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How should you spend your time off? Believe it or not, science has some answers.

By Drake Bennett | June 20, 2010

Monday summer officially begins, and freed from the hunker-inducing cold, New Englanders' imaginations have already turned to vacation: to idle afternoons and road trips, to the beach and the Berkshires. School is out, and the warm weekends stretch before us, waiting to be filled.

Of course, this creates its own pressures. Where to go? When? What to do? Is it better to try somewhere new and exotic, or return to a well-loved spot? Doze on the beach or hike the ancient ruins? Hoard vacation days for a grand tour, or spread them around? Time off is a scarce resource, and as with any scarce resource, we want to spend it wisely.

Partly, these decisions are matters of taste. But there are also, it turns out, answers to be found in behavioral science, which increasingly is yielding insights that can help us make the most of our leisure time. Psychologists and economists have looked in some detail at vacations — what we want from them and what we actually get out of them. They have advice about what really matters, and it's not necessarily what we would expect.

For example, how long we take off probably counts for less than we think, and in the aggregate, taking more short trips leaves us happier than taking a few long ones. We're often happier planning a trip than actually taking it. And interrupting a vacation — far from being a nuisance — can make us enjoy it more. How a trip

ends matters more than how it begins, who you're with matters as much as where you go, and if you want to remember a vacation vividly, do something during it that you've never done before. And though it may feel unnecessary, it's important to force yourself to actually take the time off in the first place — people, it turns out, are as prone to procrastinate when it comes to pleasurable

things like vacations as unpleasant ones like paperwork and visits to the dentist.

"How do we optimize our vacation?" asks Dan Ariely, a behavioral economist at Duke University and the author of the new book "The Upside of Irrationality." "There are three elements to it — anticipating, experiencing, and remembering. They're not the same, and there are different ways to change each."

There is, of course, plenty that we still don't know. People take vacations for all sorts of reasons beyond pure hedonism — to learn about new places, to test themselves, to placate their children, to bask in the envy of their friends and co-workers. Research cannot settle questions like whether the pleasure we derive from anticipating a minutely planned trip will be outweighed by the disappointment when things don't measure up.

For psychologists and behavioral economists, vacations are a window into the still only dimly understood mystery of human pleasure, a field known as hedonic psychology. Their research, along with other work on prototypically pleasant (and unpleasant) experiences, has begun to yield a portrait of your mind on vacation. And if the findings tell us anything, it's that we might actually need some help. When we guess the best way to spend our free time, it seems that we often guess wrong.

There are untold shelves of books dedicated to the art of maximizing our time at work, but no corresponding literature on maximizing our leisure time. Even asking the question of how to "optimize" a vacation seems fundamentally un-vacation-like. And yet people constantly puzzle over how to get the most out of their valuable time off: poring over guidebooks, checking the forecast, looking up online reviews of hotels and restaurants, arguing with spouses over where to go and what to do, and when.

The problem, say some social scientists, is that people do all this — and spend thousands of dollars — with an incomplete understanding of what qualities make an experience enjoyable. Take duration. A longer vacation seems, by definition, better than a shorter one, and having lots of paid vacation time is a highly valued job perk. But when we recall an experience, and how it made us feel, it turns out that length isn't terribly important.

The strongest evidence here comes from social psychology experiments that looked at people being subjected to various pleasant and unpleasant stimuli. The most frequently cited study is one done by the physician Donald Redelmeier and Daniel Kahneman, a psychologist whose work helped launch the field of behavioral economics. Patients undergoing colonoscopies — a quite painful procedure — with either little or very light sedation were subjected to a few extra minutes of lesser pain at the end of the procedure. Overall, those patients rated the experience as less painful and less unpleasant than others, even though they had been in pain longer. Kahneman has found similar results for stimuli like watching film clips of playful puppies and soothing landscapes — a pleasant experience isn't recalled later as more pleasurable just because it lasts longer.

Looking back, what matters far more is the intensity of sensation, whether it's excitement or pain or contentment. And it's not the overall average of the experience that people remember, but how they felt at the most intense moments, combined with how they felt right as the experience ended. Psychologists call this the "peak-end rule."

The research on the peak-end rule has focused on shorter-term sensations — colonoscopies, thankfully, are brief compared to vacations — but psychologists suspect that it also applies to longer experiences. If so, that means worrying about whether it's possible to get extra days off to stretch a trip is wasted energy. And if you're deciding between a longer trip and a more eventful one — if, for example, the money it would cost for a few more nights in a hotel would mean you wouldn't be able to afford a coveted splurge dinner or surfing lessons or concert tickets or a rain forest guide — then it makes more sense to just shorten the trip in the interest of making it more intense while you're there.

"I really emphasize this in the happiness lecture that I give in my social psychology course," says Thomas Gilovich, a psychologist at Cornell University specializing in decision-making. "My lectures are not really didactic in this 'go live your life this way' way, but my happiness lecture is. If you have to sacrifice how long your vacation is versus how intense it is, you want shorter and more intense."

The peak-end rule also suggests that there's little point worrying about how much fun or how relaxing every last moment of a vacation is, since the trip will be remembered for its high points. Of course, our peak-end proclivities also mean that a trip could be remembered for its low points, experiences of vacation trauma so searing that they overwhelm all else — gastrointestinal disasters, perhaps, or a stolen passport or camera, or epic, frustration-induced tantrums.

But research looking at how people actually feel about their vacations suggests that, by and large, they remember them warmly — more warmly, in fact, than they feel while taking them. The psychologists Leigh Thompson, of Northwestern University's Kellogg School of Management, and Terence Mitchell, of the University of Washington's Foster School of Business, in 1997 reported the results of a study in which they asked people on three different vacations — a trip to Europe, Thanksgiving break, and a three-week bicycle tour of California — to fill out a series of emotional inventories before the vacation, during it, and then after.

They found that in all three cases, the respondents were least happy about the vacation while they were taking it. Beforehand, they looked forward to it with eager anticipation, and within a few days of returning, they remembered it fondly. But while on it, they found themselves bogged down by the disappointments and logistical headaches of actually going somewhere and doing something, and the pressure they felt to be enjoying themselves.

A recent Dutch study had a more striking finding. Looking not at vacation memories, but measuring general happiness level through a simple three-question questionnaire, the researchers found that going on vacation gave a notable boost to pre-vacation mood but had hardly any effect on post-vacation feelings. Anticipation, it seems, can be a more powerful force than memory.

Vacations can't all be short and intense, and we wouldn't want them to be. What if we want to just improve a week at the beach house?

One consistent research finding is that people have a stubborn unconscious ability to adapt to their circumstances, whether those circumstances are good — like marrying their true love — or bad, like getting divorced. Whether they want to or not, people quickly begin to take things for granted.

One way to head that off, psychologists have found, is by constantly varying how we do things. Sonja Lyubomirsky of the University of California, Riverside has done a series of studies showing that in all sorts of everyday activities, from hobbies to studying to acts of charity to walking routes, people derive more pleasure

from them the more they vary how they do them. When planning for how to keep ourselves (and our families) happy and engaged through a week off, it may help to keep the value of novelty and variation in mind.

The most effective way to inoculate a vacationer against the deadening power of adaptation, however, may be the most counterintuitive — to break it up, to interrupt it with real life. The psychologist Leif Nelson of the University of California, Berkeley's Haas School of Business, working with Tom Meyvis of the New York University Stern School of Business, has found that people, whether having a pleasant experience like a massage or an unpleasant one like prolonged separation from a loved one, felt the pain or pleasure more intensely if the experience was stopped and then restarted.

"If you put a disruption in a hedonic experience, it intensifies it," Nelson says. The same principle, he argues, would apply to a vacation. "You can imagine spending a weekend at some wonderful beach house. While it's great for the first couple of hours, by the second day, it's pleasant and then no longer exciting. If for some reason you're forced to leave the beach house, when you return, you have all that new pleasure again."

Other psychologists have a slightly different explanation for the hedonic boost that interruption gives. They see it less as a matter of adaptation and more a matter of evaluation. Having a trip interrupted in effect turns what had been a more open-ended experience into a bounded one, triggering the peak-end rule. That means, says Gal Zauberman of the University of Pennsylvania's Wharton School, that if we break up our trips strategically, we might actually get more enjoyment out of them.

"If you partition after each peak experience, then you remember that piece as better than if you partition after each lousy thing," he suggests.But for those who can't get away at all this summer, either because time or money prevents it, there is a finding for you, as well. Odd as it seems, people are often reluctant to take advantage of opportunities for pleasure that they do have, unless they're in some way compelled. In a study published earlier this year, Ayelet Gneezy and Suzanne Shu, marketing experts at the University of California, San Diego and University of California, Los Angeles business schools respectively, found that giving someone longer to redeem a gift certificate actually makes them less likely to do so. And using sidewalk surveys in London, Chicago, and Dallas, they reinforced a creeping suspicion that many Boston residents probably share — that people who live in cities with major attractions and landmarks are actually less likely to visit those landmarks than tourists are, and likely to only do so when hosting out-of-town guests.

The finding is a testament to the human tendency to procrastinate, in pleasure as in work. Seen this way, part of why we enjoy ourselves on a vacation stems from the fact that it gives us a deadline: an often sharply limited time window during which we have to go out and enjoy ourselves.

If you realize this, suggests Shu, you can give yourself some of the benefits of a vacation without going anywhere, simply by cordoning off a day or two and strictly scheduling it for leisure. That way you'll actually go out and see the play or concert you would otherwise have skipped, or take the time to dig the tent and camp stove out of the basement."Give yourself a milestone or a deadline by which you're going to go do this enjoyable thing," Shu says, "and you'll actually enjoy yourself more often."

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http://www.boston.com/bostonglobe/ideas/articles/2010/06/20/the_best_vacation_ever/

Follow the Money: Wealth, Population Are Key Drivers of Invasive Species

This alien, destructive parakeet is currently expanding its range across Western Europe. It can be a serious agricultural pest and competes with native birds for nesting cavities. (Credit: Photo courtesy of Oregon State University)

ScienceDaily (June 7, 2010) — A new study of biological invasions in Europe found they were linked not so much to changes in climate or land cover, but to two dominant factors -- more money and more people.

Wealth and population density, along with an increase in international trade and commerce, were the forces most strongly associated with invasive species that can disrupt ecosystems and cause severe ecological or agricultural damage, scientists said.

An international group of 26 researchers reported the new findings this week in *Proceedings of the National Academy of Sciences*.

Dealing with these issues will be "pivotal for policy makers and future management," the researchers said, although no easy or inexpensive solutions exist, and many nations have been reluctant to take steps that might interfere with economic growth.

"Invasive species are a continuing and extensive ecological crisis, and we're finding that human population and accumulated wealth are important drivers of this problem," said Susan Shirley, a research assistant in the Department of Forest Ecosystems and Society at Oregon State University, and co-author on this study.

"Regional patterns of species invasions are complex, and there is still unexplained variation, likely due to local scale differences in several of the ecological factors," Shirley said. "But invasive species are in large part an international trade issue, and this is an important problem we have not yet come to grips with. Next to population density, the closest correlation is to long-standing wealth, not more recent increases in income or economic activity."

Human activities often related to trade, travel and transport, particularly in the past 50 years, have caused a surge in the number of introduced species, ranging from plants to fungi, insects, fish, birds, reptiles and mammals. Some are innocuous, but many displace native species and cause a range of ecosystem disruption. As a crossroads of international travel and trade, with both a high population and high income, Europe has experienced many invasive species.

The study concluded that other possible factors, such as climate, geography or land cover, were less significant than population density and wealth capital, and that those secondary causes may have been overestimated in the past.

The mechanisms of species invasion are often associated with international trade. Invasive species can hitch-hike on imported products, be brought to new regions as pets, be associated with contaminated food, or even introduced on purpose, as in the case of some ornamental plants or new crops.

In another recent study, Shirley and her colleagues researched bird introductions in Europe, and the findings supported this premise. Trade with Eastern Europe was severely disrupted for decades during the Cold War. By the end of that long period of international tension and restricted trade, Western Europe had experienced an increase in invasive bird species, but numbers in Eastern Europe actually declined.

In the new study, researchers were able to predict the number of alien species in Europe to a reasonably high degree simply by defining the level of wealth and the number of people.

"The overwhelming effect of human factors, wealth and demography, found for several taxonomic groups translates to human activities responsible for enhancing biological invasions," researchers wrote in the study.

Solving this problem will not be easy, the study suggested.

Identifying the specific mechanisms of invasion is critical. Monitoring may need to be improved. Legislation to restrict or regulate certain imports will likely be needed, in addition to charging fees or tariffs that would help deal with invasive species when they occur. But the World Trade Organization and other international agreements "have no effective mechanisms" to address this concern, the authors said. And aside from good intentions, restrictions could be costly.

A major challenge, Shirley said, will be to understand the specific economic factors leading to introductions so they can be effectively addressed while minimizing negative impacts on international trade. These factors are likely to differ among species. For example, minimizing releases of vertebrate species might require additional regulation of the pet trade, while a focus on transport infrastructures such as roads may help control introductions of alien invertebrates.

"Nations do not have a good track record in forsaking future economic prosperity for environmental benefits," the study concluded. "Only if the true determinants are identified will it be possible to predict and manage alien species invasions adequately without adverse effects on other economic sectors."

Story Source:

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

Journal Reference:

1. Petr Pysek et al. **Disentangling the role of environmental and human pressures on biological invasions across Europe**. *PNAS*, June 7, 2010 DOI: 10.1073/pnas.1002314107

http://www.sciencedaily.com/releases/2010/06/100607151314.htm

Student Invention Helps Infants With Respiratory Ailments

Haruka Maruyama of Tokyo prepares a doll for a prototype of the Baby Bubbler, which will be demonstrated this summer in Malawi and Lesotho as part of Rice's global health initiative, Beyond Traditional Borders. (Credit: Jeff Fitlow/Rice University)

ScienceDaily (June 9, 2010) — Gently, gently. That's how babies should be handled, and it was the prime consideration when a team of Rice University seniors developed a device that could save babies' lives.

The Baby Bubbler -- or in its more technical guise, the Continuous Positive Airway Pressure (CPAP) device -- helps children with acute respiratory infections breathe naturally as they recover. According to the World Health Organization, about 20 percent of deaths in children under 5 are caused by acute lower respiratory infections; 90 percent of those deaths are caused by pneumonia.

Rice's global health team recognized the need for a portable device for infants that can be taken to countries lacking resources for medical equipment.

"Our device is not a replacement for a ventilator -- it's a respiratory support device," said Heather Machen, an attending physician in the emergency center and assistant professor of pediatrics at Texas Children's Hospital, who advised the students. "Unlike a ventilator, a patient must be able to breathe on his or her own. With the use of CPAP, many children will be able to recover without a ventilator."

The Baby Bubbler has two main components, said Michael Pandya, a Lubbock, Texas, native who developed it with four other seniors.

One component, a flow generator, pumps air through a tube and allows clinicians to add oxygen if needed. The tube goes from the generator to the infant, who breathes through nasal prongs, and then to the second component, a water bottle that serves as a regulator. "The pressure level to the patient can be changed by adjusting the depth of water in the bottle," Pandya said.

An alarm to detect backflow of water into the line warns doctors if the circuit loses pressure. "It's a simple design, but it's incredibly important in developing countries where the nurse-to-patient ratio is sometimes one nurse for 40 or so patients," he said.

Members of the Baby Bubbler team also included Jocelyn Brown of Pittsburgh, Joseph Chang of Lexington, Mass., Haruka Maruyama of Tokyo, and Katie Schnelle of Cincinnati.

Brown served double duty as the only bioengineering student on the five-member infantAIR team, which brought the Baby Bubbler to Rwanda this spring as part of a global health technology commercialization class offered at Rice University's Jones Graduate School of Business. The team subsequently won $11,750 in the prestigious Rice Business Plan Competition, including first prize for Best Social Venture, and earned honors for Best Engineering Design in Service to Society in this year's Brown School of Engineering Design Showcase.

