, doctors could instead refer people for a colonoscopy only if they had tested positive in one of the DNA tests.

Unlike colonoscopy, in which a seeing tube is threaded up the colon, the DNA tests are noninvasive, so more people would take them. Both tests could be brought to market within two years.

One of the tests, developed by Exact Sciences of Madison, Wis., looks in stool samples for the presence of four altered genes that are diagnostic of colon cancer. The test could catch cancerous and precancerous tumors at an early stage, when they are curable, and allow doctors to remove them promptly.

The other test looks in blood for changes in a single gene, called Septin 9, which is not in the Exact Sciences' panel of four genes. The test has been developed by Epigenomics AG in Germany.

Both tests would be less expensive than colonoscopy, and potentially more effective. Compliance with colonoscopy is low, since people don't want to have one, and the overall cost per detection is high because most people are healthy, and even colonoscopy misses many tumors in the upper part of the intestine.
Exact Sciences now plans to enlist several thousand patients in a prospective trial designed to win the Food and Drug Administration's approval. The trial will be completed in 2012 and the test, if approved, should be available shortly thereafter.

"If widely used, and regularly, this test really does have the opportunity to eliminate colon cancer," said Dr. David A. Ahlquist, a colon cancer expert at the Mayo Clinic and an adviser to Exact Sciences.

The practical value of the tests depends critically on details like their sensitivity, meaning the proportion of tumors that are detected, and their specificity, meaning how many of the positive results are in fact false alarms.

Exact Sciences reported in July that its test was highly sensitive and specific when applied directly to cells taken from tumors. But in the real world, the tumor DNA must be detected in stool samples, even though almost all the DNA comes from the bacteria of the gut. Just 0.01 percent of the DNA is human, and most of this is normal DNA, not the altered DNA of tumors.

The company reported Thursday at a meeting of the American Association for Cancer Research that in a trial of 1,100 patients, the test had detected 64 percent of adenomas, or polyps, larger than one centimeter in diameter, and 85 percent of cancers, as judged by the colonoscopies also given to the patients.
Dr. Ahlquist said he was very pleased with the new results, especially the 64 percent detection rate for precancerous polyps, since these are best targets for intervention.

Although such a detection rate sounds far from perfect, it can be effective if the test is given on a regular schedule. "The Pap smear detects only 50 percent of cervical cancers, but applied over time it virtually eliminates the disease," Dr. Ahlquist said.

The specificity of the Exact Sciences test is 88 percent, meaning that 12 percent of the time the patient will be given a false alarm. This may be acceptable, given that the worst that will happen is that the patient will get an unnecessary colonoscopy.

"With stool tests, you need a 90 percent specificity," said Dr. Bert Vogelstein, a cancer expert at Johns Hopkins University who is also an adviser to the company. "Exact Sciences has gotten close to that. There's a lot of hope for getting a stool-based test."

Promising results for the blood-based tests were reported this week at a meeting in Barcelona, Spain. Epigenomics said its test had a sensitivity of 86 percent and a specificity of 93 percent.

Proponents of each test note possible weaknesses of the other. Dr. Achim Plum, a vice president for Epigenomics, said that 30 to 40 percent of people have small polyps, but less than 10 percent of these ever become cancerous. The colon-based test may pick up too many of these, sending far too many people in for colonoscopy.

"The health economics of such a test make no sense," he said.

But the blood-based test may have a similar problem, since a positive signal could come from cancers anywhere in the body. If the patient is advised to take a whole body imaging scan, more false positives could be generated "so you end up doing more harm than good," Dr. Vogelstein said.

Dr. Plum said that Epigenomics did not see its test as being necessarily in competition with the Exact Sciences test, because the blood-based test would be good alternative for people put off by stool testing.

http://www.nytimes.com/2010/10/29/health/29cancer.html?ref=research

The Cancer Sleeper Cell

By SIDDHARTHA MUKHERJEE

In the winter of 1999, a 49-year-old psychologist was struck by nausea —a queasiness so sudden and strong that it seemed as if it had been released from a catapult.

More puzzled by her symptoms than alarmed — this nausea came without any aura of pain — she saw her internist. She was given a diagnosis of gastroenteritis and sent home to bed rest and Gatorade.

But the nausea persisted, and then additional symptoms appeared out of nowhere. Ghostly fevers came and went. She felt perpetually full, as if she had just finished a large meal. Three weeks later, she returned to the hospital, demanding additional tests. This time, a CT scan revealed a nine-centimeter solid mass pushing into her stomach. Once biopsied, the mass was revealed to be a tumor, with oblong, spindle-shaped cells dividing rapidly. It was characterized as a rare kind of cancer called a gastrointestinal stromal tumor, or GIST.

A surgical cure was impossible: her tumor had metastasized to her liver, lymph nodes and spleen. Her doctors halfheartedly tried some chemotherapy, but nothing worked. “I signed my letters, paid my bills and made my will,” the patient recalled. “I was told to go home to die.”

In June, several months after her diagnosis, she stumbled into a virtual community of co-sufferers — GIST patients who spoke to one another online through a Listserv. In 2001, word of a novel drug called Gleevec began to spread like wildfire through this community. Gleevec was the exemplar of a brand-new kind of cancer medicine. Cancer cells are often driven to divide because of mutations that activate genes crucial to cell division; Gleevec directly inactivated the mutated gene driving the growth of her sarcoma, and in early trials was turning out to be astonishingly effective against GIST.

The psychologist pulled strings to enroll in one of these trials. She was, by nature, effortlessly persuasive, and her illness had made her bold. She enrolled in a Gleevec trial at a teaching hospital. A month later, her tumors began to recede at an astonishing rate. Her energy reappeared; her nausea vanished. She was resurrected from the dead.

Her recovery was a medical miracle, emblematic of a new direction in cancer treatment. Medicine seemed to be catching up on cancer. Even if no cure was in sight, there would be a new generation of drugs to control cancer, and another when the first failed. Then, just short of the third anniversary of her unexpected recovery, cancer cells suddenly began multiplying again. The dormant lumps sprouted back. The nausea returned. Malignant fluid poured into the cisterns of her abdomen.

Resourceful as always, she turned once more to the online community of GIST patients. She discovered that there were other drugs — second-generation analogues of Gleevec — in trial in other cities. Later that year, she enrolled in one such trial in Boston, where I was completing my clinical training in cancer medicine.

The response was again striking. The masses in her liver and stomach shrank almost immediately. Her energy flowed back. Resurrected again, she made plans to return home. But the new drug did not work for long: within months she relapsed again. By early winter, her cancer was out of control, growing so fast that she could record its weight, in pounds, as she stood on the hospital’s scales. Eventually her pain reached a point when it was impossible for her to walk.

Toward the end of 2003, I met her in her hospital room to try to reconcile her to her medical condition. As usual, she was ahead of me. When I started to talk about next steps, she waved her hand and cut me off. Her goals were now simple, she told me. No more trials. No more drugs. She realized that her reprieve had finally come to an end. She wanted to go home, to die the death that she expected in 1999.

The word “relapse” comes from the Latin for “slipping backward,” or “slipping again.” It signals not just a fall but another fall, a recurrent sin, a catastrophe that happens again. It carries a particularly chilling resonance in cancer — for it signals the reappearance of a disease that had once disappeared. When cancer recurs, it often does so in treatment-resistant or widely spread form. For many patients, it is relapse that presages the failure of all treatment. You may fear cancer, but what cancer patients fear is relapse.

Why does cancer relapse? From one perspective, the answer has to do as much with language, or psychology, as with biology. Diabetes and heart failure, both chronic illnesses whose acuity can also wax and wane, are rarely described in terms of “relapse.” Yet when a cancer disappears on a CT scan or becomes otherwise undetectable, we genuinely begin to believe that the disappearance is real, or even permanent, even though

statistical reasoning might suggest the opposite. A resurrection implies a previous burial. Cancer's "relapse" thus implies a belief that the disease was once truly dead.

But what if my patient's cancer had never actually died, despite its invisibility on all scans and tests? CT scans, after all, lack the resolution to detect a single remnant cell. Blood tests for cancer also have a resolution limit: they detect cancer only when millions of tumor cells are present in the body. What if her cancer had persisted in a dormant state during her remissions — effectively frozen but ready to germinate? Could her case history be viewed through an inverted lens: not as a series of remissions punctuated by the occasional relapse, but rather a prolonged relapse, relieved by an occasional remission?

In fact, this view of cancer — as tenaciously persistent and able to regenerate after apparently disappearing — has come to occupy the very center of cancer biology. Intriguingly, for some cancers, this regenerative power appears to be driven by a specific cell type lurking within the cancer that is capable of dormancy, growth and infinite regeneration — a cancer "stem cell."

If such a phoenixlike cell truly exists within cancer, the implication for cancer therapy will be enormous: this cell might be the ultimate determinant of relapse. For decades, scientists have wondered if the efforts to treat certain cancers have stalled because we haven't yet found the right kind of drug. But the notion that cancers contain stem cells might radically redirect our efforts to develop anticancer drugs. Is it possible that the quest to treat cancer has also stalled because we haven't even found the right kind of cell?

Even the earliest theories of cancer's genesis had to contend with the regenerative power of this illness. The most enduring of these theories was promulgated by Galen, the Greek physician who began practicing among the Romans in A.D. 162. Galen, following earlier Greek physiologists, proposed that the human body was composed of four cardinal fluids: blood, phlegm, yellow bile and black bile. Each possessed a unique color (red, white, yellow and black) and an essential character, temperature and taste. In normal bodies, these fluids were kept in a perfect, if somewhat precarious, balance. Illness was the pathological overabundance or depletion of one or more fluids. Catarrh, pustules, tuberculotic glands — all boggy, cool and white — were illnesses of the excess of phlegm. Jaundice was obviously an overflow of yellow bile. Heart failure arose from too much blood. Cancer was linked to the most malevolent and complex of all fluids — black bile, imagined as an oily, bitter fluid also responsible for depression (melancholia takes its name from black bile).

Fantastical as it was, Galen's system nonetheless had one important virtue: It explained not just cancer's occurrence but also its recurrence. Cancer, Galen proposed, was a result of a systemic malignant state, an internal overdose of black bile. Tumors were the local outcroppings of a deep-seated bodily dysfunction, an imbalance that pervaded the entire corpus. The problem with treating cancer with any form of local therapy, like surgery, was that black bile was everywhere in the body. Fluids seep back to find their own levels. You could cut a tumor out, Galen argued, but black bile would flow right back and regenerate cancer.

Galen's theory held a potent grip on the imagination of scientists for centuries — until the invention of the microscope quite literally threw light on the cancer cell. When 19th-century pathologists trained their lenses at tumors, they found not black bile in overabundance but cells in excess — sheet upon sheet of them that had divided with near-hyperactive frenzy, distorting normal anatomy, breaking boundaries and invading other tissues. The crucial abnormality of cancer was unbridled cellular proliferation, cell growth without control.

We now have a vastly enriched understanding of how this runaway growth begins. Cancer results from alterations to cellular genes. In normal cells, powerful genetic signals regulate cell division with exquisite control. Some genes activate cellular proliferation, behaving like minuscule accelerators of growth. Others inactivate growth, acting like molecular brakes. Genes tell a limb to grow out of an embryo, for example, and then instruct the limb to stop growing. A cut prompts the skin to heal itself, but heaps of skin do not continue to grow in excess. In a cancer cell, in contrast, the accelerators of growth are jammed permanently on, the brakes permanently off. The result is a cell that does not know how to stop growing.

Uncontrolled cell division imbues cancer cells not just with the capacity to grow but also with a crucial property that often accompanies growth: the capacity to evolve. Cancer is not merely a glum cellular copying machine, begetting clone after clone. Every generation of cancer cells produces cells that in turn bear additional mutations, changes beyond those already present in the accelerator and brake genes. And when a selective pressure like chemotherapy is applied to a cancer, resistant mutants escape that pressure. Just as antibiotics can give rise to resistant strains of bacteria, anticancer drugs can produce resistant cancer cells.

This process — evolution's slippery hand driving cancer's adaptation and survival — provided biologists with an explanation for cancer's recurrence after treatment. Relapse occurs because cancer cells that are genetically resistant to a drug outgrow all the nonresistant cells. Chemotherapy unleashes a ruthless Darwinian battle in every tumor. A relapsed cancer is the ultimate survivor of that battle, the direct descendant of the fittest cell.

And yet this theory seemed incomplete. Some cancers relapse months or even years after a chemotherapeutic drug has been stopped — a delay that would make little sense if relapse were simply due to resistance. In other instances, treating a recurrent cancer with the same drug can lead to a second remission — an outcome difficult to explain if the recurring cancer has acquired resistance to the original drug. Could there be a deeper explanation for cancer's persistence and regenerative power beyond simple mutations and resistance?

In 1994, a researcher at the University of Toronto named John Dick performed a striking experiment that would upend the received wisdom about cancer relapses. Trained as a stem-cell biologist, Dick was particularly interested in blood stem cells.

Stem cells, regardless of their origin, are defined by two cardinal characteristics. The first is hierarchy, or potency. A stem cell is the originator of the many different cell types in a tissue; it sits, like the founder of a massive clan, at the tip of a pyramid of growth. The second is self-renewal: even as stem cells create the cells that make up a tissue, they must also renew themselves. This dynast doesn't just produce a clan; in each generation, it rebirths itself. The perpetual rebirth of a founding cell yields a virtually inexhaustible supply of cells in a tissue, a reservoir of growth that can be tapped repeatedly on demand.

In humans, all circulating blood cells — white cells, red cells and platelets — arise from a population of blood stem cells exclusively dedicated to the genesis of blood. In their normal, unperturbed state, these blood-founding cells hibernate deep in the cavities of the bone marrow. But when circulating blood cells are killed — by chemotherapy, say — the stem cells awaken and begin to divide with awe-inspiring fecundity, generating millions of cells that gradually mature into blood cells. A defining feature of this process is its regenerative capacity: in generating blood, the blood stem cells also regenerate themselves. Each round of blood formation restores their supply. If the entirety of blood is again depleted, by another round of chemo, it can be regenerated again and yet again — theoretically, an infinite number of times — because the stem cells replenish themselves in every cycle.

Blood, in short, is hierarchically organized. Its reservoir of renewal is concentrated in a rare population of highly potent cells. As long as these cells exist in the marrow, blood can be regenerated. Eliminate this reservoir, and the vast organ-system of blood gradually collapses.

Now imagine that cancer is also hierarchically organized — with a secret cellular reservoir dedicated to its renewal. Typically, cancer is envisioned as a mass of dividing cells, with no difference between one cell and its neighbor. But what if some cells in a tumor are dedicated "founders," capable of infinite regeneration, while others are limited in their capacity to divide and unable to continuously generate new cells? Cancer cells bear mutations that enable rapid growth, but what if only some cells within a tumor possess *indefinite* growth? Such a model of cancer would still retain the essential pathological features of the disease — distorted growth, invasiveness, the capacity to mutate and evolve. Yet the driver of regeneration would be different: as with blood, only a certain subpopulation of cells in the tumor would be responsible for a cancer's regeneration. Might such cells lie at the root of relapse?

John Dick had an obvious place to begin looking for such cancer-regenerating cells — in leukemia, or cancers of white blood cells. Dick implanted human leukemia cells into immune-paralyzed mice and found that these leukemias could survive and grow in these mice. But not every leukemia cell could. Dick and his students implanted fewer and fewer leukemia cells — one million, 100,000, 1,000 and so on — to determine the smallest number of cells required to cause cancer in a mouse. The answer was surprising: one needed to implant between a quarter-million and one million cells to be sure of implanting at least one cell that could generate leukemia. The rest could not; the other 999,999 cells, in short, had evidently grown out of that single cell — but were themselves incapable of regenerating the cancer.

When Dick's team focused on defining the characteristics of this one-in-a-million cell, there was another surprise. All cells express subsets of proteins on their cell surface that correspond to their identity like tiny bar codes. The bar codes on the surface of the leukemia-generating cell bore a familiar mark: of all cell types

found in blood, it most closely resembled the blood stem cell. And when Dick transplanted this cell from one mouse to the next, he found that he could generate and regenerate the leukemia — just as a blood stem cell would generate blood cells.

Dick's leukemia-forming cell was, in effect, the normal stem cell's malignant doppelgänger. It possessed the blood stem cell's incredible regenerative ability — but unlike a normal stem cell, it could not stop regenerating, dividing and producing more cells. It, too, was an inexhaustible reservoir of growth, but of unstoppable growth. Noting the analogy between this cell and the blood stem cell, Dick called the one-in-a-million cell the "leukemia stem cell."

In time, biologists began to see the implication of Dick's experiment. If leukemia possessed stem cells, then — much like normal blood — its regenerative capacity may be contained exclusively within that select population. And if so, it was this rare stem cell — not the other 999,999 — that had to be attacked by a new generation of drugs. Traditional chemotherapy, of course, makes no distinction between a cancer's stem cells and any other of its cells, between the roots and the shoots of a tumor. All cells are treated equal — and what is poison to one growing cell is largely poison to another. Indeed, most forms of chemotherapy in use today are derived from enormous chemical hunts begun in the 1970s, decades before the birth of the cancer-stem-cell theory. Many of these chemicals came into use because of their ability to kill dividing cancer cells in a petri dish. The fact that most such drugs turn out to be nearly indiscriminate poisons of cellular growth should hardly come as a surprise: they were selected to be generic cell killers.

But if tumors contain dedicated stem cells, then delivering maximal doses of poisons to kill the bulk of the tumor might achieve one response — a shrinkage of the tumor — but have no effect on relapse. If the rare stem cell lurking within a tumor somehow escapes death, then it will reassert itself and grow again. Cancers will come back like a garden that has been cleared by hacking at its weeds while leaving the roots behind.

The publication of John Dick's paper eventually produced an avalanche of interest in cancer stem cells. In 2003, another laboratory, led by Michael Clarke at the University of Michigan, isolated a rare population of cancer-regenerating cells from human breast cancers, thereby extending Dick's model beyond leukemia to a "solid" tumor. In 2005, a Harvard professor named Martin Nowak used mathematical modeling to demonstrate that another human leukemia known as CML also possesses a rare subpopulation of regenerating cells. In the winter of 2006, Dick's lab and an Italian team independently discovered cancer stem cells in colon cancers. Laboratories around the United States rushed to extract cancer stem cells from brain, prostate, lung and pancreatic cancers. Pharmaceutical companies joined the bandwagon, spending millions, and then tens of millions, on mammoth chemical searches for drugs that might destroy cancer stem cells. The National Institutes of Health issued dozens of grant requests to study and isolate cancer stem cells. The paradox of this moment was not lost on researchers. For decades, cancer had been imagined as a degenerative disease — an illness caused by the corruption of genes and cells over time, often a side-effect of aging. Yet in the search for a new generation of anticancer drugs, it was to the science of regeneration — to embryos and stem cells — that the field turned.

In 2005, by the time I finished my training, the cancer-stem-cell model had acquired an overheated quality. The boil and froth inevitably brought challenges. In Michigan, a stem-cell biologist named Sean Morrison returned to John Dick's original test for stem cells — diluting and rediluting cells to find the cells that could regenerate a cancer. Morrison first tested the model in mouse leukemias and confirmed Dick's results in human leukemias. He subsequently tried the experiment with another type of cancer — melanoma, deadly blue-black cancers that arise in the skin and metastasize often to the lungs and brain. Others had suggested that only a few cells — about one in a million — could regenerate the tumor in mice. But when Morrison tested the melanoma cells' regenerative capacity by conducting a variation of Dick's experiment, he found that some 25 percent of the cells from a melanoma could grow a tumor in a mouse. If stem cells were this common in tumors — if one in four cells could grow cancer — then their very definition might be reduced to semantic oblivion. How could a tumor have a stem-cell-like "hierarchy" if every cell occupied the primary spot?

New questions emerged again in May this year at the Wistar Institute in Philadelphia. A group there was working on melanoma, the cancer that Morrison studied. As previous studies had, the Wistar study also identified a subpopulation of self-renewing cells marked by a distinct bar code within human melanomas. But

when these cells were studied more deeply, they appeared to possess no greater ability to regenerate cancers in mice than the nonrenewing cells — thus seemingly disconnecting the link between self-renewal and cancer regeneration.

The Wistar and the Morrison studies are among the many that have begun to challenge the universality and the reliability of the cancer-stem-cell model. "Look," Morrison told me, "this is all going to become more complicated. Some cancers, including myeloid leukemias, really do follow a cancer-stem-cell model. But in some other cancers, there is no meaningful hierarchy, and it will not be possible to cure a patient by targeting a rare subpopulation of cells. The field has a lot of work to do to figure out which cancers, or even which patients, fall in each category."