"This team has been great at understanding the design challenges and addressing them head-on," said Maria Oden, professor in the practice of engineering education and director of Rice's Oshman Engineering Design Kitchen, where much of the work was done. Bioengineers at Texas Children's helped students check the flows and pressures of their device. "That's been very valuable," she said.

Prototypes, which cost about $140 to make, will travel with students this summer as part of Rice's global health initiative, Beyond Traditional Borders. They will be demonstrated in Malawi and Lesotho, the first step toward clinical testing.

In addition, Machen is recruiting local physicians interested in piloting the device and educational materials in their hospitals. "Their input and involvement will be vital to the success of this project," she said.

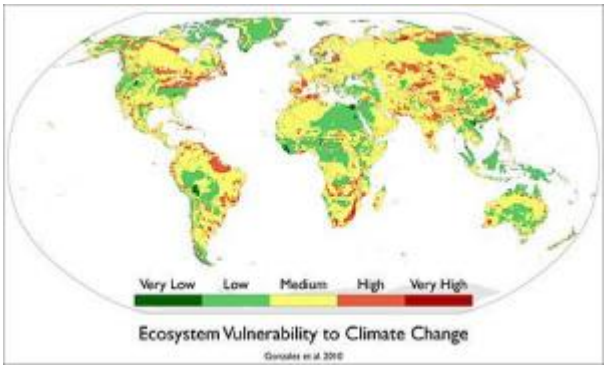
"The United Nations has designated reducing under-5 mortality by two-thirds by 2015 as one of its Millennium Development Goals," said Machen, who credited Texas Children's Steven Abrams, a neonatologist, and Suzanne Iniguez, a respiratory therapy educator, for their help in realizing the project. "We hope that this bubble CPAP will contribute toward achieving that goal."

Story Source:

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

http://www.sciencedaily.com/releases/2010/06/100607111316.htm

Climate Change Linked to Major Vegetation Shifts Worldwide



To identify the areas most vulnerable to future vegetation shifts, the researchers combined statistical analyses of observed climate data from the 20th century with models of vegetation change in the 21st century. (Credit: Map by Patrick Gonzalez et al)

ScienceDaily (June 9, 2010) — Vegetation around the world is on the move, and climate change is the culprit, according to a new analysis of global vegetation shifts led by a University of California, Berkeley, ecologist in collaboration with researchers from the U.S. Department of Agriculture Forest Service.

In a paper published June 7 in the journal *Global Ecology and Biogeography*, researchers present evidence that over the past century, vegetation has been gradually moving toward the poles and up mountain slopes, where temperatures are cooler, as well as toward the equator, where rainfall is greater.

Moreover, an estimated one-tenth to one-half of the land mass on Earth will be highly vulnerable to climate-related vegetation shifts by the end of this century, depending upon how effectively humans are able to curb greenhouse gas emissions, according to the study.

The results came from a meta-analysis of hundreds of field studies and a spatial analysis of observed 20th century climate and projected 21st century vegetation.

The meta-analysis identified field studies that examined long-term vegetation shifts in which climate, rather than impacts from local human activity such as deforestation, was the dominant influence. The researchers found 15 cases of biome shifts since the 18th century that are attributable to changes in temperature and precipitation.

"This is the first global view of observed biome shifts due to climate change," said the study's lead author Patrick Gonzalez, a visiting scholar at the Center for Forestry at UC Berkeley's College of Natural Resources. "It's not just a case of one or two plant species moving to another area. To change the biome of an ecosystem, a whole suite of plants must change."

The researchers calculated that from 1901 to 2002, mean temperatures significantly increased on 76 percent of global land, with the greatest warming in boreal, or subarctic, regions. The most substantial biome shifts occurred where temperature or precipitation changed by one-half to two standard deviations from 20th century mean values.

Some examples of biome shifts that occurred include woodlands giving way to grasslands in the African Sahel, and shrublands encroaching onto tundra in the Arctic.

"The dieback of trees and shrubs in the Sahel leaves less wood for houses and cooking, while the contraction of Arctic tundra reduces habitat for caribou and other wildlife," said Gonzalez, who has served as a lead author on reports of the Intergovernmental Panel on Climate Change (IPCC). "Globally, vegetation shifts are disrupting ecosystems, reducing habitat for endangered species, and altering the forests that supply water and other services to many people."

To identify the areas most vulnerable to future vegetation shifts, the researchers combined statistical analyses of observed climate data from the 20th century with models of vegetation change in the 21st century.

Based upon nine different combinations of IPCC greenhouse gas emissions scenarios and climate models, the researchers divided the world's land into five classes -- from very high to very low -- of vulnerability to biome shifts.

"Scientists had not quantified this risk before," said Gonzalez. "We developed a simple classification system that natural resource management agencies can use to identify regions in greatest need of attention and planning. We have worked with the U.S.D.A. Forest Service and the U.S. Fish and Wildlife Service to explore the application of our results to adaptation of natural resource management."

Gonzalez said that because of limited resources, it may be prudent to focus on protecting areas of greater resilience to ecological changes so that they can serve as refuges for plants and animals. "It is also useful to identify places of higher vulnerability, because agencies will need to consider adaptation measures for vulnerable ecosystems," he said. "Some shifts in vegetation could increase fuel for wildfires, for example, so prescribed burning may be necessary to reduce the risk of catastrophic fires."

"Approximately one billion people now live in areas that are highly to very highly vulnerable to future vegetation shifts," said Gonzalez. "Ecosystems provide important services to people, so we must reduce the emissions that cause climate change, then adapt to major changes that might occur."

Story Source:

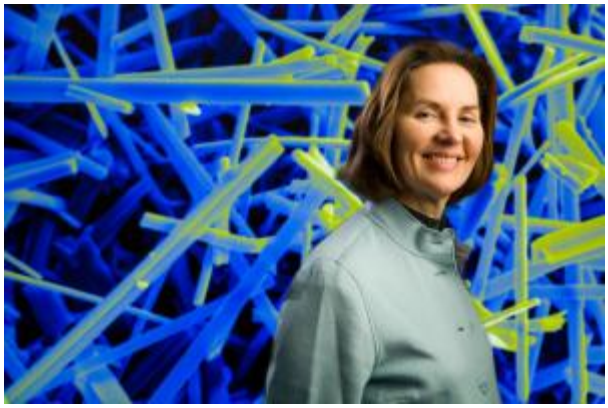
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of California - Berkeley**. The original article was written by Sarah Yang.

Journal Reference:

1. Patrick Gonzalez, Ronald P. Neilson, James M. Lenihan, Raymond J. Drapek. **Global patterns in the vulnerability of ecosystems to vegetation shifts due to climate change**. *Global Ecology and Biogeography*, 2010; DOI: 10.1111/j.1466-8238.2010.00558.x

http://www.sciencedaily.com/releases/2010/06/100607092143.htm

Scientist Brings Fresh Perspective to the Nation's Electrical Grid



Esther Takeuchi, who developed the battery that made possible the first implantable cardiac defibrillators, is using her knowledge to improve the electrical grid. (Credit: Image courtesy of University at Buffalo)

ScienceDaily (June 7, 2010) — If battery-making is an art, then University at Buffalo scientist Esther Takeuchi is among its most prolific masters, with more than 140 U.S. patents, all in energy storage.

Takeuchi developed the battery that made possible the first implantable cardiac defibrillators, a feat that was recognized last fall with the National Medal of Technology and Innovation from President Obama. Millions of heart patients worldwide have benefited from the implantable cardiac defibrillators powered by Takeuchi's silver vanadium oxide battery. With funding from the National Institutes of Health, she is developing new cathode materials for improved implantable cardiac defibrillator batteries, with her latest advances on this project recently published in the *Journal of Power Sources*.

A slide show highlighting Takeuchi's biomedical research is available on YouTube: http://www.youtube.com/watch?v=Gm8MqA3u4MQ.

But now Takeuchi is applying to the electrical grid -- the vast, national network that delivers energy from suppliers to consumers -- her unique perspective on how to coax the best performance out of battery chemicals.

Having two years ago made the jump from industry to academia after 22 years, Takeuchi, a SUNY Distinguished Professor in UB's School of Engineering and Applied Sciences, may be just the scientist to find the right combination of materials that will usher in the next energy storage revolution.

"Esther has a unique perspective," says Amy Marschilok, PhD, UB research assistant professor of engineering, who has worked with Takeuchi for more than six years. "In developing the silver vanadium oxide material that now powers the implantable cardiac defibrillator, she took an idea and turned it into a functional battery."

"Now she's taking that experience and applying it to these very different areas," Marschilok continues. "Could a variation on one of the battery systems one day be applied to powering homes and buildings? That's the kind of perspective she has and it's what battery research really needs."

In the past year, Takeuchi been awarded more than $1 million in funding by several federal agencies to develop better materials for batteries and ways to prevent their degradation.

With a new project recently funded by the New York State Energy Research and Development Authority, Takeuchi and her husband, SUNY Distinguished Teaching Professor Kenneth Takeuchi, are developing new, low-cost materials for rechargeable batteries.

The focus is on developing a distributed grid where renewable power is generated closer to where it's needed, rather than in a central place and transmitted long distances, the way the current grid operates.

"One of the key challenges in moving from our fossil-fuel based system to greener, renewable forms of energy is that whether you're talking about solar or wind power, these forms of energy are intermittent," says Takeuchi.

And even though the sun may be shining or the wind may be blowing, it's unlikely that either phenomenon will occur at a constant rate over time.

"There will be fairly large fluctuations in the amount of power being generated," she says.

That makes a robust, reliable method of storing energy absolutely critical. And it's a feature that has been essential in the life-saving biomedical devices Takeuchi has worked on in the past.

"To generate energy at a usable, consistent level, we will need to couple a dependable, energy-storage system with renewable power sources," she says.

Takeuchi's work on biomedical devices has provided her with an unusual appreciation for the properties of batteries that have exceptional longevity. The typical lifetime of a battery in an implantable device is 5-10 years and Takeuchi is one of those leading the push to increase that for both biomedical and utility applications.

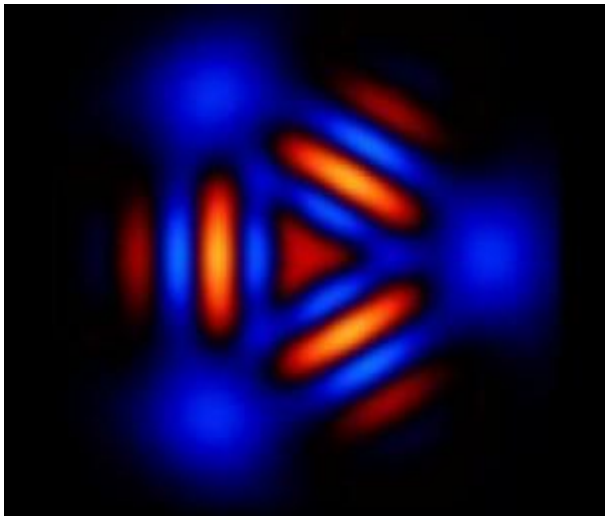
"Whether you're talking about the power grid, electrical vehicles or biomedical devices the quest is for low cost, longer life and rechargeability," she says.

Story Source:

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

http://www.sciencedaily.com/releases/2010/06/100607142225.htm

Applying Tomographics to the Quantum World



This image is an example of quantum tomographics. (Credit: Max Hofheinz et al.)

ScienceDaily (June 7, 2010) — Scientists at the Universidad Carlos III of Madrid (UC3M) have demonstrated the validity of tomographic representation of quantum states, which can help quantum technologies transmit information more safely and efficiently.

Any physical system -- be it an electron, a molecule of water, a virus, a human being, a whole planet -- is characterized at each moment in time distinctively and specifically in a specific place by particular characteristics. This is what we call the "state of the system," but when one tries to describe said "state" precisely according to our current knowledge of the laws governing the universe, it is necessary to appeal to abstract formulations since the laws of quantum physics, the theory of physics which best describes the universe in which we live, are different from those that govern Newton's classical physics. In the last century various scientists obtained different representations which help to understand the world of quantum mechanics, which prevails in the area of the smallest things, of the subatomic. Now researchers at UC3M working with the tomographic description of quantum states have proven that it is equivalent to classic descriptions carried out by the great scientists of the 20th century in that they contain the same information and are equally as rich as the classic descriptions.

"We are trying to mark the limits of the conceptual aspects of tomographical representation of quantum states and we just finished proving that the tomographical representation of quantum states is complete, meaning that it is just as good as the traditional representations from Schrodinger, Heisenberg, Dirac, etc.," states the UC3M professor Alberto Ibort. He has been carrying out research in this area for some years and has recently published a summary of his discoveries on the tomography of quantum states in an article in the journal Physics Letters A, in collaboration with scientists from Lebedev Physics Institute (Russia) and the Frederico II University of Naples (Italy).

The quantum world in detail

What these researchers are trying to do is dissect quantum states in order to describe their true nature in a similar, although more sophisticated, way in which some hospital diagnostic machines work. "A tomographic image of a quantum state describes the quantum state completely, the same as an ordinary tomographic image allows us to see an organism or a body in complete detail," explains Professor Ibort, of the Mathematics Department of UC3M. In this way, a tomographic image of a quantum state is a mathematical function obtained when carrying out certain manipulations of the physical system intended for analysis, in the same way that computerized tomography used in hospitals obtains a function of the density of human tissue in any direction in order to reconstruct a 3D image of our body.

The use of tomography techniques can have huge implications in communication technology, according to the researchers. "If quantum tomography is developed in the same way as medical tomography, we could use methods derived from it to improve information transfer through quantum channels," states Alberto Ibort. And one of the principal applications of quantum technologies is the manipulation and transfer of information using quantum properties of light. In this sense, quantum tomography permits the manipulation of light at a quantum level in a different and more versatile way. For example, one could think of "compressing" quantum information (qbits) using a tomographic representation of it, according to experts.

The field of Quantum Information is one of the most promising areas of development within Physics and it is even more relevant in quantum cryptography and quantum computation. These technologies promise, for example, absolutely secure communication and immense computational capacity, in that they are destined to revolutionize our lives in the same way laser or personal computers have.

The researchers at UC3M lead the research project QUITEMAD (QUatnum Information Technologies MADrid -- http://www.quitemad.org/), a scientific consortium which brings together experts in quantum Information from the Universidad Complutense of Madrid, the Universidad Politécnica of Madrid and the Consejo Superior de Investigaciones Científicas (The Spanish National Research Council), with the support of national and international companies and funding from the Comunidad de Madrid (Madrid Autonomous Region) and the European Social Fund. "We are working in collaboration with other members of QUITEMAD on the development of techniques from the telecommunications world for use in quantum tomography and we would particularly like to develop an analogue to the sampling techniques which are so useful in the telecommunications domain in analysis of certain kinds of quantum states," reveals professor Ibort.

QUITEMAD has five specific research objectives: quantum cryptography, quantum computation, quantum control and tomography, quantum correlations and quantum simulation. These five lines of research have relevant scientific and technological applications ranging from quantum cryptography implementation in the industrial sector to the development and application of new computation and information techniques, including their experimental application in collaboration with national and international laboratories. Besides these scientific objectives, the project has strategic considerations such as to educate new teams in quantum information technology capable of meeting the future challenges of universities and industry, with the aim of endowing Madrid the status of excellence and being at the forefront of Europe and the world.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Universidad Carlos III de Madrid - Oficina de Información Científica**.

Journal Reference:

1. A. Ibort, V.I. Man'ko, G. Marmo, A. Simoni, F. Ventriglia. **On the tomographic picture of quantum mechanics**. *Physics Letters A*, 2010; DOI: 10.1016/j.physleta.2010.04.056

http://www.sciencedaily.com/releases/2010/06/100607065904.htm

Site of Human Evolution Was Scorching

Lake Turkana, Kenya. (Credit: iStockphoto/Markus Karner)

ScienceDaily (June 8, 2010) — If you think summer in your hometown is hot, consider it fortunate that you don't live in the Turkana Basin of Kenya, where the average daily temperature has reached the mid-90s or higher, year-round, for the past 4 million years.