Even Morrison, however, acknowledges that the existence of such cells would have a transformative impact on cancer. "For a model to be useful, it need not be universal," he says. "Even if the stem-cell model applies only to certain forms of cancer, it would be absolutely worthwhile studying the biology of these stem cells. Universal cures and theories of cancer have so often failed that we may as well spend time talking about specific theories for specific forms of cancer. And it's in specific cancers that the stem-cell theory might still apply — and powerfully so."

My patient, the psychologist, returned to her hometown in the South. "No bed like your own bed," she told me in parting, smiling her pointed, distinctive smile. A week later, when I called her, there was no answer on the phone. I assume that she died — in her own bed, on her own terms — with the same dignity with which she lived. I finished my clinical fellowship in Boston in 2005 and then moved to New York four years later to set up a laboratory. Our lab studies leukemia stem cells. We, too, have joined the quest to create drugs that will wipe out malignant stem cells while sparing normal stem cells.

How might someone go about finding such a drug? Traditionally, three strategies have produced anticancer drugs. The first relies on serendipity: someone hears of a chemical that works on some cell, it is tested on cancer and — lo! — it is found to kill cancer cells while sparing most normal ones.

The second approach involves discovering a protein present or especially active in cancer cells — and relatively inactive in normal cells — and targeting that protein with a drug. Gleevec, the drug used against GIST, was designed to destroy the functioning of a family of proteins that are uniquely hyperactive in GIST and in certain leukemias. (There are only a few drugs with such exquisite specificity for cancer cells.)

The final strategy involves identifying some behavior of a cancer cell that renders it uniquely sensitive to a particular chemical. Most traditional chemotherapies, for instance, attack the rapid division of cells. These drugs kill cancer cells because those divide the most rapidly, resulting in a narrow discrimination between cancer cells and normal cells.

Nearly every drug in oncology's current pharmacopeia can trace its origins to some variation or combination of these three approaches. But notably, while each method depends crucially on discriminating between normal cells and cancer cells, almost none make any distinction *among* the cells of any cancer.

The stem-cell hypothesis of cancer poses new challenges for all three modes of drug discovery. To start, cancer stem cells might be fleetingly rare — one in a million, in Dick's original case. A serendipitous discovery involving a rare cell demands an unusual confluence of luck — chance multiplied by chance. Defining specific targets in cancer stem cells might work, but here again there is a battle against numbers. Finding such genes unique to cancer stem cells first requires isolating and extracting these rare cells from real tumors, a formidable technical hurdle.

The most difficult challenge for drug discovery, though, lies perhaps in modeling the self-renewing behavior of cancer stem cells. To create drugs, researchers typically begin with a simple cell behavior — say, its growth or death, or its capacity to change shape. Chemicals are then tested for their ability to alter this behavior. But in order to reach cancer stem cells, we might need to devise assays far more complex than conventionally used. The most traditional metric by which an anticancer chemical is judged — its ability to reduce the size of a tumor, or to kill cancer cells in a petri dish — won't work, of course. If a chemical kills only the one-in-a-million cell that drives relapse, then it may not register as a tumor-shrinking or cancer-killing agent. A traditional drug hunt would most likely miss this kind of chemical — and yet this is precisely what is needed to attack the roots of cancer. To find drugs for cancer stem cells, then, we will need not just to find new chemicals, but also to find new strategies to test these chemicals.

Still, for cancer researchers, the stem-cell hypothesis is as exciting as it is vexing. The capacity to tear out the roots of a tumor, and thereby dispel the specter of relapse, represents a sea change in our thinking about cancer. Indeed, the effort to isolate and target cancer stem cells is central to a much larger paradigm shift sweeping through cancer biology. Until recently, much of the field was focused on understanding the most salient feature of the cancer cell: its ability to divide uncontrollably. But our understanding of cancer has reached far beyond distorted cell division. Cancer cells co-opt neighboring blood vessels to supply themselves with oxygen. They enable their own movement through the body by hijacking genes that allow normal cells to move. When some cancers metastasize and punch holes in the bone to support their survival, they imitate an accelerated form of osteoporosis — in effect, recapitulating the aging process in bone.

Cancer, it seems, is not merely mimicking the biology of rapidly dividing cells, but that of organs — or even organisms. At its cellular core, a tumor might nourish itself with its own supply of oxygen; it might organize its environment to fuel its growth; it might regenerate itself from a dedicated population of stem cells. Perhaps if we looked at cancers using appropriate conceptual lenses, we might find that tumors possess their own anatomy and physiology — a parallel universe to that of normal cells and organs. Such a tumor can hardly be described as a disorganized group of cells. It is a cellular empire, with its own sustenance, grammar, logic and organization. It is a growing being within a growing being.

Hence the quest to discriminate between normal and malignant cells is progressively beginning to resemble one of those devastating surgical operations to separate conjoined twins. Every drug that kills cancer stem cells might also kill the normal stem cells. This operation, too, might end in tragedy for both twins.

But it might not — and therein resides the hope for a next generation of drugs. If stem cells can be found for certain forms of cancer, and if a drug can be found to kill these cells in humans, then the clinical impact of such a discovery would obviously be enormous. And its scientific impact would be just as profound.

Centuries after the discovery of cancer as a disease, we are learning not just how to treat it — but what cancer truly is.

Siddhartha Mukherjee is an assistant professor of medicine in the division of medical oncology at Columbia University. This article is adapted from his book “Emperor of All Maladies: A Biography of Cancer,” which will be published by Scribner next month.

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Street Art Way Below the Street

By JASPER REES

Garrett
A zigzag flag by Faile in the abandoned subway station where Workhorse and PAC organized a show of street art, much of it painted right on the walls of the site

A vast new exhibition space opened in New York City this summer, with a show 18 months in the making. On view are works by 103 street artists from around the world, mostly big murals painted directly onto the gallery's walls.

It is one of the largest shows of such pieces ever mounted in one place, and many of the contributors are significant figures in both the street-art world and the commercial trade that now revolves around it. Its debut might have been expected to draw critics, art dealers and auction-house representatives, not to mention hordes of young fans. But none of them were invited.

In the weeks since, almost no one has seen the show. The gallery, whose existence has been a closely guarded secret, closed on the same night it opened.

Known to its creators and participating artists as the Underbelly Project, the space, where all the show's artworks remain, defies every norm of the gallery scene. Collectors can't buy the art. The public can't see it. And the only people with a chance of stumbling across it are the urban explorers who prowl the city's hidden infrastructure or employees of the Metropolitan Transportation Authority.

That's because the exhibition has been mounted, illegally, in a long-abandoned subway station. The dank, cavernous hall feels a lot farther than it actually is from the bright white rooms of Chelsea's gallery district. Which is more or less the point: This is an art exhibition that goes to extremes to avoid being part of the art world, and even the world in general.

The show's curators, street artists themselves, unveiled the project for a single night, leading this reporter on a two-and-a-half hour tour. Determined to protect their secrecy, they offered the tour on condition that no details that might help identify the site be published, not even a description of the equipment they used to get in and out. And since they were (and remain) seriously concerned about the threat of prosecution, they agreed only to the use of street-artist pseudonyms.

Workhorse, in his late 30s, is a well-known street artist with gallery representation; PAC, younger by a decade, is less established but familiar (under a different name) to followers of urban-art blogs. The two came up with the idea for the Underbelly Project in 2008, a few years after PAC first saw the old station, led to it from a functioning one by an urban explorer acquaintance.

Abandoned stations like this — and there are a fair number of them in the city — are irresistible to those who search out hidden spaces in the city, despite or perhaps because of the fact that being there is illegal and potentially dangerous. PAC too found himself compelled after that first visit, and he began going back sporadically.

Seduced by the Abandoned

The place was pitch black, but standing with a powerful flashlight on a platform, PAC said, he had been able to make out a landscape of several more platforms, each lined with rows of columns, alternating with sunken track beds. The station, about the size of a football field, had clearly never been completed: no track had been laid in those beds, no escalators or staircases met the gaping holes in the platforms, and there was no electricity.

"I would hang out here for hours," PAC said, enjoying "the solitude of being underground" and the architecture.

Then he met Workhorse, whose art often focuses on abandoned spaces.

"I told him I knew about a space that was pretty cool," PAC said, and "brought him down here, and that night the idea for the project hatched."

The difficult process of getting to the Underbelly space — which involves waiting at an active station's platform until it's empty, slipping from it into the damp and very dirty no man's land beyond, and traversing that to get to the old station's entrance — suggested to PAC and Workhorse how challenging the project would be. And the legal risks were obvious. Charles F. Seaton, a spokesman for New York City Transit, described such incursions as "trespassing, punishable by law," and said "anyone caught defacing M.T.A. property is subject to arrest and fine." Beyond that, Workhorse and PAC worried that given anxiety about terrorism in the subway, a large-scale, long-term project like theirs might even lead to more serious charges.

But Workhorse said: "There is a certain type of person that the urban art movement has bred that enjoys the adventure as much as the art. Where else do you see a creative person risking themselves legally, financially, physically and creatively?"

In recent years, he said, as the vogue for street art has led to "anything that could possibly appreciate in value being ripped off the street by those looking to cash in," the old sense of adventure and punk-rock energy has faded. The change isn't all bad, he said: the runaway market for stars like Banksy has had a nice trickle-down effect for artists like him. But he said he feels strongly that something fundamental has been lost.

PAC and Workhorse saw the Underbelly Project as a way to recapture that feeling and evade the whims of the marketplace. Workhorse called it "an eternal show without a crowd." (He waved away the idea that there might be something perverse about creating art that normally revels in visibility for an audience of just a few. "We just see it as art, not street art," he said, adding he had never felt a need to take all his drawings, for example, "and shove them in someone's face.")

Not that he and PAC are averse to the project being publicized. Asked why they had sought out the freelance reporter who wrote this article, as well as one for this week's Sunday Times Magazine of London, they cited their pride.

"We do want to preserve the kind of sacred quality of the place," PAC said, "but we also want people to know it exists. And we want it to become part of the folklore of the urban art scene."

Let's Put On a Show

In early 2009 Workhorse and PAC began putting out feelers among street artists, seeking a mix of the established and the up and coming. (For security reasons they avoided "anyone more than a step away from someone we knew well," Workhorse said.) Soon they brought their first collaborators down to the site, Jim and Tina Darling, West Coast artists who painted big, contrasting images — his a leering man's face, hers a woman with windblown hair — in a small side room. They worked for two long nights, after which all parties emerged exhausted and filthy with soot. Workhorse and PAC realized that their goal of including about 100 contributors would be more difficult than they had imagined, and would take a lot more time.