The need to stay cool in that cradle of human evolution may relate, at least in part, to why pre-humans learned to walk upright, lost the fur that covered the bodies of their predecessors and became able to sweat more, Johns Hopkins University earth scientist Benjamin Passey said.

"The 'take home' message of our study," said Passey, whose report appears in the online early edition of *Proceedings of the National Academy of Sciences*, "is that this region, which is one of the key places where fossils have been found documenting human evolution, has been a really hot place for a really long time, even during the period between 3 million years ago and now when the ice ages began and the global climate became cooler."

Passey, an assistant professor in the Morton K. Blaustein Department of Earth and Planetary Sciences at the university's Zanvyl Krieger School of Arts and Sciences, says that conclusion lends support to the so-called "thermal hypothesis" of human evolution.

That hypothesis states that our pre-human ancestors gained an evolutionary advantage in walking upright because doing so was cooler (when it is sunny, the near-surface air is warmer than air a few feet above the ground) and exposed their body mass to less sunlight than did crawling on all fours. The loss of body hair (fur) and the ability to regulate body temperature through perspiration would have been other adaptations helpful for living in a warm climate, according to the hypothesis.

"In order to figure out if (the thermal hypothesis) is possibly true or not, we have to know whether it was actually hot when and where these beings were evolving," he said. "If it was hot, then that hypothesis is credible. If it was not, then we can throw out the hypothesis."

Evaluating whether the ancient Turkana Basin climate was, in fact, the same scorching place it is today has been difficult up until now because there are very few direct ways of determining ancient temperature. Efforts to get a handle on temperatures 4 million years ago through analysis of fossil pollen, wood and mammals

were only somewhat successful, as they reveal more about plants and rainfall and less about temperature, Passey said.

Passey, however, previously was part of a team at the California Institute of Technology that developed a geochemical approach to the "temperature problem." The method involves determining the temperatures of carbonate minerals that form naturally in soil (including a sedimentary rock called "caliche" and hard pan, which is a dense layer of soil, usually found below the uppermost topsoil layer) by examining "clumps" of rare isotopes. (Isotopes are atoms of the same element that have different masses due to differences in the number of neutrons they contain.)

In the case of soil carbonates common in the Turkana Basin, the amount of rare carbon-13 bonded directly to rare oxygen-18 provides a record of the temperature during the initial formation of the mineral. It told the team that soil carbonates there formed at average soil temperatures between 86 and 95 degrees Fahrenheit, leading to the conclusion that average daytime air temperatures were even higher. In other words, it was hot way back then in what is now northeastern Kenya.

"We already have evidence that habitats in ancient East Africa were becoming more open, which is also hypothetically part of the scenario for the development of bipedalism and other human evolution, but now we have evidence that it was hot," Passey said. "Thus, we can say that the 'thermal hypothesis' is credible."

This research was supported by the National Science Foundation and the Camille & Henry Dreyfus Foundation.

Story Source:

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

Journal Reference:

1. Benjamin H. Passey, Naomi E. Levin, Thure E. Cerling, Francis H. Brown, and John M. Eiler. **High-temperature environments of human evolution in East Africa based on bond ordering in paleosol carbonates**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.1001824107

http://www.sciencedaily.com/releases/2010/06/100608135043.htm

Violent Video Games May Increase Aggression in Some but Not Others, Says New Research

Bad effects from playing violent video games depend on certain personality traits; games can offer learning opportunities for some people, according to new research. (Credit: iStockphoto/Adam Filipowicz)

ScienceDaily (June 8, 2010) — Playing violent video games can make some adolescents more hostile, particularly those who are less agreeable, less conscientious and easily angered. But for others, it may offer opportunities to learn new skills and improve social networking.

In a special issue of the journal *Review of General Psychology*, published in June by the American Psychological Association, researchers looked at several studies that examined the potential uses of video games as a way to improve visual/spatial skills, as a health aid to help manage diabetes or pain and as a tool to complement psychotherapy. One study examined the negative effects of violent video games on some people.

"Much of the attention to video game research has been negative, focusing on potential harm related to addiction, aggression and lowered school performance," said Christopher J. Ferguson, PhD, of Texas A&M International University and guest editor of the issue. "Recent research has shown that as video games have become more popular, children in the United States and Europe are having fewer behavior problems, are less violent and score better on standardized tests. Violent video games have not created the generation of problem youth so often feared."

In contrast, one study in the special issue shows that video game violence can increase aggression in some individuals, depending on their personalities.

In his research, Patrick Markey, PhD, determined that a certain combination of personality traits can help predict which young people will be more adversely affected by violent video games. "Previous research has shown us that personality traits like psychoticism and aggressiveness intensify the negative effects of violent video games and we wanted to find out why," said Markey.

Markey used the most popular psychological model of personality traits, called the Five-Factor Model, to examine these effects. The model scientifically classifies five personality traits: neuroticism, extraversion, openness to experience, agreeableness and conscientiousness.

Analysis of the model showed a "perfect storm" of traits for children who are most likely to become hostile after playing violent video games, according to Markey. Those traits are: high neuroticism (e.g., easily upset,

angry, depressed, emotional, etc.), low agreeableness (e.g., little concern for others, indifferent to others feelings, cold, etc.) and low conscientiousness (e.g., break rules, don't keep promises, act without thinking, etc.).

Markey then created his own model, focusing on these three traits, and used it to help predict the effects of violent video games in a sample of 118 teenagers. Each participant played a violent or a non-violent video game and had his or her hostility levels assessed. The teenagers who were highly neurotic, less agreeable and less conscientious tended to be most adversely affected by violent video games, whereas participants who did not possess these personality characteristics were either unaffected or only slightly negatively affected by violent video games."These results suggest that it is the simultaneous combination of these personality traits which yield a more powerful predictor of violent video games," said Markey. "Those who are negatively affected have pre-existing dispositions, which make them susceptible to such violent media."

"Violent video games are like peanut butter," said Ferguson. "They are harmless for the vast majority of kids but are harmful to a small minority with pre-existing personality or mental health problems."

The special issue also features articles on the positives of video game play, including as a learning tool. For example:

- Video games serve a wide range of emotional, social and intellectual needs, according to a survey of 1,254 seventh and eighth graders. The study's author, Cheryl Olson, PhD, also offers tips to parents on how to minimize potential harm from video games (i.e., supervised play, asking kids why they play certain games, playing video games with their children).
- Commercial video games have been shown to help engage and treat patients, especially children, in healthcare settings, according to a research review by Pamela Kato, PhD. For example, some specially tailored video games can help patients with pain management, diabetes treatment and prevention of asthma attacks.
- Video games in mental health care settings may help young patients become more cooperative and enthusiastic about psychotherapy. T. Atilla Ceranoglu, M.D., found in his research review that video games can complement the psychological assessment of youth by evaluating cognitive skills and help clarify conflicts during the therapy process.

Story Source:

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

Journal Reference:

1. Patrick M. Markey, Charlotte N. Markey. **Vulnerability to Violent Video Games: A Review and Integration of Personality Research**. *Review of General Psychology*, Special Issue on Video Games, Vol. 14. No. 2

http://www.sciencedaily.com/releases/2010/06/100607122547.htm

Polymer-Based Filter Successfully Cleans Water, Recovers Oil in Gulf of Mexico Test

A piece of chemically treated cotton cloth is able to separate crude oil from sea water (both from the Gulf of Mexico) completely within seconds by using gravity alone. It can be developed into various effective tools for cleaning up the oil spill in Gulf of Mexico. The treated cloth allows water to path through but not oil. The novel surface chemical treatment method is developed by University of Pittsburgh. (Credit: Still image from video courtesy of YouTube)

ScienceDaily (June 8, 2010) — In response to the massive oil leak in the Gulf of Mexico, a University of Pittsburgh engineering professor has developed a technique for separating oil from water via a cotton filter coated in a chemical polymer that blocks oil while allowing water to pass through. The researcher reports that the filter was successfully tested off the coast of Louisiana and shown to simultaneously clean water and preserve the oil.

Di Gao, an assistant professor and William Kepler Whiteford Faculty Fellow in the Department of Chemical and Petroleum Engineering in Pitt's Swanson School of Engineering, created his filter as a possible method to help manage the spreading oil slick that resulted from the April 20 explosion of BP's "Deepwater Horizon" drilling platform. Gao has submitted his idea through the Deepwater Horizon Response Web site managed by the consortium of companies and government agencies overseeing the disaster response.

A video of Gao testing his filter with oil and water samples from the Gulf of Mexico spill is available on YouTube at www.youtube.com/watch?v=kfRKjiOXVWE

Gao's filter hinges on a polymer that is both hydrophilic -- it bonds with the hydrogen molecules in water -- and oleophobic, meaning that it repels oil. When the polymer is applied to an ordinary cotton filter, it allows water to pass through but not oil. The filter is produced by submerging the cotton in a liquid solution containing the polymer then drying it in an oven or in open air, Gao explained.

For the massive slick off the U.S. Gulf Coast, Gao envisions large, trough-shaped filters that could be dragged through the water to capture surface oil. The oil could be recovered and stored and the filter reused. Current cleanup methods range from giant containment booms and absorbent skimmers to controlled fires and chemical dispersants with questionable effects on human health and the environment.

Gao focuses his research in the development and application of chemical nanostructures, including liquid-resistant coatings. In 2009, Gao reported in the journal *Langmuir* his demonstration of a nanoparticle-based solution that can prevent the formation of ice on solid surfaces, from power lines to airport runways and roads. More information is available on Pitt's Web site at www.chronicle.pitt.edu/?p=4206

Story Source:

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

Journal Reference:

1. Liangliang Cao, Andrew K. Jones, Vinod K. Sikka, Jianzhong Wu, Di Gao. **Anti-Icing Superhydrophobic Coatings**. *Langmuir*, 2009; 25 (21): 12444 DOI: 10.1021/la902882b

http://www.sciencedaily.com/releases/2010/06/100607122446.htm

New 360-Degree Video Surveillance System Uses Image Stitching Technology That Is Perfectly Detailed Edge to Edge

ISIS takes new video-camera and image-stitching technology and bolts it to a ceiling, mounts it on a roof, or fastens it to a truck-mounted telescoping mast. (Credit: DHS S&T)

ScienceDaily (June 8, 2010) — Traditional surveillance cameras can be of great assistance to law enforcement officers for a range of scenarios -- canvassing a crowd for criminal activity, searching for who left a suitcase beneath a bench, or trying to pick out a suspect who has fled a crime scene and blended into a teeming throng in the subway.

But there are shortfalls. For starters, once they zoom in on a specific point of interest, they lose visual contact with the rest of the scene.

Now, a new video surveillance system currently being developed by the Department of Homeland Security's Science and Technology Directorate (S&T) may soon give law enforcement an extra set of eyes. The Imaging System for Immersive Surveillance (or ISIS) takes new video camera and image-stitching technology and bolts it to a ceiling, mounts it on a roof, or fastens it to a truck-mounted telescoping mast.

Like a bug-eyed fisheye lens, ISIS sees v-e-r-y wide. But that's where the similarity ends. Whereas a typical fisheye lens distorts the image and can only provide limited resolution, video from ISIS is perfectly detailed, edge-to-edge. That's because the video is made from a series of individual cameras stitched into a single, live view -- like a high-res video quilt.

"Coverage this sweeping, with detail this fine, requires a very high pixel count," says program manager Dr. John Fortune, of S&T's Infrastructure and Geophysical Division, "ISIS has a resolution capability of 100 megapixels." That's as detailed as 50 full-HDTV movies playing at once, with optical detail to spare. You can zoom in close…and closer…without losing clarity.

The stitching together of several images isn't exactly cutting-edge magic. For years, creative photographers have used low-cost stitching software to create breathtaking high-res images (like that famous image of the National Mall from Inauguration Day 2009). But those are still images, created days or weeks after a scene was shot. ISIS is quilting video -- in real time. And, a unique interface allows maintenance of the full field of view, while a focal point of choice can be magnified.

Other tricks -- many of which are commercially available -- will be provided by a suite of software applications called video analytics. One app can define a sacrosanct "exclusion zone," for which ISIS provides an alert the moment it's breached. Another lets the operator pick a target -- a person, a package, or a pickup truck -- and the detailed viewing window will tag it and follow it, automatically panning and tilting as needed. Video analytics at high resolution across a 360-degree field of view, coupled with the ability to follow objects against a cluttered background, would provide enhanced situational awareness as an incident unfolds.

In the event that a terrorist attack occurs, forensic investigators can pore over the most recent video, using pan, zoom, and tilt controls to reconstruct who did what and when. Because these controls are virtual, different regions of a crime scene can feasibly be studied by separate investigative teams simultaneously.

Many of the ISIS capabilities were adapted from technology previously developed by MIT's Lincoln Laboratory for military applications. With the help of technology experts from the Department of Energy's Pacific Northwest National Laboratory, Lincoln Laboratory has built the current system with commercial off-the-shelf cameras, computers, image processing boards and software.

ISIS creators already have their eyes on a new and improved second generation model, complete with custom sensors and video boards, longer range cameras, higher resolution, a more efficient video format, and a discreet, chandelier-like frame -- no bigger than a basketball. Eventually, the Department plans to develop a version of ISIS that will use infrared cameras to detect events that occur at night.

S&T formed a partnership with the Massachusetts Port Authority (Massport), and in December 2009, began an ISIS pilot at Logan International Airport, allowing potential Homeland Security end users the opportunity to evaluate the technology. Beyond the potential for enhancing security at our nation's airports, if successful, the current testing at Logan could pave the way for the eventual deployment of ISIS to protect other critical venues.

That's a good thing, says S&T's Fortune. "We've seen that terrorists are determined to do us harm, and ISIS is a great example of one way we can improve our security by leveraging our strengths."

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **US Department of Homeland Security - Science and Technology**, via EurekAlert!, a service of AAAS.

http://www.sciencedaily.com/releases/2010/06/100607192733.htm

Crocodiles Ride Ocean Currents for Ocean Travel

A 4.8-meter male estuarine crocodile ready for release with satellite transmitter. This crocodile traveled over 590 km by sea. (Credit: Australia Zoo)

ScienceDaily (June 8, 2010) — The mystery of how the world's largest living reptile -- the estuarine crocodile -- has come to occupy so many South Pacific islands separated by huge stretches of ocean despite being a poor swimmer has at last been solved by a group of Australian ecologists.

Publishing their new study in the British Ecological Society's *Journal of Animal Ecology*, they say that like a surfer catching a wave, the crocodiles ride ocean currents to cross large areas of open sea.

The estuarine crocodile (*Crocodylus porosus*) is a semi-aquatic reptile, living mainly in rivers, mangroves and estuaries. Its geographical range extends over 10,000 km^2 of the South-East Pacific, from East India to Fiji and from southern China to North Australia. Although it spends most of its life in salt-water, it cannot be considered a marine reptile in the same way as a turtle is, for example, because it relies on land for food and water.

Many anecdotal accounts exist of large crocodiles being sighted far out to sea, but this is the first study to show -- using underwater acoustic tags and satellite tracking -- that estuarine crocodiles ride surface currents during long-distance travel, which would enable them to voyage from one oceanic island and another.

The results explain why, despite occupying such a large range, species diversification of the estuarine crocodile has not occurred.

Working in the remote Kennedy River in North Queensland, Australia, Dr Hamish Campbell from University of Queensland and colleagues from Queensland Parks and Wildlife Service and Australia Zoo tagged 27 adult estuarine crocodiles with sonar transmitters and used underwater receivers to track their every move over 12 months.

During that time they recorded 1.2 million data packets and found that both male and female adult crocodiles undertook long-distance journeys, regularly traveling more than 50km from their home area to the river mouth and beyond into open sea.

The data showed that crocodiles always began long-distance travel within an hour of the tide changing, allowing them to go with the flow, and that they halted their journeys by hauling out on to the river bank when the tide turned against them.