They set some ground rules. Since bringing artists in and out of the space required careful planning — by now they had figured out that the active platform was emptiest on late nights early in the week — and since one or both of the curators had to be on hand, Workhorse and PAC set strict schedules and limited each artist to one visit, with four hours of working time. The artists were not allowed to go out for more materials if they ran out. (Workhorse and PAC supplied lighting in the form of camping lanterns. "We went through hundreds of batteries," Workhorse said.) And in addition to their materials, the artists had to pay for their transportation, regardless of the distance.

Of the international artists approached, most were from Europe. (Banksy, the most famous of this group, turned them down: He was promoting his film "Exit Through the Gift Shop," Workhorse said, and told them through a mutual friend, " 'Great project, love it, but I can't risk going in.' ") But more contributors were American, among them well known names like Ron English (whose most recent work has been priced at up to $200,000), Swoon and Revok.

And many lived in New York, the wellspring of the graffiti movement in the 1970s. Patrick McNeil, of the Brooklyn collective Faile, received an e-mail from PAC, and signed on quickly. "It was really appealing because it sounded a little crazy," he said. "You did it because you wanted to do it, not because there was any money."

Working conditions were far from favorable. The ambient humidity made stenciling and the wheat-pasting used by some artists laborious. While making his own piece — a self-portrait in an empty subway car — Workhorse had "to literally bash the tape for the stencil into the wall with the palm of my hand," he said. "I woke up the next morning and couldn't write." (PAC, meanwhile, was happy with the dripping effect caused by the paint's refusal to dry in his black-and-white diamond-pattern mural.)

The Metropolitan Transit Authority would occasionally shut down the nearby subway line. The artists, working through the night, would hear workers on the tracks and go silent, turning out any lights. The members of Faile were among several participants stuck that way for hours after their work (in their case, a woozy, zigzagging version of the Stars and Stripes) was done. "We were getting crazy," Mr. McNeil recalled. "We were like, 'We've got to get the hell out of this dusty blackness.' You couldn't see your hand in front of your face."

Finally at 4 a.m., Mr. McNeil said, the coast seemed clear, and "we walked out there with our gear"; but the workers were still there. "We just walked by them and they're like, 'Where the hell did these guys come from?' "

The scariest moment came around 1:30 one morning, just after Workhorse had left the site with a Moscow-based Australian artist known as Strafe (who spoke on condition that her real name not be used). They heard workers nearby and sprinted back in the dark, but once back on their platform, Strafe said, "I swung round and stepped into thin air, and literally fell onto my back on the track bed." Too stunned to move, she looked at Workhorse, who had jumped down to join her with a flashlight. She said she saw a look of horror that said, " 'What are we going to do if she's seriously injured?' " Eventually she was able to sit up, but they still had to wait until after 5 a.m. to leave.

Art, Underground

Workhorse said he felt that about 90 percent of the art was successful. For this reporter, the most arresting pieces are those that are sinisterly in sync with the Hades-like space, among them skulls, a pair of huge rats and a set of typographical strokes by the British graffiti artist SheOne that resemble the skeletal scratchings of a Lascaux cave painter.

There is a certain amount of anarchic sloganeering and sly digs at the corporate-commercial complex. "WE OWN THE NIGHT," blares one painting on an end wall. Another, by Mr. English, depicts Mickey Mouse on a respirator.

One installation features a dining table set for two in the middle of a track bed, a relic of a three-course meal served on site by the artist-impresario Jeff Stark to the winner of a competition and her guest. "She wrote an essay about inviting a veteran of the club scene from the early '90s who was a little out of touch with what younger artists are up in New York these days," Mr. Stark said. "But he showed up and announced that he was claustrophobic," so she ended up dining with a friend.

Although other artists' pieces would seem to be more permanent, the dampness of the space is already working against them. One thickly sprayed painting has simply never dried. The curators said they thought the painted works could last two or three decades if left untouched. But even assuming the work is discovered by the transportation authority sooner than that, PAC said, "I like the fact that it'll feel apocalyptic, because things will be deteriorating, and it'll already be a memory."

After this reporter's tour, the curators destroyed the equipment they had been using to get in and out of the site. "We're not under the illusion that no one will ever see it," Workhorse said. "But what we are trying to do is to discourage it as much as possible." He stressed that any self-styled explorer who found the site and attempted to enter it would be taking a real risk.

"If you go in there and break your neck, nobody's going to hear you scream," he said — at least assuming there are no track workers around. "You're just going to have to hope that someone is going to find you before you die."

http://www.nytimes.com/2010/11/01/arts/design/01underbelly.html?ref=design

Down From the Heights

By ROBIN POGREBIN

Librado Romero/The New York Times

"Big Bambú," on the roof of the Metropolitan Museum, is being dismantled.

Take 6,800 bamboo poles, 70 miles of colorful cord and plans for an art installation that will change every day over a six-month period and ultimately grow to 50 feet high. Add two artists and a bunch of rock climbers who like to listen to the Rolling Stones while they add to the piece, and drink pilsner when they're done working. And then stick the whole thing on the roof of the esteemed, establishment Metropolitan Museum of Art.

It was bound to be a combustible mix.

"There's the good and the bad," Doug Starn, one of the artists, said last week while watching the piece, "Big Bambú: You Can't, You Don't and You Won't Stop," being dismantled. (It closed on Sunday.) "People like us — and rock climbers — we don't fit into the dead artist thing. As much as they welcomed us in" — he said of the Met — "there were struggles all the way through. Us and the climbers are part of the piece, part of the organism. We live in the piece. We need to enjoy what we make, and we need to enjoy ourselves while we're making it."

Curfews and adjusting music volume became part of the creative experience for Mr. Starn and his twin brother, Mike. But it wasn't all tension and sticky red tape. There was also enormous success: 600,000 visitors (400,000 had been projected), international acclaim, six marriage proposals in the bamboo thicket, and famous climbers like Mayor Michael R. Bloomberg; the artists Martin Puryear and Francesco Clemente; Bono, Lou Reed and Paul McCartney, who went up barefoot or — as Mike Starn put it — " 'Abbey Road' style."

And though the Starns had mapped out certain elements, like staircases and "living rooms" with benches inside the structure, plenty of things were unexpected, which was actually kind of the point.

They hadn't planned, for example, to have bamboo cup holders, which sprouted throughout the piece (the climbers put them in), or the cresting wave of bent bamboo at the top, or the spontaneous wind chime that turned up toward the southern end. They could not have predicted that the roof's wisteria would wend its way all the way up the piece; that the red-tailed hawk Pale Male would regularly circle overhead; or how

breathtaking Central Park would look from "Big Bambú" as the seasons changed. The installation had to close every time it rained and the climbers and the Starns had to stop work for a week when the artists ran out of cord, which was used to lash the poles together.
"We used up all the rope in the United States," Mike said. "Then we had to wait for the ash cloud to pass so we could ship the rope from Switzerland."
Met officials last week seemed satisfied, if still catching their breath.
"It is certainly the most complex and ambitious project to date on the roof," said Anne L. Strauss, an associate curator at the museum, who organized the installation. "Their project has brought our sculpture program on the roof to a new dimension and literally to great heights."
And the Met had to navigate some uncharted territory. To prepare for "Big Bambú" the museum secured approval from the city Buildings Department and ran its plans by several other city agencies, including the Fire Department. It plotted how people could safely go up the undulating sculpture, though the piece was a perpetual work in progress. And it came up with requirements that visitors sign waivers and follow strict rules (no sandals, no cellphones) as they ascended the installation's winding walkways.
And there was more: How do you handle a fleet of rock climbers who insist on listening to Jimi Hendrix while they help construct the sculpture? And how do you enforce museum operating hours if the artists have Friday-night parties atop the sculpture that stretch past closing time?
Standing on "Big Bambú" last week, sipping bottles of beer in T-shirts and jeans, the Starns said they thought the Met had responded like a pretty cool parent.
"It's amazing that the Met had the nerve to take on an evolving structure like this," Mike said. "But we had to pull them along to create something about chaos. It's a habitat. They wanted us out at 5 o'clock. But we're not just here working. We're a part of it. They didn't like that — the beers. We finally got them to understand that this piece wouldn't exist if it were too controlled. The vibe is important."
The music was clearly a flashpoint. Ms. Strauss said: "There might have been from time to time some volume issues, but then those were addressed. We've had a very collegial working experience with them."
When it came to the artistic side of the piece, the Starns were given a lot of rope (so to speak). "Big Bambú" took shape from one day to the next. Except for designated locations for the vertical poles to touch ground, placing each pole was largely up to the rock climbers. "That's a moment-to-moment decision on their parts," Mike said. The only time the artists exercised a veto is when "it wasn't interconnected enough," Doug said, "when it wasn't part of the flow of the piece."
The Starns ran out of bamboo after using 3,200 poles and had to order two more shipments of 1,800 each. (They said they had to share the cost of the bamboo and the extra cord with the Met, which declined to discuss the matter.)
It was all worth it, though, according to many who waited hours for tickets or returned repeatedly because they wanted to see how "Big Bambú" kept changing. "It's exciting for people to become part of an installation like this," said Ryan Wong, one of the tour guides. "People are just exhilarated to be up there. You can see it in their faces. They say, 'This is like being Robinson Crusoe or being on a wooden roller coaster.' "
A melancholy hangs over the piece's dismantling, which is expected to take two months. The Starns will cut out whole sections to keep as relics and are planning to gather the thousands of photographs they took of the piece into a pile, which will become an exhibition of its own. "It's a lot of ambivalent feelings, conflicted feelings," Doug said. "There is also an excitement taking it apart. I'm not quite sure why."
Many fans of the piece have suggested the Met make it permanent. "I don't know how many times I've heard people talk about a petition," Mike said. "But as far as I know, there isn't one." The Met, whose roof sculpture program is in its 13th year, does not seem to have considered the possibility. "We use that space for a rotating series of exhibitions, so every time we invite an artist to work there, they know it's for a limited amount of time," Ms. Strauss said. "Next year there will be someone else." The rock climbers found it hard to go. One tried to sleep up there once — he just curled up until a guard discovered him and made him come down. The Starns said they understood the impulse. "If we could, we would camp out here," Doug said. "When we do this again," Mike added, "we'll definitely make living in the piece part of the contract."
http://www.nytimes.com/2010/11/01/arts/design/01bambu.html?ref=design

Drawing as an End, Not a Means

By TED LOOS

Robin Holland

Thomas Nozkowski said that drawing a finished painting helps him let go of the painting

HIGH FALLS, N.Y.