The team -- which included the late Steve Irwin ("The Crocodile Hunter") -- also re-analyzed archival data from the few crocodiles that have been satellite tracked whilst undertaking ocean travel. By overlaying the crocodiles' movements with surface current estimates they found that ocean swimming crocodiles showed a similar behavioral strategy when at sea.

One satellite-tagged crocodile -- a 3.84-meter-long male -- left the Kennedy River and traveled 590 km over 25 days down the west coast of Cape York Peninsula timing its journey to coincide with a seasonal current system that develops in the Gulf of Carpentaria.

A second crocodile -- a 4.84-meter-long male -- traveled more than 411 km in only 20 days from the east coast of Cape York Peninsula through the Torres Straits to the Wenlock River on the west coast of Cape York. The Torres Straits are notorious for strong water currents, and when the crocodile arrived the currents were moving opposite to its direction of travel. It waited in a sheltered bay for four days and only passed through the Straits when the currents switched to favor its journey.

According to Dr Campbell: "The estuarine crocodile occurs as island populations throughout the Indian and Pacific ocean, and because they are the only species of salt-water living crocodile to exist across this vast area, regular mixing between the island populations probably occurs.

"Because these crocodiles are poor swimmers, it is unlikely that they swim across vast tracts of ocean. But they can survive for long periods in salt-water without eating or drinking, so by only traveling when surface currents are favorable, they would be able to move long distances by sea. This not only helps to explains how estuarine crocodiles move between oceanic islands, but also contributes to the theory that crocodilians have crossed major marine barriers during their evolutionary past."

Story Source:

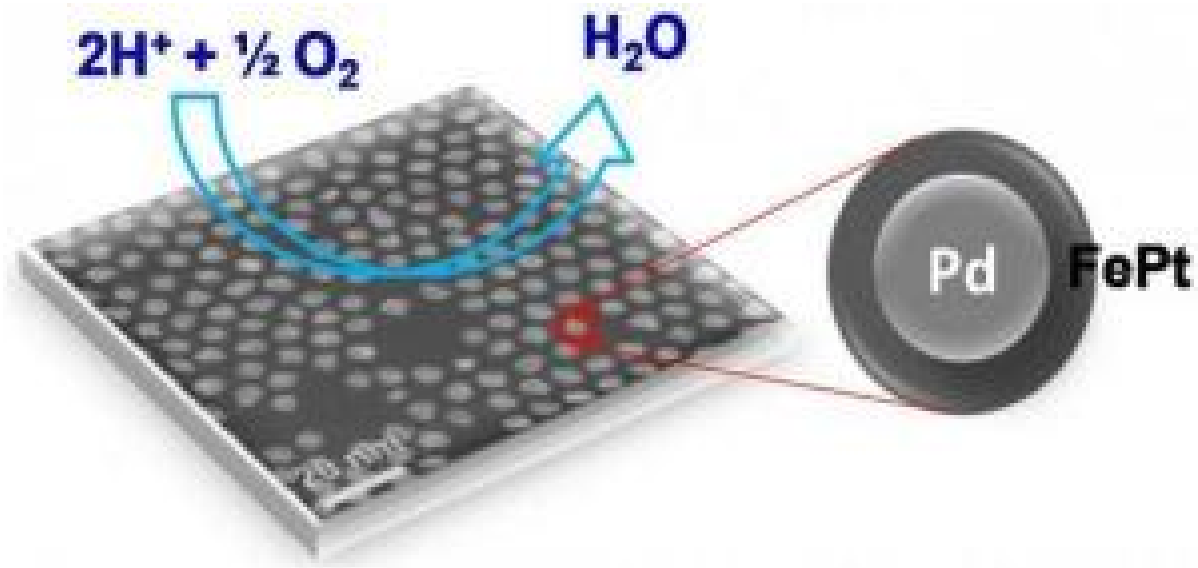
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Wiley-Blackwell**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Hamish A. Campbell, Matthew E. Watts, Scott Sullivan, Mark A. Read, Severine Choukroun, Steve R. Irwin, Craig E. Franklin. **Estuarine crocodiles ride surface currents to facilitate long-distance travel**. *Journal of Animal Ecology*, 2010; DOI: 10.1111/j.1365-2656.2010.01709.x

http://www.sciencedaily.com/releases/2010/06/100607092136.htm

Chemists Report Promising Advance in Fuel-Cell Technology



The multi-metallic nanoparticle created by Brown University chemists for fuel-cell reactions uses a palladium core and an iron-platinum shell. (Credit: Vismadeb Mazumder & Shouheng Sun, Brown University)

ScienceDaily (June 8, 2010) — Creating catalysts that can operate efficiently and last a long time is a big barrier to taking fuel-cell technology from the lab bench to the assembly line. The precious metal platinum has been the choice for many researchers, but platinum has two major downsides: It is expensive, and it breaks down over time in fuel-cell reactions.

In a new study, chemists at Brown University report a promising advance. They have created a unique core and shell nanoparticle that uses far less platinum yet performs more efficiently and lasts longer than commercially available pure-platinum catalysts at the cathode end of fuel-cell reactions.

The chemistry known as oxygen reduction reaction takes place at the fuel cell's cathode, creating water as its only waste, rather than the global-warming carbon dioxide produced by internal combustion systems. The cathode is also where up to 40 percent of a fuel cell's efficiency is lost, so "this is a crucial step in making fuel cells a more competitive technology with internal combustion engines and batteries," said Shouheng Sun, professor of chemistry at Brown and co-author of the paper in the *Journal of the American Chemical Society*.

The research team, which includes Brown graduate student and co-author Vismadeb Mazumder and researchers from Oak Ridge National Laboratory in Tennessee, created a five-nanometer palladium (Pd) core and encircled it with a shell consisting of iron and platinum (FePt). The trick, Mazumder said, was in molding a shell that would retain its shape and require the smallest amount of platinum to pull off an efficient reaction. The team created the iron-platinum shell by decomposing iron pentacarbonyl [$Fe(CO)_5$] and reducing platinum acetylacetonate [$Pt(acac)_2$], a technique Sun first reported in a 2000 *Science* paper. The result was a shell that uses only 30 percent platinum, although the researchers say they expect they will be able to make thinner shells and use even less platinum.

"If we don't use iron pentacarbonyl, then the platinum doesn't form on the (palladium) core," Mazumder said.

The researchers demonstrated for the first time that they could consistently produce the unique core-shell structures. In laboratory tests, the palladium/iron-platinum nanoparticles generated 12 times more current than commercially available pure-platinum catalysts at the same catalyst weight. The output also remained consistent over 10,000 cycles, at least ten times longer than commercially available platinum models that begin to deteriorate after 1,000 cycles.

The team created iron-platinum shells that varied in width from one to three nanometers. In lab tests, the group found the one-nanometer shells performed best.

"This is a very good demonstration that catalysts with a core and a shell can be made readily in half-gram quantities in the lab, they're active, and they last," Mazumder said. "The next step is to scale them up for commercial use, and we are confident we'll be able to do that."

Mazumder and Sun are studying why the palladium core increases the catalytic abilities of iron platinum, although they think it has something to do with the transfer of electrons between the core and shell metals. To that end, they are trying to use a chemically more active metal than palladium as the core to confirm the transfer of electrons in the core-shell arrangement and its importance to the catalyst's function.

Miaofang Chi and Karren More at the Oak Ridge Laboratory also contributed to the paper. The U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy funded the research as part of its Fuel Cell Technologies Program.

Story Source:

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

Journal Reference:

1. Vismadeb Mazumder, Miaofang Chi, Karren L. More, Shouheng Sun. **Core/Shell Pd/FePt Nanoparticles as an Active and Durable Catalyst for the Oxygen Reduction Reaction**. *Journal of the American Chemical Society*, 2010; : 100524140222057 DOI: 10.1021/ja1024436

http://www.sciencedaily.com/releases/2010/05/100524161340.htm

Secondhand Smoke Associated With Psychiatric Distress, Illness

Second hand smoke exposure is associated with psychological distress and risk of future psychiatric illness (Credit: iStockphoto/Michael Bodmann)

ScienceDaily (June 8, 2010) — Exposure to secondhand smoke appears to be associated with psychological distress and the risk of future psychiatric hospitalization among healthy adults, according to a report posted online that will appear in the August print issue of *Archives of General Psychiatry.*

"A growing body of literature has demonstrated the harmful physical health effects of secondhand smoke exposure," the authors write as background information in the article. "Given the highly prevalent exposure to secondhand smoke -- in the United States, an estimated 60 percent of American non-smokers had biological evidence of exposure to secondhand smoke -- even a low level of risk may have a major public health impact."

Mark Hamer, Ph.D., of University College London, and colleagues studied 5,560 non-smoking adults (average age 49.8) and 2,595 smokers (average age 44.8) who did not have a history of mental illness and participated in the Scottish Health Survey in 1998 or 2003. Participants were assessed with a questionnaire about psychological distress, and admissions to psychiatric hospitals were tracked over six years of follow-up. Exposure to secondhand smoke among non-smokers was assessed using saliva levels of cotinine -- the main

product formed when nicotine is broken down by the body -- "a reliable and valid circulating biochemical marker of nicotine exposure," the authors write.

A total of 14.5 percent of the participants reported psychological distress. Non-smokers with a high exposure to secondhand smoke (cotinine levels between 0.70 and 15 micrograms per liter) had higher odds of psychological distress when compared with those who had no detectable cotinine.

Over the six-year follow-up, 41 individuals were newly admitted to psychiatric hospitals. Smokers and non-smokers with high exposure to secondhand smoke were both more likely than non-smokers with low levels of secondhand smoke exposure to be hospitalized for depression, schizophrenia, delirium or other psychiatric conditions.

Animal data have suggested that tobacco may induce a negative mood, and some human studies have also identified a potential association between smoking and depression. "Taken together, therefore, our data are consistent with other emerging evidence to suggest a causal role of nicotine exposure in mental health," the authors write.

"To our knowledge, this is the first study to demonstrate a prospective association between objectively assessed secondhand smoke exposure and mental health in a representative sample of a general population," they conclude.

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. Mark Hamer; Emmanuel Stamatakis; G. David Batty. **Objectively Assessed Secondhand Smoke Exposure and Mental Health in Adults: Cross-sectional and Prospective Evidence From the Scottish Health Survey**. *Arch Gen Psychiatry*, 2010; 0 (2010): 2010. 76 [link]

http://www.sciencedaily.com/releases/2010/06/100607165625.htm

Florida Ridges' Mystery Marine Fossils Tied to Rising Land, Not Seas, Geologist Says

Topographic Map of Florida. Including state borders, rivers and longitude/latitude lines. Relief texture and satellite images courtesy of NASA (http://earthobservatory.nasa.gov). Further data source courtesy of CIA World Data Bank II database. (Credit: iStockphoto/Frank Ramspott)

ScienceDaily (June 8, 2010) — Sea level has not been as high as the distinctive ridges that run down the length of Florida for millions of years. Yet recently deposited marine fossils abound in the ridges' sands.

Now, a University of Florida geologist may have helped crack that mystery.

In a paper appearing June 1 in the June edition of the journal *Geology*, Peter Adams, a UF assistant professor of geological sciences, says his computer models of Florida's changing land mass support this theory: The land that forms the sandy Trail Ridge running north to south from North Florida through South Georgia, as well as lesser-known ridges, was undersea at the time the fossils were deposited -- but rose over time, reaching elevations that exceeded later sea level high stands.

"If you look at the best records, there's no evidence that global sea level has come close to occupying the elevation of these fossils since the time of their emplacement," Adams said, referring to Trail Ridge's elevation today, nearly 230 feet above modern sea level. "The only thing that explains this conundrum is that Trail Ridge was underwater, but later rose to an elevation higher than subsequent sea levels."

At the heart of the phenomenon are Florida's unique weather patterns and geology, Adams said.

The state's abundant rain contains a small amount of carbon dioxide, which forms carbonic acid in lake and river water. This slightly acidic water slowly eats away at Florida's limestone bedrock, forming the karst topography for which Florida is so well known, replete with pockmarks, underground springs and subterranean caverns. The surface water washes the dissolved limestone out to sea, over time significantly lightening the portion of the Earth's crust that covers Florida.

A mass of slow-moving mantle rock resides 6 to 18 miles below the crust. As the Florida land mass lightens, this mantle pushes upward to equilibrate the load, forcing Florida skyward, Adams said. The process is known as isostatic rebound, or isostatic uplift.

"It's just like what happens when you get out of bed in the morning. The mattress springs raise the surface of the bed back up," Adams said, adding that the uplift is similar to what takes place when glaciers retreat, with Maine and Norway, for example, also gaining elevation.

Glaciers melt off the land surface to drive isostatic uplift. But in Florida, varying rainfall rates during different periods have slowed or quickened the karstification just below the land. This has in turn slowed or quickened the mantle's push up from below. Additionally, sea level high stands do not always return to the same elevation, which creates a complex history of which beach ridges are preserved and which aren't, Adams said.

For instance, during periods when sea level rose quickly, some pre-existing ridges were overtaken and wiped out. During other periods, however, when sea level rose slowly or did not reach a certain ridge's elevation, a beach ridge was preserved. In effect, Trail Ridge, Lake Wales Ridge and other lesser-known ridges are the remains of isostatically uplifted land that was kept out of harm's way, Adams said. The ridges carry with them the marine fossils that are the evidence of their lowly early beginnings.

Today, the land surface of Florida is rising at a rate of about one-twentieth of a millimeter annually, far more slowly than sea level rise estimated at approximately 3 millimeters annually. Adams noted that Florida's rise is not nearly rapid enough to counteract sea level rise -- and that society should be mindful that low-lying coastal areas are threatened.

Neil Opdyke, a UF professor emeritus and a co-author of the recent paper, first proposed the uplift process in a 1984 paper. Adams tested it using computer models that matched known information about sea levels dating back 1.6 million years with historic rainfall patterns, karstification rates and mantle uplift. The models concluded that Trail Ridge is approximately 1.4 million years old -- and has been preserved because of uplift and the fact that sea levels have not reached the ridge's elevation since its formation. In addition, Florida's one-twentieth of a millimeter rise is twice as fast as previously thought.

"The neat thing about this paper is, it combines many different systems that people work on. There are people who work on uplift, people who work on erosion of karst, people who work on precipitation and paleoclimate," Adams said. "And I knew just enough about all these things to be dangerous. So I said. 'Let's take what we know from the literature and put it together in a simple mathematical model to see how the whole system responds.'"

Story Source:

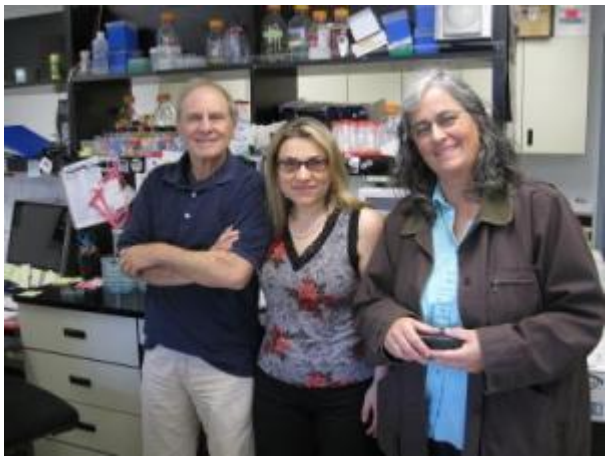
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Florida**. The original article was written by Aaron Hoover.