OVER the centuries painters have used drawing to prepare for committing their ideas to posterity on canvas. Paper has been a material for sketching, planning and trying out a composition in advance of the main event.

But for an exhibition at the Pace Gallery at 510 West 25th Street in Chelsea that opened this month, the veteran abstract painter Thomas Nozkowski took a different approach. He used drawing as a cool-down exercise rather than a warm-up. The show features 19 pairs of works, each one a painting and a smaller, corresponding work on paper in ink, pencil and gouache.

The drawings are still studies of a kind, but they all reflect back on a just-finished major canvas filled with the artist's signature squares, triangles and rounded biomorphic forms.

"I started this nine months ago," said Mr. Nozkowski, 66, who lives with his wife, the sculptor Joyce Robins, in this small town in Ulster County about 90 miles north of Manhattan. "I do a lot of drawing, but I've never done this method before. I was just kind of bored one afternoon."

Mr. Nozkowski — who is widely admired among his art-world peers, if not widely known by the greater public — has spent from 18 months to as many as 15 years on a canvas but can turn out two drawings in a day. He has never been in the habit of preparatory drawing.

"I came to New York in 1961, and all my teachers were second-generation Abstract Expressionist painters," he said. "I believe in those principles of not doing preliminary sketches — of acting, not having a preconception of where you're going to go."

For Mr. Nozkowski paintings are "hot," he said, while drawings are "cooler, less passionate." He added that the new method helps him let go of work that has consumed him for years.

"It solves the problem of the emotional engagement with the painting," he said.

He also has an old-school abstractionist's attitude about titles and divulging anything about a painting's inspiration. "Too much information is a trap for the viewer," he said, which can trivialize an open-ended work. He did allow that of the three pairs shown here, one relates to his father's stay in a nursing home.

None of the pieces in the Pace exhibition is large. The paintings are 22 by 28 inches, a size so familiar (a window, a medium-size TV screen) as to be invisible, Mr. Nozkowski said. The drawings are just 8 by 10 inches, and all represent a brief, final riff on the main pictorial idea.

"For me a painting is finished when I finally understand why I wanted to do it in the first place," Mr. Nozkowski said. "Like Godard said, the most interesting thing is to go to the end of an idea, to play something out almost to the point of madness."

http://www.nytimes.com/2010/10/31/arts/design/31nozko.html?ref=design

Garry Wills on Life in and Out of Books

By DWIGHT GARNER
OUTSIDE LOOKING IN
Adventures of an Observer

Joe Schuyler

By Garry Wills
195 pages. Viking. $25.95.

"Square," "colorless," "stodgy," "unthreatening." Those are some of the adjectives that the prolific journalist and historian Garry Wills uses to describe himself in "Outside Looking In," his pointillistic new memoir.

Off the page, all those things may (or may not) be true. On it, as countless politicians and writers have learned, having Mr. Wills sternly contemplate your work can be like having the Red Baron on your tail.

"Unthreatening" is hardly the word. Writing in The New York Review of Books and other journals, he's sent entire squadrons of shoddy works and ideas down in flames.

Mr. Wills has written some 40 books of his own, from pinwheeling political analysis ("Nixon Agonistes," published in 1970) to sober inquiry about celebrity ("John Wayne's America," published in 1997) to meditations on oratory and language. In 1993 he won a Pulitzer Prize for "Lincoln at Gettysburg: The Words That Remade America."

Now 76, Mr. Wills is also among America's leading, dissenting Roman Catholic intellectuals; in recent years faith has become his abiding preoccupation. In the last decade alone he's written nearly a dozen books about religion, including "Saint Augustine's Sin" (2003) and "What the Gospels Meant" (2008), in addition to many on other subjects.

He's become a publishing machine, issuing a steady drip of erudite but remote volumes from the broad and rectangular plain of his parsonlike forehead. Few of Mr. Wills's recent books have warmed in your hands. They've been easier to admire than to embrace.

The good news about "Outside Looking In" is that it's the most limber and humane book Mr. Wills has written in years. It's far from a proper autobiography, although it does detail bits of Mr. Wills's bookwormish childhood in Michigan and Wisconsin. (His father, a college boxing coach, gambler and instigator of business schemes, once paid him not to read so much. The boy used the money to buy another book.)

It also offers warm set pieces from his life with his wife, Natalie, to whom he has been married for more than 50 years. He met her on an Eastern Airlines flight in 1957 — she was working as a stewardess — when she commented on the book he was reading by the French philosopher Henri Bergson.

"I can scare myself silly," Mr. Wills writes, "by considering the close calls" that almost made him miss that particular flight.

"Outside Looking In" is, most fundamentally, a series of pointed scenes from a busy life. Its vaguely oxymoronic subtitle ("Adventures of an Observer") seems misleading. No one who counted William F.

Buckley, John Waters, Studs Terkel, Beverly Sills and Murray Kempton among his many friends, and who had close-up views of many of the last century's signal events, can qualify as a true outsider.

The early chapters of "Outside Looking In" are a Greyhound bus tour through many events Mr. Wills covered as a barnstorming young journalist, writing for Harold Hayes's Esquire and other publications. He was thrown in jail along with Benjamin Spock, Joe Papp and Judy Collins during the 1968 Democratic convention in Chicago, after agreeing to take part in a protest. He flew into Memphis on the night of the Rev. Dr. Martin Luther King Jr.'s assassination. He visited strip clubs in Dallas in 1966 while writing about Jack Ruby, Lee Harvey Oswald's killer, who owned a club called the Carousel.

There is a chapter here on Nixon (Wills landed on his enemies list), as well as on Jimmy Carter, whom he admired, and on the Clintons (he has kinder things to say about Hillary than about Bill, and admires her gifts as a mimic). There are chapters as well on Buckley, who asked the young and unknown Mr. Wills to write theater criticism for National Review, and on Studs Terkel. Mr. Wills also writes fondly about his friendship with the actor and antiwar activist Dick Cusack, the father of the actors John and Joan, and the rest of the busy Cusack clan.

Mr. Wills writes gratefully, and with relish, about the intellectual and spiritual armor he acquired early. "I was blessed by my schooling — Catholic grade school, high school, college (St. Louis University) and graduate school (Xavier of Cincinnati)," he says.

Mr. Wills also has a Ph.D. in classics from Yale, and he is eloquent about why this sort of education matters to anyone who wishes to write and think seriously. "Learning classical Greek is the most economical intellectual investment one can make," he writes. "On many things that might interest one — law and politics, philosophy, oratory, history, lyric poetry, epic poetry, drama — there will be constant reference back to the founders of those forms in our civilization."

There are moments when "Outside Looking In" seems like a data dump, as if Mr. Wills were flipping though a trunk of his yellowed magazine clips. There's more here than is strictly necessary about things like the particulars of Sills's run as chairwoman of the Metropolitan Opera. And a bit, spread over several pages, about the actor Joseph Fiennes's behaving like a twerp on a film set that Mr. Wills visited is a waste of this book's already limited storage capacity.

Other narrative detours are pure labors of love. Mr. Wills's chapter on his family's years in Baltimore (he and his wife have three children) includes a long and ardent disquisition on the glories of Johnny Unitas's passing with the Baltimore Colts, and Raymond Berry's receiving. Mr. Wills approvingly quotes the sportswriter Frank Deford, who declared: "If there were one game scheduled, Earth versus the Klingons, with the fate of the universe on the line, any person with his wits about him would have Johnny U. calling signals in the huddle."

Mr. Wills's politics have never been doctrinaire, but he makes it clear that he arrived at his middle-class conservatism by temperament. He says the rosary daily. He has never smoked pot. He dresses, in his daughter's words, "like a bum." He has had sex with only one woman.

"I agree with Hilaire Belloc: 'it is well to have loved one woman from a child,' " he writes.

More than faith, Mr. Wills admires faithfulness. He's justifiably proud that he's been true to his wife, to his friends, to the two universities where he's taught for long stretches over 43 years and to the few literary agents he's had. For a man who describes himself as one of the least interesting people on the planet, he makes the old virtues sound surprisingly sexy.

http://www.nytimes.com/2010/11/03/books/03book.html?ref=books

Stuff Nightmares Are Made Of

By DOUGLAS WOLK

From "The Amazing Screw-On Head and Other Curious Objects"

There's nothing quite as creepy as a creepy drawing: almost real, but just wrong enough to suggest it's wearing only the torn-off skin of reality. Charles Burns's comics are fluid, smooth and as solidly built as a vintage TV set, but they shudder with the chill of the uncanny. His slim graphic novel **X'ED OUT (Pantheon, $19.95)** filters William S. Burroughs's body-loathing and disjunction through the iconography of Hergé's "Tintin" comics. (Hergéphiles will notice a string of allusions, beginning with the front cover's visual paraphrase of "The Shooting Star.")

As with Burns's 2005 graphic novel "Black Hole," the central source of unease here is the world-warping chaos of youth and sex. The tufty-haired protagonist, Doug, is a frustrated young punk whose life's tiny orbit encompasses pills, Pop-Tarts and the transgressive art that he and his girlfriend are awkwardly starting to imitate. He also becomes a more Tintin-ish, stylized version of himself, wandering through a nightmarish post-catastrophe landscape where cyclopean monsters trade omelets for cigarettes.

The most insidious kinds of horror are all about what you don't see, especially in comics. You have to fill in the gaps between panels yourself, and whatever's lurking there can be as terrible as you imagine. Burns exploits that effect: Doug keeps trying to look away, to think of something else, and the story leaps from ghastly intimations to blank or black panels, then to a different point in time or a different reality. Still, a handful of images bubble up in varying guises: eggs, tunnels of blood, curled-up homunculi, holes in walls

that lead to a sadder place. The first installment of a projected series, "X'ed Out" ends on a sort of cliffhanger that also serves as a thematic conclusion: an image (the largest in the book) that mashes its narrative threads together and hints at the nature of the disaster that has transformed Doug's life and fantasies.