Journal Reference:

1. P. N. Adams, N. D. Opdyke, J. M. Jaeger. **Isostatic uplift driven by karstification and sea-level oscillation: Modeling landscape evolution in north Florida**. *Geology*, 2010; 38 (6): 531 DOI: 10.1130/G30592.1

http://www.sciencedaily.com/releases/2010/06/100601072524.htm

Substance in Iron Metabolism Displays Life-Saving Potential for Inflammatory Diseases



University of Utah molecular biologists Jerry Kaplan, Ivana De Domenico and Diane Ward have made a surprising discovery that hepicidin -- a hormone that helps regulate iron balance in the body -- can prevent deadly inflammation in mice. Their study raises hope that the substance someday might be used to combat a variety of human inflammatory diseases. (Credit: Curry Koening, University of Utah)

ScienceDaily (June 8, 2010) — In a surprising discovery that someday may lead to new treatments for many inflammatory diseases, University of Utah scientists found that a hormone involved in iron metabolism can save mice from deadly acute inflammation.

"It's well recognized that the hormone hepcidin helps regulate iron balance. This study shows it has an additional, brand-new, unexpected role in reducing inflammation," says the study's principal author, Jerry Kaplan, a pathology professor and assistant vice president for basic sciences at the University of Utah Health Sciences Center.

The findings by Kaplan and his fellow molecular biologists were scheduled for publication online June 7 in *The Journal of Clinical Investigation* and in the print issue dated July 1. The research was funded by the National Institutes of Health.

The study reveals that "hepcidin has an anti-inflammatory effect, reducing the consequences of inflammation," says the study's first author, Ivana De Domenico, an assistant professor of internal medicine.

Coauthor Diane Ward, an associate professor of pathology, adds: "This could mean that hepcidin might be considered as a therapy for a wide range of acute inflammatory conditions such bacterial infections; inflammation from surgery, injury or burns; organ transplantation; and rare cases of inflammation from blood transfusions."

Toxic shock and fever also might be subject to hepcidin treatment, Kaplan says.

"Clinical trials in humans are required to determine if hepcidin is effective at treating human inflammatory conditions -- and that will be a few years away," he adds.

Hepcidin Rescues Cells and Mice from Fatal Inflammation

In the study's key experiments, mice were given one of three substances in doses that cause fatal inflammation:

1. Lipopolysaccharide or LPS, a toxin on the outside of bacteria and recognized as "foreign" by the immune system, inducing inflammation;
2. Poly I:C, which is found in viruses and also provokes inflammation;
3. Turpentine, a solvent used historically to provoke and study inflammation.

Cells called macrophages were cultured in the lab and exposed to LPS. Some cell cultures were pretreated with hepcidin. The untreated cells showed high levels of inflammatory proteins, while the treated cells had lower levels.

"When your body sees either that LPS coating or the bacteria, your innate immune system signals to make cytokines, which are proteins that cause inflammation," Ward says. "That inflammation response makes immune cells like macrophages and neutrophils converge on the invading bacteria and kill them."

But the "big release of inflammatory agents can cause septic shock, which can be fatal," she adds. "Your temperature drops, there's inactivity and eventually you can die."

So in the key experiments, "we took mice and either preinjected them with hepcidin or just saline as a control, and then two hours later we injected them with LPS [or one of the two other inflammatory substances] to provoke inflammation," says Ward.

"In animals injected with saline before the inflammatory substance, the animals' temperatures dropped, their cytokines and inflammation increased and they became so sick they couldn't move. If mice were injected with hepcidin prior to the inflammatory substance, they showed less inflammation, only minor illness and remained mobile."

It has been known for at least a decade that hepcidin is released into the bloodstream in response to inflammation. It also has been known that hepcidin attacks bacteria and kills them. And increased hepcidin reduces iron in the blood, which also has an antibacterial effect, since infectious agents require iron, says Ward.

"The new finding is that the presence of hepcidin in the blood actually reduces inflammation," she says.

Kaplan and colleagues cautioned that they showed only that hepcidin works against acute inflammation. It did not help mice who suffered chronic bowel inflammation and resulting sepsis or blood poisoning.

They speculated larger hepcidin doses might combat chronic inflammation, but only during some limited time window, say, early in the inflammation process.

Hepcidin: Maintaining Iron Balance in Your Body

Kaplan says iron balance in the human body is regulated by hepcidin, which is a peptide hormone secreted to help metabolize iron that we eat. Hepcidin attaches or "binds" to a substance named ferroportin, which exports iron from cells into the blood.

"High levels of hepcidin in the blood results in the loss of ferroportin from cells, leading to decreased export of iron from cells to blood," Kaplan says.

If too little iron in the blood persists, a person has anemia.

"Usually when you take an iron pill or you get a bacterial infection that is self-limiting, you'll get an increase in hepcidin, which in time will decrease," says Kaplan. "As hepcidin binds to ferroportin, it removes ferroportin from the blood and also removes hepcidin from the blood. Both are degraded in the cells."

The opposite of anemia is iron overload, and "most diseases of iron overload result from not enough hepcidin to remove ferroportin from cells," he adds. Ferroportin brings iron from our diet into the blood, so without enough hepcidin, too much iron accumulates in the blood.

"Hepcidin monitors your body's iron status," Kaplan says. "When you have too much iron, hepcidin increases to help prevent more iron from coming in. When you need more iron, hepcidin levels decrease, permitting more iron to come into the body from your diet and from iron stored in your cells, particularly your spleen."

In a series of previous studies, Kaplan and colleagues worked out how hepcidin causes ferroportin to be carried into cells and degraded.

They discovered an enzyme named Jak2 changes or "phosphorylates" ferroportin so it can be carried into cells to be degraded.

In the new study, they showed the same Jak2 enzyme also phosphorylates or adds a phosphate molecule to Stat3, which is a protein that turns various genes on or off. In other words, Jak2 makes it possible for Stat3 to turn genes on or off.

The new study shows that "among the genes that are turned on are genes that reduce inflammation," Kaplan says.

Yet only a couple of the genes activated by Stat3 involve inflammation. What the rest of them do isn't known. So it's possible the iron metabolism process involving hepcidin, ferroportin, Jak2 and Stat3 may be involved in other processes in the body.

A Mystery of Evolution

Why would a hormone that regulates iron balance also combat inflammation?

"Our view is that this is a feedback system, so anytime in your body when you turn on a gene, there's always a mechanism by which you can turn it off or limit it," Kaplan says. "So here's a case where bacteria come in, turn on inflammation, and this hepcidin pathway we discovered is a way of limiting that. Inflammation is good, but too much inflammation is bad. So here is a way of regulating inflammation."

But, he adds, "How an antibacterial agent got to regulate iron and then got to reduce inflammation is one of the mysteries of evolution."

In addition to Kaplan, De Domenico and Ward, the study's coauthors are medical students Tian Zhang and Nyall London; physician Curry Koening, an assistant professor of rheumatology; Ryan Branch, a high school student who worked as a lab aide; Eric Lo, a lab technician; Raymond Daynes, a professor of pathology; James Kushner, a professor of hematology; and cardiologist Dean Li, a professor of internal medicine.

Story Source:

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

Journal Reference:

1. Ivana De Domenico, Tian Y. Zhang, Curry L. Koening, Ryan W. Branch, Nyall London, Eric Lo, Raymond A. Daynes, James P. Kushner, Dean Li, Diane M. Ward and Jerry Kaplan. **Hepcidin mediates transcriptional changes that modulate acute cytokine-induced inflammatory responses in mice**. *Journal of Clinical Investigation*, 2010; DOI: 10.1172/JCI42011

http://www.sciencedaily.com/releases/2010/06/100607122434.htm

Earth and Moon Formed Later Than Previously Thought, New Research Suggests

The planet Earth and the Moon are thought to have been created when the solar system was about 30 million years old, some 4.5 billion years ago. But new research shows that the Earth and Moon must have formed much later -- perhaps up to 150 million years after the formation of the solar system. (Credit: NASA/iStockphoto/Kirill Putchenko)

ScienceDaily (June 7, 2010) — Astronomers have theorized that the planet Earth and the Moon were created as the result of a giant collision between two planets the size of Mars and Venus. Until now, the collision was thought to have happened when the solar system was 30 million years old, or approximately 4,537 million years ago. But new research shows that Earth and the Moon must have formed much later -- perhaps up to 150 million years after the formation of the solar system.

The research results have been published in the scientific journal *Earth and Planetary Science Letters*.

"We have determined the ages of the Earth and the Moon using tungsten isotopes, which can reveal whether the iron cores and their stone surfaces have been mixed together during the collision," explains Tais W. Dahl, who did the research as his thesis project in geophysics at the Niels Bohr Institute at the University of Copenhagen in collaboration with professor David J. Stevenson from the California Institute of Technology (Caltech).

Turbulent collisions

The planets in the solar system are thought to have been created by collisions between small dwarf planets orbiting the newborn Sun. In the collisions, the small planets melted together and formed larger and larger planets. Earth and the Moon are believed to be the result of a gigantic collision between two planets the size of Mars and Venus. The two planets collided at a time when both had a core of metal (iron) and a surrounding mantle of silicates (rock). But when did it happen and how did it happen? The collision took place in less than 24 hours and the temperature of the Earth was so high (7000º C), that both rock and metal must have melted in the turbulent collision. But were the stone mass and iron mass also mixed together?

Until recently it was believed that the rock and iron mixed completely during the planet formation and so the conclusion was that the Moon was formed when the solar system was 30 million years old or approximately 4,537 million years ago. But new research shows something completely different.

Dating with radioactive elements

The age of Earth and the Moon can be dated by examining the presence of certain elements in Earth's mantle. Hafnium-182 is a radioactive substance, which decays and is converted into the isotope tungsten-182. The two elements have markedly different chemical properties and while the tungsten isotopes prefer to bond with metal, hafnium prefers to bond to silicates, i.e. rock.

It takes 50-60 million years for all hafnium to decay and be converted into tungsten, and during the Moon forming collision nearly all the metal sank into Earth's core. But did all the tungsten go into the core?

"We have studied to what degree metal and rock mix together during the planet forming collisions. Using dynamic model calculations of the turbulent mixing of the liquid rock and iron masses we have found that tungsten isotopes from the Earth's early formation remain in the rocky mantle," explains Dahl.

The new studies imply that the moon forming collision occurred after all of the hafnium had decayed completely into tungsten.

"Our results show that metal core and rock are unable to emulsify in these collisions between planets that are greater than 10 kilometres in diameter and therefore that most of the Earth's iron core (80-99 %) did not remove tungsten from the rocky material in the mantle during formation," explains Dahl.

The result of the research means that Earth and the Moon must have been formed much later than previously thought -- that is to say not 30 million years after the formation of the solar system 4,567 million years ago but perhaps up to 150 million years after the formation of the solar system.

Story Source:

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

Journal Reference:

1. Tais W. Dahl, David J. Stevenson. **Turbulent mixing of metal and silicate during planet accretion -- And interpretation of the Hf-W chronometer**. *Earth and Planetary Science Letters*, 2010; 295 (1-2): 177 DOI: 10.1016/j.epsl.2010.03.038

http://www.sciencedaily.com/releases/2010/06/100607111310.htm

Eat less, live longer?

- 03 June 2010 by **Laura Cassiday**

Magazine issue 2762.

Less is more (Image: Eisebhut & Mayer - Wein/Foodpix Artpartner-Images/Getty)

IN GREEK mythology, the tale of the Trojan prince Tithonus is a tragic one. His lover, the goddess Eos, asks Zeus to grant him eternal life, but forgets to specify eternal youth. Time passes, and while the goddess of dawn stays young and beautiful, Tithonus degenerates into bedridden senility. Eventually Eos shuts him in a chamber of her celestial palace, where his feeble voice can be heard begging for death.

Dreams of eternal youth feature in many cultures throughout history, but it was only in the 20th century that research into longevity really began. Much about ageing is still mysterious - we don't even know the underlying reasons why we journey into old age. There are many lines of enquiry into how to live longer, though, with one of the most intriguing being calorie restriction: in effect, going on a lifelong diet.

Calorie restriction dramatically extends not only the lifespan of laboratory animals, but also their "healthspan" - how long they live free of disease. On the assumption that it has the same effect in people, some individuals have already adopted a restricted diet. The latest evidence suggests that while calorie restriction is indeed beneficial for humans, when it comes to lifespan extension, it may not be the whole story.

The good news is that we might be able to delay ageing without cutting our food intake. "There's a definite possibility that if you balance the diet correctly, a longer lifespan can be achieved without full food restriction," says Matthew Piper, a researcher into ageing at University College London.

There is a definite possibility that if you balance the diet correctly, a longer lifespan can be achieved without full-on food restriction

Interest in calorie restriction began in 1935, when scientists made the surprising discovery that rats on a reduced-calorie diet lived longer, provided they were supplemented with sufficient vitamins and minerals.

The idea sounds counter-intuitive; after all, a state of starvation is not usually conducive to health. But there seems to be a window of benefit. While lifespan is reduced if calories are cut too drastically, it can be extended by cutting them moderately (see graph).

Calorie restriction has since been shown to extend the lives of other organisms including yeast, nematode worms, fruit flies and mice. Mice, for example, live up to 50 per cent longer if their calorie intake is cut by 30 to 50 per cent. What's more, mammals are protected from a number of age-associated maladies such as cancer, heart disease, type 2 diabetes and Alzheimer's disease.

It is unclear why eating less should make animals live longer. While a restricted diet triggers numerous changes at the molecular and genetic levels, only some of these are common across all the species tested. However, there does seem to be a general principle that a dearth of nutrients causes organisms to divert resources away from growth and reproduction and towards basic survival functions. From an evolutionary perspective, these adaptations could help an organism survive famine.

Longevity pioneers

The million-dollar question is whether calorie restriction has a similar effect in people. Humans are longer-lived and clearly harder to study than flies or mice, but recently two sources of evidence have hinted that it does.

The first comes from a 20-year study of rhesus macaques, a species obviously closer to humans than worms and mice. When the macaques were about 10 years old, equivalent to young adulthood in humans, half the group were placed on a diet in which they received 30 per cent fewer calories than the others. While none has yet beaten the record for the longest-lived macaque in captivity (about 40 years), the latest results, reported last year, look promising. About 80 per cent of the calorie-restricted monkeys were still alive when the study was published, beating the control group's survival rate of 50 per cent. And the dieting animals were one-third less likely to have died from an age-related disease (*Science*, vol 325, p 201).

The second strand of evidence comes from studying people who are practising calorie restriction. The first enthusiasts banded together through an email forum in the early 1990s. The group has since evolved into the Calorie Restriction Society International, which now has over 3000 members who refer to themselves as "CRONies", short for Calorie Restriction with Optimal Nutrition.

Needless to say, this lifestyle is not for everyone. Some people report struggling with hunger pangs, and the society warns on its website that side effects can include feeling cold, poor wound-healing and temporary infertility. But many CRONies insist that hunger is not a big problem and that they actually feel happier and healthier on their frugal diet (see "A day in the life of a CRONie").

CRONies typically cut calories by 10 to 30 per cent of the recommended intake, and most hover around the lower limit of "normal" body mass index, at 18.5 kilograms per height-in-metres squared. To ensure they get all the nutrients they need without busting their calorie quota, their diet is mainly vegetable-based and must be carefully planned, often with the help of a computer program. "People think calorie restriction involves tiny portions, but these people are eating huge amounts of low-calorie, nutrient-dense food," says Luigi Fontana, a professor of medicine at Washington University in St Louis and head of the Division of Nutrition and Aging at the Italian National Institute of Health, who has studied CRONies for the past eight years.

As with the macaques, it is too soon to tell if calorie restriction extends lifespan. The oldest people in Fontana's studies are only in their 70s - the average life expectancy for Americans. But there is evidence suggesting that it extends healthspan. In 2007, Fontana showed that CRONies have optimal metabolic profiles, and low blood pressure and cholesterol levels (*Experimental Gerontology*, vol 42, p 709). "They have hearts that are 15 years younger than those of typical Americans their age," he says.

So far, so good. But Fontana has found a notable difference in the way people and animals respond to calorie restriction, and it is not great news. It involves a hormone made by the liver called insulin-like growth factor 1.

IGF-1 has emerged as an important promoter of ageing. IGF-1 levels are lower than normal in worms, flies and mice on a restricted diet, and this is thought to be at least partly responsible for their longer lifespan. When it comes to people, however, CRONies have the same IGF-1 levels as the rest of us.

The explanation for this anomaly may lie in a new theory about how diet affects ageing. This says that it may not only be the drop in calories that is responsible for lifespan extension - in some species at least, perhaps it is also the accompanying drop in dietary protein.

One piece of evidence for this idea comes from studies in fruit flies and rodents. If these animals are fed special diets with less amino acids - the building blocks of proteins - they can eat as many calories as they want and still live longer. "These results clearly show that you don't need to restrict calories as a whole to get lifespan extension," says Piper, an author of the study on flies (*Nature*, vol 462, p 1061).

Further support for this idea comes from studying the molecular pathways inside cells that affect lifespan. A molecule called TOR has been found to set off a chain of reactions that boost cell growth at the expense of longevity. Blocking TOR increases lifespan in all organisms studied to date, including yeast and mice (*Aging Cell*, vol 9, p 105). Crucially, the most potent activators of TOR are amino acids.

Where does the protein theory leave the CRONies? Fontana noticed that the people in his study group were eating high levels of protein, about 1.7 grams per kilogram of body weight per day. This is more than the US government-recommended intake of 0.8 g/kg/day, and higher than that in a typical American's diet, about 1.2 g/kg/day.

Accelerated ageing

So Fontana asked six CRONies to cut their protein intake to 0.95 g/kg/day while maintaining their usual calorie intake. After only three weeks on the low-protein diet, the CRONies showed a 25 per cent drop in their levels of IGF-1 (*Aging Cell*, vol 7, p 681). "Even if the CRONies are restricting their calories severely, if they're eating a high-protein diet, they're probably negating some of the most important beneficial effects," says Fontana.

If the new theory is right, then the whole concept of calorie restriction needs to be rethought. The very term would be misleading; Fontana and others have started referring to dietary restriction instead. As news of the study has spread, some CRONies have already reduced their protein intake.

The protein theory is bad news for people on low-carbohydrate weight-loss plans like the Atkins diet. "I'd be wary of diets that put a heavy emphasis on protein," says Piper. "It's hard to see how that could be healthy." Fontana goes one step further, saying that high-protein diets could risk accelerated ageing and cancer.

It's good news, however, for people already on low-protein diets, like vegans, who avoid eating meat, eggs and dairy products. In 2007, Fontana showed that vegans have lower levels of IGF-1 than meat-eaters (*Rejuvenation Research*, vol 10, p 225).

There may be another reason for vegans to celebrate. Studies on flies and rodents suggest that cutting intake of one particular amino acid, called methionine, lengthens life to a similar degree as calorie restriction. Proteins in meat and other animal products have high levels of methionine, so a vegan diet would score well by that measure, too (*Medical Hypotheses*, vol 72, p 125).

If calorie restriction would be hard for most people, calorie *and* protein restriction would be doubly so. Those determined to live to 130 may want to give it a shot, but for the rest of us, simply sticking to recommended dietary protein levels could have benefits for both lifespan and healthspan. "Protein restriction is much less difficult to maintain than [calorie] restriction and may be more powerful in reducing IGF-1 in humans," Fontana said in a recent review (*Science*, vol 328, p 321).

For those who don't fancy changing their diet, a more tempting prospect is a pill that replicates the effects without the hard work. Drug firms have taken a keen interest in trying to find such calorie-restriction mimetics, as they are sometimes called.

A decade ago the main focus was on signalling molecules called sirtuins that reduce the expression of several ageing-related genes. Reports that resveratrol, a compound found in red wine, extended lifespan in some species by activating sirtuins boosted sales of red wine and resveratrol supplements. Resveratrol still has supporters, but inconsistent animal data have since dampened much of the enthusiasm.

The focus has lately switched to finding compounds that block TOR. One such agent is a drug called rapamycin, an immunosuppressant given to recipients of organ transplants. Last year rapamycin was found to extend the lifespan of mice, even in those started on the drug in later life, equivalent to 60-year-old humans (*Nature*, vol 460, p 392). However, because people don't live in a sanitised lab environment, rapamycin's strong immunosuppressive effects make it an unlikely candidate for a practical anti-ageing drug. Similar compounds that are less toxic would be more promising.

Another candidate is a drug called metformin, already used to treat type 2 diabetes. Metformin also blocks TOR, and lengthens lifespan in worms and mice (*Cell Metabolism*, vol 11, p 390). Does metformin slow ageing in people too? Studies published earlier this year suggest that diabetics taking metformin do get less cancer (*Diabetes Care*, vol 33, p 322). "The major risk factor for cancer, above all others, is ageing," says David Gems at University College London. He calls the studies a "smoking gun of a more generalised effect of metformin on ageing, rather than just strictly diabetes".

While metformin is less toxic than rapamycin, it, too, can have side effects, such as nausea and diarrhoea. So researchers may have a way to go before they find the perfect longevity pill.

And it would be premature to consider the case proven for the protein theory of lifespan extension. Even Fontana acknowledges there may be other nutrients that play a role, such as fatty acids or cholesterol. Others have speculated that it may be the ratio of calories to protein that is key.

In the meantime, the best bet for warding off ageing and disease could still be the time-honoured advice to eat your greens. Perhaps if vegetables had been the food of the gods, Tithonus could have enjoyed a few more quality years with Eos.

A day in the life of a CRONie

Paige Collins-Rideout, a 39-year-old medical transcriptionist in Blue Ridge, Georgia, does not look like she needs to diet, but that is exactly what she is doing. Collins-Rideout is a CRONie (which stands for Calorie Restriction with Optimal Nutrition), a member of a group who believe that eating a carefully controlled diet with 10 to 30 per cent fewer calories than recommended is key to a longer, healthier life.

For the past year-and-a-half, Collins-Rideout has been limiting her food intake to 1500 calories per day. At 1.7 metres (5 feet, 6 inches) tall, she weighs only 50 kilograms (110 pounds).

Vitamin-rich foods such as sweet potatoes, broccoli, spinach, eggs and whole grains are staples of Collins-Rideout's diet. Perhaps surprisingly, she says she is rarely hungry, although she admits to occasionally succumbing to unhealthy snacks like fried jalapeños. "Once in a great while I'll have something like that," she says. "Then I'm ready to go back to healthy eating."

There are downsides. Because it is hard to get the recommended levels of vitamins and minerals without supplements, which CRONies generally avoid, calorie restrictors often invest a great deal of time in planning and tracking their diet. To avoid becoming too underweight, Collins-Rideout has also cut back on her running - she used to jog 5 kilometres per day. She also says that social eating can be difficult.

But she says benefits of her diet include improved mood, sleep, mental clarity and memory. She has no desire to live to be 100, though. "My goal is to slow the ageing process so that when I get to retirement, I'll have the energy and vitality to actually live," she says. "I can't imagine going back to any other way of life."

Laura Cassiday is a science journalist based in Denver, Colorado

http://www.newscientist.com/article/mg20627621.100-eat-less-live-longer.html

Findings May Alter Care for Early Breast Cancer

By ANDREW POLLACK

CHICAGO — For many women with early-stage breast cancer, treatment may become considerably less arduous, researchers say.

A new study found that certain women getting a lumpectomy may not need an operation to remove underarm lymph nodes, a procedure that can leave them with painfully swollen arms. Compared with not removing the nodes, the surgery did not prolong survival or prevent recurrence of the cancer.

And a second study found that a single dose of radiation, delivered directly to the site of the tumor right after a woman has a lumpectomy, was as effective as the six or so weeks of daily radiation treatments that most women now endure.

“We’re now getting really good long-term survival for breast cancer,” said Michael Baum of University College London, the lead investigator of the radiation study, which was presented here at the annual meeting of the American Society of Clinical Oncology. “The theme is now how can we improve the quality of life for women.”

There is some controversy about whether women should be treated at all for certain early breast abnormalities that some experts say may never hurt them. But if a woman is to be treated, doctors would agree the treatment should be as painless and convenient as possible while retaining effectiveness.

Removal of the underarm lymph nodes next to a cancerous breast was long the standard treatment. In the 1990s doctors began to remove and examine only the sentinel node, the one to which cancer would be likely to spread first. Usually the other nodes are removed only if cancer is found in the sentinel node, which happens in about one quarter of cases.

The more extensive removal, called axillary node dissection, can cause restricted mobility of the arm and painfully swollen arms or fingers.

The study presented here involved 991 women who had had lumpectomies, radiation therapy and a positive sentinel lymph node. Half had the other lymph nodes removed and the others did not.

After five years there was no difference in survival or disease recurrence between the two groups. Some 82.2 percent of the women who had the dissection were alive and disease free compared with 83.8 percent of those who did not. Cancer recurred in the breast or nearby in 4.3 percent of those who had the operation and 3.4 percent in those who did not.

“The evidence is overwhelming that the operation might not be necessary,” the lead investigator, Dr. Armando Giuliano of the John Wayne Cancer Institute in Santa Monica, Calif., said.

About a quarter of women had cancer in the nodes other than the sentinel one, based on the results from those who had the nodes removed. But somehow, this residual cancer did not hurt the patient. That is perhaps because of the radiation the women received. For that reason, Dr. Giuliano said, the results of the study apply

only to women who undergo a lumpectomy followed by radiation, not women who undergo complete breast removal, who do not typically get radiotherapy.

One shortcoming was that the trial enrolled only about half the number of patients intended, limiting its ability to draw conclusions. Dr. Giuliano said doctors and patients were reluctant to participate because they feared forgoing node dissection would endanger lives.

Dr. Jennifer K. Litton, a breast cancer specialist at the M. D. Anderson Cancer Center in Houston, said the results could change practice but added, "I don't think this is going to change overnight."

She said the study involved only women with tumors that had a relatively favorable prognosis and longer follow-up was needed because cancer can recur after five years.

The radiation study tested a procedure that uses a probe to deliver a high dose of radiation directly into the breast where the tumor has been removed by lumpectomy and while the woman is still under anesthesia. Some women undergo a mastectomy instead of more limited breast-conserving surgery because they do not want the weeks of radiation therapy or live too far from a radiation center.

Dr. Dennis R. Holmes of the University of Southern California, who was one of the investigators in the trial, said one of his patients ran a marathon two weeks after getting the one-time shot of radiation. "That would have been very unlikely in someone receiving standard breast radiotherapy," he said.

The study involved 2,232 women. After about four years, there were six recurrences within the affected breast in the women who received the single-dose, or intraoperative, radiation and five cases among those who received conventional radiotherapy.

Statistically, the experimental procedure was "non-inferior" to the standard practice. The frequency of major toxicity was similar in the two groups, the authors reported in The Lancet, which published the study online on Saturday. The trial was designed by academic investigators and mainly paid for by University College London Hospitals and the British and German governments. Carl Zeiss, the company that makes the machine used, picked up some expenses. Dr. Baum, the lead investigator, is a consultant to the company.

Dr. Bruce G. Haffty, chairman of radiation oncology at the Robert Wood Johnson Medical School in New Jersey, said "the follow-up isn't as long as you'd like it to be." He said cancer can recur after four years and a large dose of radiation can cause tissue damage that might not show up for three to 10 years.

An earlier version of this article ambiguously described the nature of a lumpectomy. The wording has been clarified.

http://www.nytimes.com/2010/06/08/health/08canc.html?nl=health&emc=healthupdateema2

Dengue fever strikes US

- 02 June 2010

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Knocking out the source (Image: Jorge Saenz/AP/PA)

DENGUE fever has re-entered the US via the Florida Keys after an absence of 65 years.

The mosquito-borne virus has been identified in 28 people from Key West by the US Centers for Disease Control. The CDC announced the findings last week in its Morbidity and Mortality Weekly Report.

"We don't know for sure that this hasn't happened before without being noticed," says Christopher Gregory of the CDC's dengue branch in San Juan, Puerto Rico. "It could be the tip of the iceberg."

Most cases resolve after flu-like symptoms, says Gregory. He says the best precaution is to empty standing water from potential mosquito breeding grounds, such as birdbaths.

Gregory says the blame for this dramatic rise could lie with increased travel between the US and South and Central America and the Caribbean - areas which have seen nearly 5 million cases of dengue fever from 2000 to 2007. Infected mosquitoes have also been moving northwards, thanks to global warming.

Dan Epstein of the Pan American Health Organization in Washington DC is worried that these two factors could lead to outbreaks of dengue haemorrhagic fever, the most severe and lethal form of the disease, which is present in South America.

Gregory is more concerned about the potential spread of chikungunya, an incurable mosquito-borne virus, that causes crippling arthritis-like symptoms. It's only a matter of time before it reaches the US, he says.

http://www.newscientist.com/article/mg20627632.500-dengue-fever-strikes-us.html

Later menopause for women with polycystic ovaries

- 10:00 08 June 2010 by **Jessica Hamzelou**

GOOD news for women with polycystic ovary syndrome – not normally a cause for celebration. Not only are they just as likely to have children as any other woman, but they have a better chance of conceiving later in life.

Women with PCOS produce more follicles in the ovary every month than is usual. This interferes with normal hormonal activity and decreases fertility.

Last year it turned out that women with PCOS actually had as many babies as those with normal ovaries. The natural decline in follicles that happens with age was working to their advantage.

Later menopause

Fahimeh Ramezani Tehrani and colleagues at Shahid Behesht University in Iran wondered if they might also reach menopause later.

The team compared 85 women with PCOS and 89 controls on three occasions over six years, They were looking at blood levels of AMT – a hormone used as a marker of ovarian ageing.

They found that AMH declined to menopausal levels two years later in the PCOS group. This suggests that they have a better chance of conceiving at a later age.

Journal reference: *Human Reproduction*, DOI: 10.1093/humrep/deq088

http://www.newscientist.com/article/dn19012-later-menopause-for-women-with-polycystic-ovaries.html

She Doesn't Trust You? Blame the Testosterone

By NICHOLAS WADE

The glue that binds a human society together is trust. But people who trust others too much are likely to get taken for a ride. Both trust and distrust, it now seems, are influenced by hormones that can induce people to ratchet their feeling of trust up or down.

The trust side of the equation is mediated by a brain hormone known as oxytocin. A soft touch or caress will send a pulse of oxytocin into a person's bloodstream. Swiss researchers found in 2005 that a squirt of oxytocin would make players in an investment game more willing to hand over their money to strangers.

It may seem strange that there is a hormonal influence in such a delicate calculation as to whether or not to trust someone. But perhaps trust is so important to a society's survival that natural selection has generated a hormonal basis for it.

In any event, trust has a downside — one may hand over too much money to a Mr. Madoff who promises to generate steady returns in both up and down markets. There needs to be an antidote to oxytocin that makes a person keep those warm, fuzzy feelings suppressed in the appropriate circumstances.

Researchers at Utrecht University in Holland now report that they have identified this antidote: it is testosterone. They gave young women a dose of the hormone in the form of a drop of liquid placed under the tongue, then asked them to judge the trustworthiness of a series of men's faces shown in photographs. The women were significantly less inclined to trust a face when given testosterone than when they had taken a placebo, the Dutch team reported last month in The Proceedings of the National Academy of Sciences.

But this alerting effect was not the same for all subjects. The women who were least trusting anyway, as judged by the placebo test, were affected hardly at all by testosterone. It was the trusting women whose attitude was changed most by the hormone, as might be expected if natural selection had developed the system for those most in need of protection.

"Testosterone decreases interpersonal trust and in an apparently adaptive manner," the researchers conclude.

In many mammals, testosterone's effect on social behavior is mostly to promote aggression when individuals compete for social status or resources. The Dutch team see the hormone's role in people in a more benevolent light. "In humans, however, the hormone seems to motivate for rational decision-making, social scrutiny and cleverness, the apparent tools for success in a modern society," they write.

Marc Hauser, an evolutionary biologist at Harvard, said the new finding was "very significant" and opened the door to studying the mechanisms that guide trust, social relationships and a sense of fairness, as well as the sources of variation between people.