As fragmented as its chronology is, "X'ed Out" has a story at its heart. Kevin Huizenga's **WILD KINGDOM (Drawn & Quarterly, $19.95)** has something weirder. At first, the book poses as linked stories involving the Everyman character Glenn Ganges, groping his way through places where the natural world and human detritus collide. But it gradually succeeds in violently shaking away any semblance of sense. The closest thing it has to an organizing principle is the calm, clarifying tone of natural history, absorbed via the Belgian playwright Maurice Maeterlinck's essays and various illustrated books, then run through the shredder (the "index" is in fact a collage of other books' indexes). The book is propelled by its own bank of reappearing motifs, which become funnier and more frightening with each iteration: Mutual of Omaha, a hapless squirrel, a "truth" fish that eats "Darwin" fish, the phrase "I was saved from my own life." Every few pages, there's a hilariously inventive piece of cartooning, like a series of drawings of "fancy pigeons" that start out looking almost convincing and end as horrifying abstractions of feathers and eyes, or a set of deadpan explanatory diagrams that dissolve into gibberish on examination (a caption for a drawing of a beetle: "Dangerous. Unite to form Devastator. There is no you").

Most of Mike Mignola's comics (notably his "Hellboy" series) operate within the realm of pulp fiction, specifically the uncharted territory between H. P. Lovecraft and "Doc Savage." The six eerie short comics collected in **THE AMAZING SCREW-ON HEAD AND OTHER CURIOUS OBJECTS (Dark Horse, $17.99)** are the nightmare-logic version of Mignola's other work. They're built on familiar adventure-story standbys and played for nervous giggles, but Mignola draws them drenched in shadow, as if they're dredged up from primal anxieties, and wrenches the plots out of joint whenever they start running too smoothly. The title piece involves a seemingly immortal Abraham Lincoln assigning his robot-bodied secret agent to save the world from the wicked Emperor Zombie; rather than concluding the story with Screw-On Head's secret origin, Mignola presents drawings of "three horrible old women and a monkey," as one character announces, "Cheers!"

The other stories, loosely connected to "Screw-On Head," include a variation on "Jack and the Beanstalk" and a little fable involving geometric forms that signal a magician's doom. But they're mostly an excuse for Mignola (and the colorist Dave Stewart, who sticks largely to fungal earth tones) to cut loose with surreal, cobwebbed arcana: a potbellied devil beneath a parasol; a monkey with a crown, surrounded by flies; a tuxedoed gentleman listening to a glass-domed turnip hooked up to a gramophone speaker. Everything is broken, wrinkled, potentially hazardous. It's easy to imagine a single out-of-tune violin scraping away in the background.

Renée French's graphic novels, including "The Ticking" and "The Soap Lady," tend to split the difference between adorable and horrifically gross. The wordless **H DAY (PictureBox, $30),** its cover informs us, addresses "her struggles with migraine headaches and Argentine ant infestation." The migraine part is fairly straightforward: the book's left-hand pages are a stripped-down, flipbook-style animation of a body with a ganglionic mass inside its head that crawls out, envelops the head and lashes it to a bed. The right-hand pages, though, are where French gets to show off her command of pillowy pencil textures and viscerally alarming imagery. The book's early sequences are built around lush drawings of blocky, right-angled urban megaliths and their interstices, populated by tiny dark forms (antlike people and dogs), and swirling gusts of black wind that become swarms and streams of dots. Then the plot gets more opaque: there are wrapped and mummified creatures, a hooded figure deploying a white bundle, wicker cages that turn in on themselves. You can skim through the whole thing in about four minutes or spend hours puzzling over how it all fits together. There's only one image on each page, surrounded by clean white space, but it often seems as if teensy crawling beasties are about to emerge and skitter across the whiteness, toward your tasty fingers.

Douglas Wolk is the author of "Reading Comics: How Graphic Novels Work and What They Mean." He writes frequently about comics for The Times.

http://www.nytimes.com/2010/10/31/books/review/Wolk-t.html?ref=books

Trillions of Reasons to Be Excited

By DENNIS OVERBYE

Fred Merz for The New York Times
SUPERPOWER Superconducting electromagnets power the Large Hadron Collider, 300 feet underground at the Swiss-French border outside Geneva.

CESSY, France — It was late on an August evening when the proton wranglers at the Large Hadron Collider finally got five trillion high-energy particles under control, squeezed and tweaked them into tight bunches and started banging them together.

"Seven minutes too late," grumbled Darin Acosta, a physicist from the University of Florida, whose shift running a control room here, among sunflower fields and strip malls, had just ended. On the walls around him, computer screens were suddenly blooming with multicolored streaks and curling tracks depicting the primordial subatomic chaos of protons colliding 300 feet under his feet, in the bowels of the Compact Muon Solenoid, one of the four giant particle detectors buried around the collider ring.

A dozen or so physicists crowded around the screens, calling out the names of particles on the fly, trying to guess what others, as yet unknown to physics, were spraying from the mess in the middle, looking to see some sign from the universe. "This is way cool," one of them said.

"There's a muon," somebody else said as a spike darted out and into the void. "There's a jet."

"This is good," said Maria Spiropulu, a CERN and California Institute of Technology physicist. "This is very, very good."

It has been seven months and some six trillion collisions since physicists at CERN — as the European Organization for Nuclear Research is known — began running protons around their $10 billion, 18-mile electromagnetic racetrack underneath the Swiss-French border outside Geneva and smashing them together in search of new particles and forces of nature. No new particles or forces have yet emerged, at least to the statistical satisfaction of the thousands of men and women now sifting through the debris from those collisions.

Nor, of course, has the world disappeared into a black hole.

The proton collisions are scheduled to end on Wednesday. The machine will collide lead ions later in November and then shut down for the holidays. The collider will resume banging protons in February and run until the end of 2011. But CERN physicists say that data has already been accumulating faster than they can analyze it, and that the collider has already begun to surpass its rival, Fermilab's Tevatron. "It's a really beautiful machine. It's performing far better than I expected," Lyn Evans, who oversaw the building of the collider, said recently.

In October, at a conference in Split, Croatia, Dr. Spiropulu showed fellow physicists a picture of a collision that could have produced one of the "dark matter" particles that astronomers say make up a quarter of the universe and are among the grand prizes of science these days. It is one of handful of "interesting events" popping out of the collider that could change the world — if in fact they are real.

But high-energy physics is a game of statistics, and one event is just a tantalizing hint, Dr. Spiropulu said. It will take trillions more collisions before physicists can know if events like these are the harbingers of an intellectual revolution in what the universe is made of.

Or if there is any new physics to be discovered in the collider at all.

"The stakes are violently high as we break new grounds," she said. "We must live up to the dream of 25 years with a lot of seriousness, even if we are like little kids in the candy store with all this data around."

But for all the euphoria in Geneva these days, the collider is still operating under the cloud of Sept. 19, 2008. That is when the electrical connection between two of the collider's powerful superconducting electromagnets exploded, turning one sector of the collider ring into a car wreck and shutting down the newly inaugurated machine for more than a year.

As a result, the machine is operating at only half power, at 3.5 trillion electron volts per proton instead of the 7 trillion electron volts for which it was designed, so as not to blow out the delicate splices. At the end of 2011, all the CERN accelerators will shut down for 15 months, so that the suspect splices — some 10,000 of them — can be strengthened and an unknown number of magnets that have mysteriously lost the ability to handle the high currents and produce the high fields needed to run the collider at close to full strength can be "retrained."

CERN has been under pressure lately to trim its budget, and stopping all the accelerators instead of just the collider will save $25 million, said Rolf Heuer, CERN's director general.

The collider will start up again in 2013 with proton energies of 6.5 trillion electron volts, but it is not likely to reach full power until 2014, if ever.

In interviews recently, scientists and managers said that they had been too eager to get the collider running at full power in 2008. "In perspective, we may say we started too ambitious," said Lucio Rossi, a superconductivity expert who joined CERN from the University of Milan in 2001. One reason, in his opinion, was arrogance.

In order to steer protons racing at more than 99 percent the speed of light around the underground track, the collider's electromagnets have to carry currents of some 12,000 amperes, which they can do only by being cooled by superfluid liquid helium to less than 2 degrees Celsius above absolute zero. At that point, their niobium-titanium wires conduct electricity without resistance. The engineers had been able to cool each of the 10,000 or so superconducting magnets and test them before putting them in the collider, but they could not test the connections between them, Dr. Rossi said.

Those connectors are sandwiches of superconducting wire and copper glued together with solder. The copper is there to take over carrying the enormous current if the superconductor heats up in a so-called quench and loses its superconductivity — but only for the 100 seconds or so that it takes for the magnets to dump their enormous and dangerous energy.

Dr. Rossi said that several reviews had established that the connector design was very good, but those reviews had missed the point that it was not robust against faulty construction, like missing solder, which apparently is what caused the 2008 disaster.

The current had no place to go. Sparks punctured a surrounding vessel of supercold helium, which flooded out, pushing the 30-ton magnets around like toys. Soot spread for two miles along the pipe that carries the proton beams.

"Superconductivity calls for total quality; one mistake will undo the whole system," Dr. Rossi said. "It becomes a fuse."

The fix, as described by Dr. Rossi, is fairly simple: an extra set of copper shunts on the outsides of the splices, providing an extra bridge across any divisions or junctions that might lack solder, as well as an improved system to spot trouble and bigger valves to release helium less explosively.

The result should be "supersafe for life," said Steve Myers, who is in charge of running the collider. "And we can dispense with talking about them, because I'm fed up with talking about connectors."

Indeed, undeterred by past disasters, CERN recently laid out plans for the next 20 years of running and upgrading the collider and its detectors, including an idea to swap out all its magnets in 2030 to increase the total proton energies to 33 trillion electron volts — almost as much as the ill-fated American superconducting super collider, a project canceled by Congress in 1993, would have had. The latter suggestion raised eyebrows among physicists in and out of CERN, who wondered, among other things, what it would mean for the International Linear Collider, which has long been presumed to be the next big physics machine.

"To speak of 33 trillion electron volts is premature," Dr. Evans said. The long hiatus has had a dramatic effect on the hunt for the collider's main quarry, a particle known as the Higgs boson, which theory says is responsible for imbuing other elementary particles with mass. The Higgs supposedly has a mass somewhere between 114 billion electron volts and 185 billion electron volts — in the units of mass-energy favored by physicists.

By the time it shuts down in 2011, the CERN collider should have amassed about 20 times as much data as it now has, enough to make a dent in the Higgs hunt. The lead in that quest currently belongs to the Tevatron, until last year the world's largest accelerator, which has been colliding protons and antiprotons with energies of a trillion electron volts for the last two decades at the Fermi National Accelerator Laboratory in Batavia, Ill., piling up data. Last summer, Fermilab physicists announced that they had eliminated the region between 158 billion and 175 billion electron volts.