Testosterone is known from other studies to enhance a woman's libido, and there is a peak in production of the hormone just before ovulation. From an evolutionary perspective it seems natural that a woman should be most interested in sex when she is likeliest to conceive. But how does the hormone's property of enhancing distrust fit into the picture. "Heightened skepticism about a potential mate's trustworthiness also makes

evolutionary sense in scenarios where a father's ongoing support is crucial for the survival of the infant," write Ryan T. Johnson and S. Marc Breedlove of Michigan State University in a commentary.

So guys, you knew women were complex, but it is even worse than you thought: at the moment you are most desired, you are least trusted.

This article has been revised to reflect the following correction:

http://www.nytimes.com/2010/06/08/health/08hormone.html?ref=research

Hooked on Gadgets, and Paying a Mental Price

By MATT RICHTEL

SAN FRANCISCO — When one of the most important e-mail messages of his life landed in his in-box a few years ago, Kord Campbell overlooked it.

Not just for a day or two, but 12 days. He finally saw it while sifting through old messages: a big company wanted to buy his Internet start-up.

“I stood up from my desk and said, ‘Oh my God, oh my God, oh my God,’ ” Mr. Campbell said. “It’s kind of hard to miss an e-mail like that, but I did.”

The message had slipped by him amid an electronic flood: two computer screens alive with e-mail, instant messages, online chats, a Web browser and the computer code he was writing.

While he managed to salvage the $1.3 million deal after apologizing to his suitor, Mr. Campbell continues to struggle with the effects of the deluge of data. Even after he unplugs, he craves the stimulation he gets from his electronic gadgets. He forgets things like dinner plans, and he has trouble focusing on his family.

His wife, Brenda, complains, “It seems like he can no longer be fully in the moment.”

This is your brain on computers.

Scientists say juggling e-mail, phone calls and other incoming information can change how people think and behave. They say our ability to focus is being undermined by bursts of information.

These play to a primitive impulse to respond to immediate opportunities and threats. The stimulation provokes excitement — a dopamine squirt — that researchers say can be addictive. In its absence, people feel bored.

The resulting distractions can have deadly consequences, as when cellphone-wielding drivers and train engineers cause wrecks. And for millions of people like Mr. Campbell, these urges can inflict nicks and cuts on creativity and deep thought, interrupting work and family life.

While many people say multitasking makes them more productive, research shows otherwise. Heavy multitaskers actually have more trouble focusing and shutting out irrelevant information, scientists say, and they experience more stress.

And scientists are discovering that even after the multitasking ends, fractured thinking and lack of focus persist. In other words, this is also your brain *off* computers.

“The technology is rewiring our brains,” said Nora Volkow, director of the National Institute of Drug Abuse and one of the world’s leading brain scientists. She and other researchers compare the lure of digital stimulation less to that of drugs and alcohol than to food and sex, which are essential but counterproductive in excess.

Technology use can benefit the brain in some ways, researchers say. Imaging studies show the brains of Internet users become more efficient at finding information. And players of some video games develop better visual acuity.

More broadly, cellphones and computers have transformed life. They let people escape their cubicles and work anywhere. They shrink distances and handle countless mundane tasks, freeing up time for more exciting pursuits.

For better or worse, the consumption of media, as varied as e-mail and TV, has exploded. In 2008, people consumed three times as much information each day as they did in 1960. And they are constantly shifting their attention. Computer users at work change windows or check e-mail or other programs nearly 37 times an hour, new research shows.

The nonstop interactivity is one of the most significant shifts ever in the human environment, said Adam Gazzaley, a neuroscientist at the University of California, San Francisco.

“We are exposing our brains to an environment and asking them to do things we weren’t necessarily evolved to do,” he said. “We know already there are consequences.”

Mr. Campbell, 43, came of age with the personal computer, and he is a heavier user of technology than most. But researchers say the habits and struggles of Mr. Campbell and his family typify what many experience — and what many more will, if trends continue.

For him, the tensions feel increasingly acute, and the effects harder to shake.

The Campbells recently moved to California from Oklahoma to start a software venture. Mr. Campbell's life revolves around computers. (View a slide show on how the Campbells interact with technology.)

He goes to sleep with a laptop or iPhone on his chest, and when he wakes, he goes online. He and Mrs. Campbell, 39, head to the tidy kitchen in their four-bedroom hillside rental in Orinda, an affluent suburb of San Francisco, where she makes breakfast and watches a TV news feed in the corner of the computer screen while he uses the rest of the monitor to check his e-mail.

Major spats have arisen because Mr. Campbell escapes into video games during tough emotional stretches. On family vacations, he has trouble putting down his devices. When he rides the subway to San Francisco, he knows he will be offline 221 seconds as the train goes through a tunnel.

Their 16-year-old son, Connor, tall and polite like his father, recently received his first C's, which his family blames on distraction from his gadgets. Their 8-year-old daughter, Lily, like her mother, playfully tells her father that he favors technology over family.

"I would love for him to totally unplug, to be totally engaged," says Mrs. Campbell, who adds that he becomes "crotchety until he gets his fix." But she would not try to force a change.

"He loves it. Technology is part of the fabric of who he is," she says. "If I hated technology, I'd be hating him, and a part of who my son is too."

Always On

Mr. Campbell, whose given name is Thomas, had an early start with technology in Oklahoma City. When he was in third grade, his parents bought him Pong, a video game. Then came a string of game consoles and PCs, which he learned to program.

In high school, he balanced computers, basketball and a romance with Brenda, a cheerleader with a gorgeous singing voice. He studied too, with focus, uninterrupted by e-mail. "I did my homework because I needed to get it done," he said. "I didn't have anything else to do."

He left college to help with a family business, then set up a lawn mowing service. At night he would read, play video games, hang out with Brenda and, as she remembers it, "talk a lot more."

In 1996, he started a successful Internet provider. Then he built the start-up that he sold for $1.3 million in 2003 to LookSmart, a search engine.

Mr. Campbell loves the rush of modern life and keeping up with the latest information. "I want to be the first to hear when the aliens land," he said, laughing. But other times, he fantasizes about living in pioneer days when things moved more slowly: "I can't keep everything in my head."

No wonder. As he came of age, so did a new era of data and communication.

At home, people consume 12 hours of media a day on average, when an hour spent with, say, the Internet and TV simultaneously counts as two hours. That compares with five hours in 1960, say researchers at the

University of California, San Diego. Computer users visit an average of 40 Web sites a day, according to research by RescueTime, which offers time-management tools.

As computers have changed, so has the understanding of the human brain. Until 15 years ago, scientists thought the brain stopped developing after childhood. Now they understand that its neural networks continue to develop, influenced by things like learning skills.

So not long after Eyal Ophir arrived at Stanford in 2004, he wondered whether heavy multitasking might be leading to changes in a characteristic of the brain long thought immutable: that humans can process only a single stream of information at a time.

Going back a half-century, tests had shown that the brain could barely process two streams, and could not simultaneously make decisions about them. But Mr. Ophir, a student-turned-researcher, thought multitaskers might be rewiring themselves to handle the load.

His passion was personal. He had spent seven years in Israeli intelligence after being weeded out of the air force — partly, he felt, because he was not a good multitasker. Could his brain be retrained?

Mr. Ophir, like others around the country studying how technology bent the brain, was startled by what he discovered.

The Myth of Multitasking

The test subjects were divided into two groups: those classified as heavy multitaskers based on their answers to questions about how they used technology, and those who were not.

In a test created by Mr. Ophir and his colleagues, subjects at a computer were briefly shown an image of red rectangles. Then they saw a similar image and were asked whether any of the rectangles had moved. It was a simple task until the addition of a twist: blue rectangles were added, and the subjects were told to ignore them. (

The multitaskers then did a significantly worse job than the non-multitaskers at recognizing whether red rectangles had changed position. In other words, they had trouble filtering out the blue ones — the irrelevant information.

So, too, the multitaskers took longer than non-multitaskers to switch among tasks, like differentiating vowels from consonants and then odd from even numbers. The multitaskers were shown to be less efficient at juggling problems.

Other tests at Stanford, an important center for research in this fast-growing field, showed multitaskers tended to search for new information rather than accept a reward for putting older, more valuable information to work.

Researchers say these findings point to an interesting dynamic: multitaskers seem more sensitive than non-multitaskers to incoming information.

The results also illustrate an age-old conflict in the brain, one that technology may be intensifying. A portion of the brain acts as a control tower, helping a person focus and set priorities. More primitive parts of the brain, like those that process sight and sound, demand that it pay attention to new information, bombarding the control tower when they are stimulated.

Researchers say there is an evolutionary rationale for the pressure this barrage puts on the brain. The lower-brain functions alert humans to danger, like a nearby lion, overriding goals like building a hut. In the modern world, the chime of incoming e-mail can override the goal of writing a business plan or playing catch with the children.

“Throughout evolutionary history, a big surprise would get everyone’s brain thinking,” said Clifford Nass, a communications professor at Stanford. “But we’ve got a large and growing group of people who think the slightest hint that something interesting might be going on is like catnip. They can’t ignore it.”

Mr. Nass says the Stanford studies are important because they show multitasking’s lingering effects: “The scary part for guys like Kord is, they can’t shut off their multitasking tendencies when they’re not multitasking.”

Melina Uncapher, a neurobiologist on the Stanford team, said she and other researchers were unsure whether the muddied multitaskers were simply prone to distraction and would have had trouble focusing in any era. But she added that the idea that information overload causes distraction was supported by more and more research.

A study at the University of California, Irvine, found that people interrupted by e-mail reported significantly increased stress compared with those left to focus. Stress hormones have been shown to reduce short-term memory, said Gary Small, a psychiatrist at the University of California, Los Angeles.

Preliminary research shows some people can more easily juggle multiple information streams. These “supertaskers” represent less than 3 percent of the population, according to scientists at the University of Utah.

Other research shows computer use has neurological advantages. In imaging studies, Dr. Small observed that Internet users showed greater brain activity than nonusers, suggesting they were growing their neural circuitry.

At the University of Rochester, researchers found that players of some fast-paced video games can track the movement of a third more objects on a screen than nonplayers. They say the games can improve reaction and the ability to pick out details amid clutter.

“In a sense, those games have a very strong both rehabilitative and educational power,” said the lead researcher, Daphne Bavelier, who is working with others in the field to channel these changes into real-world benefits like safer driving.

There is a vibrant debate among scientists over whether technology’s influence on behavior and the brain is good or bad, and how significant it is.

"The bottom line is, the brain is wired to adapt," said Steven Yantis, a professor of brain sciences at Johns Hopkins University. "There's no question that rewiring goes on all the time," he added. But he said it was too early to say whether the changes caused by technology were materially different from others in the past.

Mr. Ophir is loath to call the cognitive changes bad or good, though the impact on analysis and creativity worries him.

He is not just worried about other people. Shortly after he came to Stanford, a professor thanked him for being the one student in class paying full attention and not using a computer or phone. But he recently began using an iPhone and noticed a change; he felt its pull, even when playing with his daughter.

"The media is changing me," he said. "I hear this internal ping that says: check e-mail and voice mail."

"I have to work to suppress it."

Kord Campbell does not bother to suppress it, or no longer can.

Interrupted by a Corpse

It is a Wednesday in April, and in 10 minutes, Mr. Campbell has an online conference call that could determine the fate of his new venture, called Loggly. It makes software that helps companies understand the clicking and buying patterns of their online customers.

Mr. Campbell and his colleagues, each working from a home office, are frantically trying to set up a program that will let them share images with executives at their prospective partner.

But at the moment when Mr. Campbell most needs to focus on that urgent task, something else competes for his attention: "Man Found Dead Inside His Business."

That is the tweet that appears on the left-most of Mr. Campbell's array of monitors, which he has expanded to three screens, at times adding a laptop and an iPad.

On the left screen, Mr. Campbell follows the tweets of 1,100 people, along with instant messages and group chats. The middle monitor displays a dark field filled with computer code, along with Skype, a service that allows Mr. Campbell to talk to his colleagues, sometimes using video. The monitor on the right keeps e-mail, a calendar, a Web browser and a music player.

Even with the meeting fast approaching, Mr. Campbell cannot resist the tweet about the corpse. He clicks on the link in it, glances at the article and dismisses it. "It's some article about something somewhere," he says, annoyed by the ads for jeans popping up.

The program gets fixed, and the meeting turns out to be fruitful: the partners are ready to do business. A colleague says via instant message: "YES."

Other times, Mr. Campbell's information juggling has taken a more serious toll. A few weeks earlier, he once again overlooked an e-mail message from a prospective investor. Another time, Mr. Campbell signed the

company up for the wrong type of business account on Amazon.com, costing $300 a month for six months before he got around to correcting it. He has burned hamburgers on the grill, forgotten to pick up the children and lingered in the bathroom playing video games on an iPhone.

Mr. Campbell can be unaware of his own habits. In a two-and-a-half hour stretch one recent morning, he switched rapidly between e-mail and several other programs, according to data from RescueTime, which monitored his computer use with his permission. But when asked later what he was doing in that period, Mr. Campbell said he had been on a long Skype call, and "may have pulled up an e-mail or two."

The kind of disconnection Mr. Campbell experiences is not an entirely new problem, of course. As they did in earlier eras, people can become so lost in work, hobbies or TV that they fail to pay attention to family.

Mr. Campbell concedes that, even without technology, he may work or play obsessively, just as his father immersed himself in crossword puzzles. But he says this era is different because he can multitask anyplace, anytime.

"It's a mixed blessing," he said. "If you're not careful, your marriage can fall apart or your kids can be ready to play and you'll get distracted."

The Toll on Children

Father and son sit in armchairs. Controllers in hand, they engage in a fierce video game battle, displayed on the nearby flat-panel TV, as Lily watches.

They are playing Super Smash Bros. Brawl, a cartoonish animated fight between characters that battle using anvils, explosives and other weapons.

"Kill him, Dad," Lily screams. To no avail. Connor regularly beats his father, prompting expletives and, once, a thrown pillow. But there is bonding and mutual respect.

"He's a lot more tactical," says Connor. "But I'm really good at quick reflexes."

Screens big and small are central to the Campbell family's leisure time. Connor and his mother relax while watching TV shows like "Heroes." Lily has an iPod Touch, a portable DVD player and her own laptop, which she uses to watch videos, listen to music and play games.

Lily, a second-grader, is allowed only an hour a day of unstructured time, which she often spends with her devices. The laptop can consume her.

"When she's on it, you can holler her name all day and she won't hear," Mrs. Campbell said.

Researchers worry that constant digital stimulation like this creates attention problems for children with brains that are still developing, who already struggle to set priorities and resist impulses.

Connor's troubles started late last year. He could not focus on homework. No wonder, perhaps. On his bedroom desk sit two monitors, one with his music collection, one with Facebook and Reddit, a social site with news links that he and his father love. His iPhone availed him to relentless texting with his girlfriend.

When he studied, "a little voice would be saying, 'Look up' at the computer, and I'd look up," Connor said. "Normally, I'd say I want to only read for a few minutes, but I'd search every corner of Reddit and then check Facebook."

His Web browsing informs him. "He's a fact hound," Mr. Campbell brags. "Connor is, other than programming, extremely technical. He's 100 percent Internet savvy."

But the parents worry too. "Connor is obsessed," his mother said. "Kord says we have to teach him balance."

So in January, they held a family meeting. Study time now takes place in a group setting at the dinner table after everyone has finished eating. It feels, Mr. Campbell says, like togetherness.

No Vacations

For spring break, the family rented a cottage in Carmel, Calif. Mrs. Campbell hoped everyone would unplug.

But the day before they left, the iPad from Apple came out, and Mr. Campbell snapped one up. The next night, their first on vacation, "We didn't go out to dinner," Mrs. Campbell mourned. "We just sat there on our devices."

She rallied the troops the next day to the aquarium. Her husband joined them for a bit but then begged out to do e-mail on his phone.

Later she found him playing video games.

The trip came as Mr. Campbell was trying to raise several million dollars for his new venture, a goal that he achieved. Brenda said she understood that his pursuit required intensity but was less understanding of the accompanying surge in video game.