The Tevatron was scheduled to shut down in 2011, but Pier Oddone, Fermilab's director, recently said he would seek financing to keep the Tevatron running until 2014, by which time it could gather enough data to examine the whole energy range over which the Higgs is or is not hiding. But he said he needed at least $35 million a year to avoid hurting other Fermilab projects. CERN and Fermilab both deny they are in a race to find the Higgs or for predominance in physics.

"Of course we feel a healthy competition with the Tevatron, let's put it this way," said Dr. Heuer.

In September Dr. Heuer and Dr. Oddone issued a joint statement deploring what they said was a news media emphasis on competition between the labs, pointing out that Europeans and Americans have worked at one another's labs and that Fermilab played a major role in constructing the Large Hadron Collider.

"Both CERN and Fermilab directors are committed to supporting each other and the global particle physics community in addressing the most important fundamental questions of our era," they said.

John Ellis, a CERN theorist, said the future looked bright.

"The vise is closing in inexorably," he said of the Higgs. As for dark matter, he said the CERN collider would soon exceed the Tevatron in exploring for new particles: "I can hardly contain my enthusiasm."

Those sentiments were echoed by Fabiola Gianotti, a CERN physicist and leader of a collaboration of some 3,000 physicists, whose Atlas detector is the prime rival to the Compact Muon Solenoid experiment. The Atlas building is across the street from the entrance to CERN, in Meyrin, Switzerland, and on a late August day the artist Josef Kristofoletti was finishing a giant mural of the Atlas detector that is visible from the surrounding countryside.

Showing off the Atlas control room, Dr. Gianotti said that from the moment the collisions began last spring, she noticed that they were richer, with more particles coming out. That richness is only now beginning to be plumbed.

"We have been waiting so long," she said. "Only good and beautiful things are coming."

http://www.nytimes.com/2010/11/02/science/space/02cern.html?ref=science

Unearthing New Clues To Primates' Origins

By SINDYA N. BHANOO

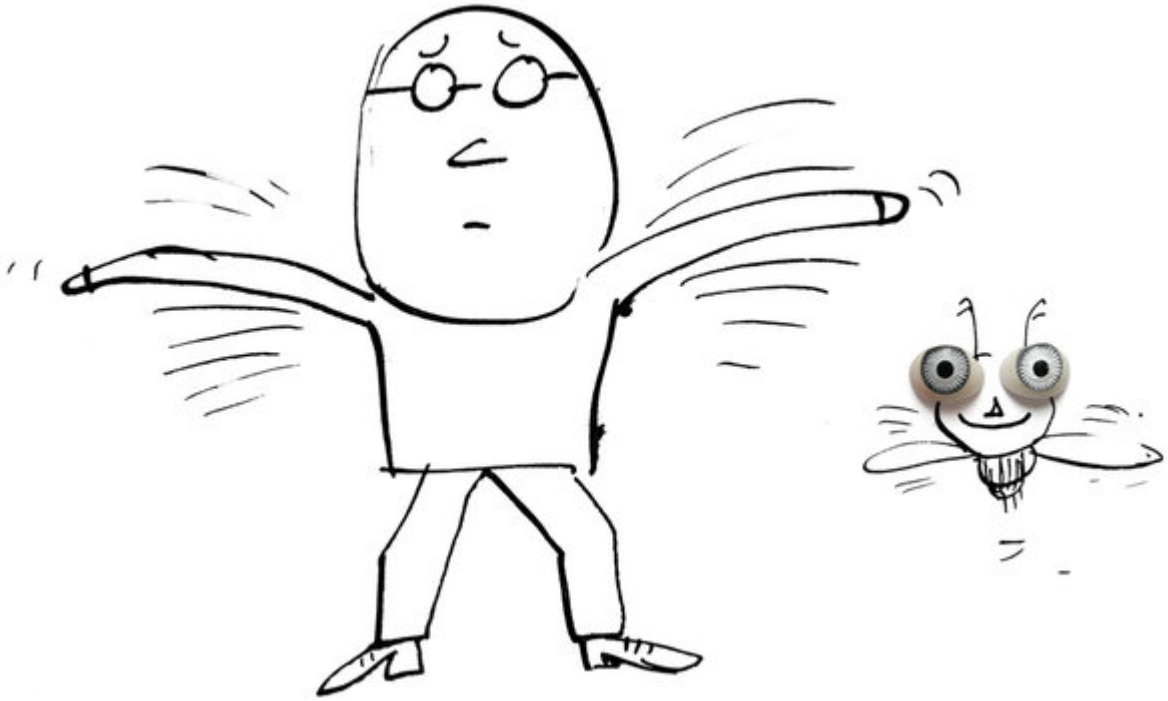
MPFL
The Dur At-Talah formation in Libya where the anthropoid fossils were found.

The ancestors of humans and other primates like apes and monkeys may have originated in Asia, not Africa, a new study in the journal Nature reports.
There has long been debate about the matter, but a recent discovery of anthropoid fossils including two previously unidentified species and one known species provides new clues.
The fossils are about 38 million years old and were uncovered in a rock formation in southern Libya. The anthropoids were small, rodent-size creatures that looked similar to larger, modern-day primates, but weighed just 4 to 17 ounces.
"At least one of these anthropoids appears to be clearly related to the older Asian form described in Myanmar," said Jean-Jacques Jaeger, a paleontologist at the University of Poitiers in France and the study's lead author. "This indicates that there was migration from Asia."
But there is another possibility: that the anthropoids originated in Africa and migrated to Asia, and that they have even older ancestors in Africa that have not yet been discovered.
There is no fossil evidence that substantiates this theory today, but more digging is required, Dr. Jaeger said. "We have to do much more work and we need more information about the older layers in Africa, which we are trying to find in Libya now," he said.
But if it is the case that the anthropoids originated in Asia and migrated, this movement was key to the proliferation of the subspecies.
"In Asia they may have gone extinct," Dr. Jaeger said. "The conditions were more difficult, and if this migration didn't occur, there would not be the rise in anthropoids in the present world."

http://www.nytimes.com/2010/11/02/science/02obanthropoids.html?ref=science

Seeing the Natural World With a Physicist's Lens

By NATALIE ANGIER



Serge Bloch

By NATALIE ANGIER

If you've ever stumbled your way through a newly darkened movie theater, unable to distinguish an armrest from a splayed leg or a draped coat from a child's head, you may well question some of the design features of the human visual system. Sure, we can see lots of colors during the day, but turn down the lights and, well, did you know that a large bucket of popcorn can accommodate an entire woman's shoe without tipping over? Yet for all these apparent flaws, the basic building blocks of human eyesight turn out to be practically perfect. Scientists have learned that the fundamental units of vision, the photoreceptor cells that carpet the retinal tissue of the eye and respond to light, are not just good or great or phabulous at their job. They are not merely exceptionally impressive by the standards of biology, with whatever slop and wiggle room the animate category implies. Photoreceptors operate at the outermost boundary allowed by the laws of physics, which means they are as good as they can be, period. Each one is designed to detect and respond to single photons of light — the smallest possible packages in which light comes wrapped.

"Light is quantized, and you can't count half a photon," said William Bialek, a professor of physics and integrative genomics at Princeton University. "This is as far as it goes."

So while it can take a few minutes to adjust to the dark after being fooled by a flood of artificial light, our eyes can indeed seize the prize, and spot a dim salting of lone photons glittering on the horizon.

Photoreceptors exemplify the principle of optimization, an idea, gaining ever wider traction among researchers, that certain key features of the natural world have been honed by evolution to the highest possible peaks of performance, the legal limits of what Newton, Maxwell, Pauli, Planck et Albert will allow. Scientists have identified and mathematically anatomized an array of cases where optimization has left its fastidious

mark, among them the superb efficiency with which bacterial cells will close in on a food source; the precision response in a fruit fly embryo to contouring molecules that help distinguish tail from head; and the way a shark can find its prey by measuring micro-fluxes of electricity in the water a tremulous millionth of a volt strong — which, as Douglas Fields observed in Scientific American, is like detecting an electrical field generated by a standard AA battery "with one pole dipped in the Long Island Sound and the other pole in waters of Jacksonville, Fla." In each instance, biophysicists have calculated, the system couldn't get faster, more sensitive or more efficient without first relocating to an alternate universe with alternate physical constants.

The tenets of optimization may even help explain phenomena on a larger scale, like the rubberiness of our reflexes and the basic architecture of our brain.

For Dr. Bialek and other biophysicists, optimization analysis offers the chance to identify general principles in biology that can be encapsulated in an elegant set of equations. They can then use those first principles to make predictions about how other living systems may behave, and even test their predictions in real-life, wetware settings — an exercise that can quickly mount in quantitative complexity for even the seemingly simplest cases.

On Wednesday, Dr. Bialek will discuss his take on biological optimization at the Graduate Center of the City University of New York, in a public lecture fetchingly titled "More Perfect Than We Imagined: A Physicist's View of Life." Dr. Bialek is a visiting professor at the graduate school, where he has helped establish an "initiative for the theoretical sciences" devoted to the grand emulsification of mathematics, neuroscience, condensed-matter physics, quantum computation, computational chemistry and the occasional seminar on the physics of mousse and marshmallows.

Wherever he is perched, Dr. Bialek seeks to train the tools of physics on biology, a discipline that historically has favored research and experimentation over theory and computation, and that sometimes can seem so number-averse you'd think it was an they were extensions of the humanities department.

"Because mathematics is so central to how we think about the world, physicists often are speaking a different language than biologists, asking different questions," said Dr. Bialek, his impish, abstractedly cerebral face and full, free-wheeling beard giving him something of a jolly professor manner. "Of course this can lead to conflict."

In one optimization study, Dr. Bialek and his colleagues considered the dynamics of a major signaling molecule in the fruit fly embryo called bicoid.

It was known that bicoid bits were dispensed into the crown end of a fruit fly egg by the mother, that the molecules diffused tailward during development, and that the relative concentration of bicoid at any given spot helped determine the segmentation of a budding fruit fly's form. But how, exactly, did the fly translate something as amorphous and borderless as a seeping oil spill into the ordered grid of a body plan?

The researchers calculated that, to operate optimally, each cell in the developing embryo would match the strength of its bicoid signal against an overall range of possible signal strengths, essentially by comparing notes with its neighbors. Sure enough, experiments later showed that embryonic fly cells perform precisely this sort of quantitative matching in response to a bicoid stimulus package. "It's one of those things where we could have failed dramatically," said Dr. Bialek, "but we succeeded better than we could have expected."

Other researchers have shown that an E. coli microbe navigating its way through a chemically chaotic environment and over to food relies on a similar algorithm of compare-contrast-act, although in this case the note-trading takes place between surface receptors on the bacterium's front and aft. "The reliability of its decision-making is so high," said Dr. Bialek, "that it couldn't do much better if it counted every single molecule in its environment."

Emanuel Todorov, a neuroscientist at the University of Washington, said that one way to identify likely cases of optimization is to find biological systems that are ubiquitous, ancient and resistant to change.

"The muscles of most species are very similar," he said, "and inside every muscle fiber are the same long, organic molecules, the same actin, myosin and troponin that latch onto each other to generate force." The engine of all animal motion, he said, is close to being an optimized machine that itself needs no forward march.

Dr. Todorov has studied how we use our muscles, and here, too, he finds evidence of optimization at play. He points out that our body movements are "nonrepeatable": we may make the same motion over and over, but we do it slightly differently every time.

"You might say, well, the human body is sloppy," he said, "but no, we're better designed than any robot."

In making a given motion, the brain focuses on the essential elements of the task, and ignores noise and fluctuations en route to success. If you're trying to turn on a light switch, who cares if the elbow is down or to the side, or your wrist wobbles — so long as your finger reaches the targeted switch?

Dr. Todorov and his coworkers have modeled different motions and determined that the best approach is the wobbly, ever-varying one. If you try to correct every minor fluctuation, he explained, not only do you expend more energy unnecessarily, and not only do you end up fatiguing your muscles more quickly, you also introduce more noise into the system, amplifying the fluctuations until the entire effort is compromised.

"So we reach the counterintuitive conclusion," he said, "that the optimal way to control movement allows a certain amount of fluctuation and noise" — a certain lack of control.

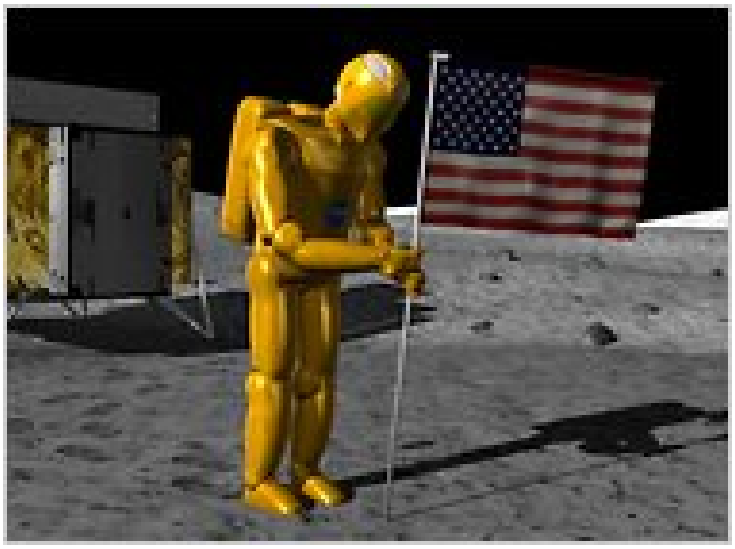
The brain, too, seems built to tolerate bloopers and static hiss. Simon Laughlin of Cambridge University has proposed that the brain's wiring system has been maximally miniaturized, condensed for the sake of speed to the physical edge of signal fidelity.

According to Charles Stevens of the Salk Institute, our brains distinguish noise from signal through redundancy of neurons and a canny averaging of what those neurons have to say.

We are like microbes trepanning for food, and why not? Bacteria have been here for nearly four billion years. They have optimized survival. They can show us the way.

http://www.nytimes.com/2010/11/02/science/02angier.html?ref=science

NASA's Quest to Send a Robot to the Moon
By KENNETH CHANG



NASA
I, ROBOT A rendering of a Robonaut 2. A NASA team says that it could have it on the Moon within a thousand days.

For $150 billion, the National Aeronautics and Space Administration could have sent astronauts back to the Moon. The Obama administration judged that too expensive, and in September, Congress agreed to cancel the program.

For a fraction of that — less than $200 million, along with about $250 million for a rocket — NASA engineers at the Johnson Space Center in Houston say they can safely send a humanoid robot to the Moon. And they say they could accomplish that in a thousand days.

The idea, known as Project M, is almost a guerrilla effort within NASA, cooked up a year ago by Stephen J. Altemus, the chief engineer at Johnson. He tapped into discretionary money, pulled in engineers to work on it part time, and horse-traded with companies and other NASA units to undertake preliminary planning and tests. "We're doing impossible things with really very little, if any, money whatsoever," Mr. Altemus said.

A humanoid dextrous robot — at least the top half — already exists: Robonaut 2, developed by NASA and General Motors, is packed on the shuttle Discovery, scheduled for liftoff on Wednesday.

Bound for the International Space Station, it will be the first humanoid robot in space. It is to help with housekeeping chores at the space station as NASA learns how astronauts and robots can work together. Eventually, an upgraded Robonaut is to take part in spacewalks.

Project M also draws on other NASA projects that were already under way, including rocket engines that burn liquid oxygen and methane — a cheap and nontoxic fuel combination — and an automated landing system that could avoid rocks, cliffs and other hazards.

Integrating the technologies into working prototypes sped up development. "That's the magic," Mr. Altemus said. "A lot of times technologies end up in the lab cooking, and then there's this valley of death where they never get to maturation or to flight."

Project M's planners say that a robot walking on the Moon would capture the imagination of students, just as the Apollo Moon landings inspired a generation of scientists and engineers 40 years ago.

"I think that's going to light a few candles," said Neil Milburn, vice president of Armadillo Aerospace, a tiny Texas company working on Project M.

But as NASA's attention turns away from the Moon — "We've been there before," President Obama declared in April — the prospects for sending a robot there are at best uncertain.

The quandary over Project M encapsulates many of the continuing debates over the future of the space agency: What should NASA be told to do when there is not enough money to do everything? What is the best way to spur advances in space technologies? And given the costs and dangers, how important is it to send people into space at all?

"The tricky part is whether it fits in the agency's framework for exploration," Mr. Altemus said.

Last year, a blue-ribbon panel was reviewing NASA's human spaceflight program, in particular an ambitious project called Constellation to send astronauts back to the Moon. Although NASA has spent $10 billion on Constellation, most of the program is to be canceled when Congress finishes work on the 2011 budget.

Mr. Altemus, for one, was frustrated by criticism of NASA that emerged during the Constellation debate and elsewhere. "I always felt like our organization was a Ferrari, and we were never allowed to drive with our foot on the gas," he said. "We were kind of at idle speed all the time."

Talking to his son at his kitchen table, Mr. Altemus wanted something that was exciting but not so big that it would require years of deliberation. The idea popped into his head: a walking robot on the Moon, one that could send back live video, in a thousand days.

Mr. Altemus took it to his staff the next day, telling them, "Let's do something amazing."

He recalled: "I said, 'Will you get behind me if I put this into the organization? I don't know if we can do it. I don't know if we'll get the money for it or will get approved — let's try.' And so we just started, and it caught like wildfire."

Sending a robot to the Moon is far easier than sending a person. For one, a robot does not need air or food. And there is no return trip.

The thousand-day deadline was arbitrary, said R. Matthew Ondler, Project M's manager. "It creates this sense of urgency," he explained. "NASA is at its best when it has a short time to figure out things. You give us six or seven years to think about something, and we're not so good. Administrations change and priorities of the country change, and so it's hard to sustain things for that long."

For the purpose of aiding science education, a thousand days fit easily into the four years that a student spends in high school or college. By contrast, even if NASA achieved Mr. Obama's stated goal of sending astronauts to an asteroid by 2025, a 7-year-old today would have already graduated from college.

To get the parts they need, Mr. Altemus and Mr. Ondler have resorted to barter. Boston Power gave them a $300,000 prototype of an advanced lithium battery in exchange for engineering help on battery management issues.

"It was an easy trade, so we made several deals like that," Mr. Ondler said.

Armadillo provided a prototype it had built for a lunar lander competition, and NASA exchanged engine technology and access to test facilities.

NASA also paid Armadillo about $1 million, but NASA's traditional development processes would have cost more and taken longer. In six months, the lander flew 18 times under tether and twice in free flight.

Not all the flights went perfectly, which was the point. "It's O.K. to put a hole in the ground once in a while," Mr. Ondler said. "It's O.K. to have flame coming out of the wrong end of the engine once in a while, as long as we're learning quickly and building and iterating."

Mr. Ondler told the story of an engineer going to Home Depot to buy about $80 worth of materials to test whether fuel sloshing in the tanks could destabilize the lander during descent. "From that, we were able to confirm our math models and design the full-scale test," he said, all in two weeks.

Project M slipped under the radar of everyone else in NASA, including the administrator, Maj. Gen. Charles F. Bolden Jr. In February, in response to a question about projects that NASA might undertake with other nations, General Bolden cited a two-legged robot that the Japanese space agency wants to send to the Moon by 2020.

"Do I think I can do that?" General Bolden said. "Probably not."

At that time, the Project M team was hoping to get a go-ahead to start in March and accomplish the robotic Moon landing by the end of 2012.

Despite the sophistication of the project, the robot's capabilities would be slight compared with what a human could do on the lunar surface. Project M was conceived as a technology demonstration, not a scientific mission.

One of the main tasks envisioned for the robot would be to simply pick up a rock and drop it, as part of an education program broadcast to schools. Students could do the same and compare the relative gravity of Earth.

Work continues on Project M, which has cost about $9 million so far. Armadillo is building a second prototype lander, but there is no money for other aspects, like finishing the legs for Robonaut. Mr. Obama's vision for NASA called for investing $16 billion over five years for space technologies, but the compromise blueprint drawn up by Congress shifts most of the money to a heavy-lift rocket.

The project did spark interest among the International Space Station managers, which is why a Robonaut is heading there. "I'm excited to see how we can evolve the technology in space and actually have a pair of hands and a working humanoid dextrous robot on the space station," Mr. Altemus said. "It's a big move forward for the agency."

But for now, the plans for sending one to the Moon are on the back burner.

http://www.nytimes.com/2010/11/02/science/space/02robot.html?ref=science