His behavior brought about a discussion between them. Mrs. Campbell said he told her that he was capable of logging off, citing a trip to Hawaii several years ago that they called their second honeymoon.

"What trip are you thinking about?" she said she asked him. She recalled that he had spent two hours a day online in the hotel's business center.

On Thursday, their fourth day in Carmel, Mr. Campbell spent the day at the beach with his family. They flew a kite and played whiffle ball.

Connor unplugged too. "It changes the mood of everything when everybody is present," Mrs. Campbell said.

The next day, the family drove home, and Mr. Campbell disappeared into his office.

Technology use is growing for Mrs. Campbell as well. She divides her time between keeping the books of her husband's company, homemaking and working at the school library. She checks e-mail 25 times a day, sends texts and uses Facebook.

Recently, she was baking peanut butter cookies for Teacher Appreciation Day when her phone chimed in the living room. She answered a text, then became lost in Facebook, forgot about the cookies and burned them. She started a new batch, but heard the phone again, got lost in messaging, and burned those too. Out of ingredients and shamed, she bought cookies at the store.

She feels less focused and has trouble completing projects. Some days, she promises herself she will ignore her device. "It's like a diet — you have good intentions in the morning and then you're like, 'There went that,' " she said.

Mr. Nass at Stanford thinks the ultimate risk of heavy technology use is that it diminishes empathy by limiting how much people engage with one another, even in the same room.

"The way we become more human is by paying attention to each other," he said. "It shows how much you care."

That empathy, Mr. Nass said, is essential to the human condition. "We are at an inflection point," he said. "A significant fraction of people's experiences are now fragmented."

http://www.nytimes.com/2010/06/07/technology/07brain.html?ref=research

Gut bacteria may contribute to autism

- 13:56 07 June 2010 by **Linda Geddes**

Children with autism appear to have a characteristic chemical signature in their urine which might form the basis of an early diagnostic test for the condition.

The finding also adds weight the hypothesis that substances released by gut bacteria are contributing to the onset of the condition.

Autism has previously been linked to metabolic abnormalities and gastrointestinal problems such as gut pain and diarrhoea. Several studies have also hinted at changes in gut bacteria in the faeces of children with autism.

To investigate whether signs of these metabolic changes might be detectable in children's urine, Jeremy Nicholson and colleagues at Imperial College London investigated 39 children with autism, 28 of their non-autistic siblings and 34 unrelated children.

Chemical fingerprint

Using nuclear magnetic resonance (NMR) spectroscopy to analyse the children's urine, they found that each of these groups had a distinct chemical fingerprint, with clear and significant differences between children with autism and unrelated controls.

"The signature that comes up is related to gut bacteria," says Nicholson. It is not yet clear whether the bacteria's metabolic products contribute to the development of autism, but it is a possibility worth investigating, he adds. A large proportion of autistic children have severe gastrointestinal problems that tend to appear at about the same time as the behavioural symptoms.

"It adds another link to the gut bacterial involvement in the onset of disorder," says Glenn Gibson of the University of Reading, UK, who has previously identified abnormally high levels of clostridium bacteria in children with autism.

One possibility is that the gut bacteria in children with autism are producing toxins that might interfere with brain development. One of the compounds identified in the urine of autistic children was *N*-methyl-nicotinamide (NMND), which has also been implicated in Parkinson's disease.

Inducing autism

Meanwhile, Derrick MacFabe of the University of Western Ontario in London, Canada, and his colleagues have found that short-chain fatty acids produced by clostridium bacteria can induce reversible autism-like behavioural and biochemical changes in rats.

"Nicholson's study did find some biomarkers of gut clostridial populations that we think contribute to autistic symptoms," says MacFabe, who presented his findings at a meeting of the International Society for Autism Research in Philadelphia, Pennsylvania, last month.

Nicholson emphasises that further research is needed to confirm whether bacteria really are contributing to autism, and if so, how. He also stresses that his findings in no way support claims of a link between vaccines and autism.

Even if bacteria are not actually contributing to the observed metabolic changes, they could still be put to use. "There is probably the basis of a test for autism based on a urinary metabolic profile," says Nicholson.

Early treatment

Autism is currently diagnosed using a series of behavioural tests, and while children can show symptoms of the condition when as young as 5 months old, a clear diagnosis is not usually possible until they are age 2 or 3 years. This is problematic, because there is growing evidence that the earlier behavioural therapies for autism are started, the better the chances of children being able to lead relatively normal lives.

"If you could identify kids who were at risk much earlier by a chemical test rather than by observing the manifestation of full-blown behaviour, we could get them into therapy much earlier," says Nicholson.

The next step is to confirm the results in a much larger group of age-matched children, as well as following high-risk children from birth in order to identify whether there are markers that precede the development of autistic symptoms.

Journal reference: *Journal of Proteome Research*, DOI:10.1021/pr901188e

http://www.newscientist.com/article/dn19011-gut-bacteria-may-contribute-to-autism.html

Unconscious purchasing urges revealed by brain scans

- 15:56 09 June 2010 by **Ewen Callaway**
- For similar stories, visit the **The Human Brain** Topic Guide

You spend more time window shopping than you may realise. Whether someone intends to buy a product or not can be predicted from their brain activity – even when they are not consciously pondering their choices.The ability to predict from brain scans alone what a person intends to buy, while leaving the potential buyer none the wiser, could bring much-needed rigour to efforts to meld marketing and neuroscience, says Brian Knutson, a neuroscientist at Stanford University in California who was not involved in the research.

Neuromarketing, as this field is known, has been employed by drug firms, Hollywood studios and even the Campbell Soup Company to sell their wares, despite little published proof of its effectiveness.Rather than soup, John-Dylan Haynes at the Bernstein Center for Computational Neuroscience in Berlin, Germany, attempted to predict which cars people might unconsciously favour. To do so, he and colleague Anita Tusche used functional MRI to scan the brains of two groups of male volunteers, aged 24 to 32, while they were presented with images of a variety of cars.One group was asked to rate their impressions of the vehicles, while the second performed a distracting visual task while cars were presented in the background. Each volunteer was then shown three cars and asked which they would prefer to buy.

First impressions

The researchers found that when volunteers first viewed the car that they would subsequently "buy", specific patterns of brain activity could be seen in the brain's medial prefrontal and insula cortices – areas that are all associated with preferences and emotion.These patterns of activity reflected the volunteers' subsequent purchasing choice nearly three-quarters of the time, whether or not the subjects had given their undivided attention to the images of the cars when they were first shown them.Previous studies have shown similar patterns of activity when we make explicit purchasing choices. What this new study suggests is that these brain regions size up products even when we are not consciously making purchasing decisions. The brain appears to be imparting automatic or possibly even unconscious value onto products, as soon as you're exposed to them, says Haynes.

Secret desires

While Knutson acknowledges that the volunteers' choices might have been different if they had been making a real decision about which car to buy, he reckons the study may still be of use to neuromarketers – specifically as a subjective way of determining whether a consumer might buy a product or not, without having to be explicitly asked.

This kind of approach might be particularly useful for inferring people's opinions of products they would be reluctant to admit to buying, says Haynes, although he emphasises that he is unwilling to promote neuromarketing for this purpose.

Journal reference: *Journal of Neuroscience*, DOI: 10.1523/jneurosci.0064-10-2010

http://www.newscientist.com/article/dn19024-unconscious-purchasing-urges-revealed-by-brain-scans.html

Biblical bee-keepers picked the best bees

- 20:00 07 June 2010 by **Shanta Barley**

Bee worship was enshrined in ancient art (Image: Ckirie/Chris Irie/Flickr)

The Bible didn't dub it "a land flowing with milk and honey" for nothing. Not only are the oldest known beehives in the world in what is now Israel, but bee-keepers of the time selected the best bees for the job.

Ancient Egyptian paintings depict bee-keeping, but hives were not found in the Middle East until 2005 when Amihai Mazar of the Hebrew University of Jerusalem excavated 30 clay cylinders identical to the hives in the paintings, in the ancient town of Tel Rehov.

"Ancient Egyptian wall paintings depict bee-keepers, but a painting can be a dream," says Mazar's colleague Guy Bloch. "We have found the first real evidence for bee hives in the ancient Near East." In its heyday, the researchers say, the apiary probably housed up to 200 hives and over 1 million bees. The hives are about 80 centimetres long and 40 cm in diameter. Each one has a hole on one side which would have served as a "bee flap" and a lid on the opposite side to give bee-keepers access to the honeycomb.

The remains of bees were found in two of the hives, but instead of being the Syrian bees, they hailed from what is now Turkey. Importing bees would have been a shrewd business decision: Turkish bees produce up to eight times as much honey as Syrian bees, and are less aggressive.

Cool bees

Turkish bees are used to cool, rainy conditions. "In order to get the bees to thrive in the warm, dry climate of northern Israel, these bee-keepers must have been highly skilled," says Bloch.

In fact, "Jewish settlers in Israel in the 1900s may have unwittingly followed in the footsteps of the ancient bee-keepers of Tel Rehov," says Bloch. When they arrived in Israel, they attempted to farm Syrian bees – but failed and had to resort to importing the less aggressive Turkish strains.

The Bible refers to Israel as "a land flowing with milk and honey." Because no evidence for bee-keeping had been found until now, "honey" was deemed to mean jam. "Our discovery suggests that this aspect of the Bible may need to be reinterpreted," says Bloch.

Journal reference: *Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.1003265107

http://www.newscientist.com/article/dn19013-biblical-beekeepers-picked-the-best-bees.html

Paper trail: Inside the stem cell wars

- 09 June 2010 by **Peter Aldhous**
- Magazine issue 2764.

(Image: *New Scientist*)

ALL'S fair in love and war, they say, but science is supposed to obey more noble ideals. New findings are submitted for publication, the studies are farmed out to experts for objective "peer review" and the best research appears promptly in the most prestigious journals.

Some stem cell biologists are crying foul, however. Last year, 14 researchers in this notoriously competitive field wrote to leading journals complaining of "unreasonable or obstructive reviews". The result, they claimed, is that "publication of truly original findings may be delayed or rejected".

Triggered by this protest, *New Scientist* scrutinised the dynamics of publication in the most exciting and competitive area of stem cell research, in which cells are "reprogrammed" to acquire the versatility of those of an early-stage embryo. In this fast-moving field, where a Nobel prize is arguably at stake, biologists are racing feverishly to publish their findings in top journals.

Our analysis of more than 200 research papers from 2006 onwards reveals that US-based scientists are enjoying a significant advantage, getting their papers published faster and in more prominent journals (find our data, methods and analyses here). The disparity is likely to spark debate when the International Society for Stem Cell Research (ISSCR) meets in San Francisco next week.

There are several plausible and reasonable explanations, but feelings are running high nonetheless. With two of the most delayed papers coming from a Japanese researcher who pioneered the field, and some of his rivals using controversial channels that give members of the US National Academy of Sciences an inside track to rapid publication, it is easy to see why.

The protest letter called for journals to publish the anonymised comments of researchers who act as reviewers of papers, to expose examples of potential obstruction. Just two of its signatories were from labs in the US. And when leaders of the protest talked to the media, unfair treatment of researchers outside the US was among the complaints. "There does seem to be this bias against groups from the rest of the world," Robin Lovell-Badge of the UK's National Institute for Medical Research in London told *New Scientist*.

Research on induced pluripotent stem (iPS) cells is the obvious place to look for biases in publication, given the high stakes involved. One of the signatories of the letter was the pioneer of cellular reprogramming - Shinya Yamanaka of Kyoto University in Japan. Less than four years after he first showed how to reprogram a mouse skin cell, Yamanaka is routinely mentioned as a candidate for a Nobel prize. He may be sharing that honour if other scientists make faster strides towards therapies based on cellular reprogramming. Our analysis of the citations between researchers reveals that Yamanaka is still the most influential figure in the field, but also shows that several well-connected US-based scientists are giving him a run for his money (see diagram and "The strongest link").

New Scientist searched the Web of Science database for studies on iPS cells, recording the dates each was submitted, accepted for publication, and published. Advised by Matthew Strickland of Emory University in Atlanta, Georgia, whose research employs a branch of statistics called survival analysis, we found that papers submitted by authors outside the US took significantly longer to be accepted and published.

This difference was particularly clear for papers in 29 high-profile journals with an "impact factor" of 5 or more (see "What's the hold-up?"). Impact factor is a measure of the frequency with which a journal's articles are cited in the scientific literature. We chose this cut-off score to focus on journals that received the protest letter, or those with similar prominence. "It's really very interesting," says Lovell-Badge. "I didn't think it would be possible get quantitative data."

So what might explain the pattern? Obstruction of papers could happen if a reviewer delays their comments, or makes many demands for changes. The journals with the greatest lag between US and non-US papers deny that their reviews are biased, and say that the former explanation can be ruled out. "The review process itself is quite short, and the majority of the intervening time is taken up by the authors performing revisions to address the criticisms that the reviewers raised," says Deborah Sweet, editor of *Cell Stem Cell*, which is the official journal of ISSCR - and is published by Elsevier, a sister company of the publisher of *New Scientist*.

Bigger, better?

Konrad Hochedlinger of the Harvard Stem Cell Institute, among the foremost in the field, suggests that leading US labs can deal with revisions more easily because they are often larger and better funded. When asked to run extra experiments, for example, he can quickly deploy junior scientists or hire a commercial lab to do them.

Could it also be that the US-based scientists tend to produce better work? There's no simple way to measure the calibre of studies in our sample - and if papers are rejected by leading journals and end up lower down the publishing hierarchy, it is hard to separate unfair treatment from genuine differences in quality.

Any deviation from strict merit-based review would bias the entire development of a field. "Papers that are scientifically flawed or comprise only modest technical increments often attract undue profile," the protest letter argued.

Whatever the reason, US-based researchers were more successful at getting their work into top journals. Overall, our analysis included 216 papers, 119 from scientists working in the US. The sample from higher-impact journals, however, was noticeably skewed, with US-based scientists accounting for 94 of 148 papers.

Poor English is another factor that puts some scientists at a disadvantage. Rudolf Jaenisch at the Massachusetts Institute of Technology, the leading US-based researcher working on iPS cells, argues that some papers from Asia are so badly written that they are difficult to assess - particularly if they come from a lab with no track record. "There are labs in those countries that are not up to standard," he asserts. "You get a paper from someone you've never heard of, and they're making outrageous claims."

You get a paper from someone you've never heard of... making outrageous claims

If other reviewers are similarly disinclined to trust results from labs they don't know well, the stronger connections that seem to exist among US-based stem cell biologists may help to explain their advantage.

More mysterious, given his standing in the field, is why two of Yamanaka's papers were among the 10 with the longest lags. In the most delayed of all, Yamanaka reported that the tumour-suppressing gene *p53* inhibits the formation of iPS cells. The paper took 295 days to be accepted. It was eventually published by *Nature* in August 2009 alongside four similar studies. "Yamanaka's paper was submitted months before any of the others," complains Austin Smith at the University of Cambridge, UK, who coordinated the letter sent to leading journals.

Yamanaka suggests that editors may be less excited by papers from non-US scientists, but may change their minds when they receive similar work from leading labs in the US. In this case, Hochedlinger submitted a paper similar to Yamanaka's, but nearly six months after him. Ritu Dhand, *Nature*'s chief biology editor, says that each paper is assessed on its own merits. Hochedlinger says he was unaware of Yamanaka's research on *p53* before publication.

Of papers published in leading journals:
78 per cent from US-based authors accepted within 100 days
54 per cent from authors elsewhere accepted within 100 days

While arguments about delayed papers rumble on, the data for *Proceedings of the National Academy of Sciences* reveals how some have found a fast track. Each academy member can "contribute" up to four of their papers to *PNAS* each year, and "communicate" two on behalf of other scientists, in both cases choosing the reviewers. Other academic journals do not have such routes to publication. Of 16 *PNAS* papers on iPS cells in our sample, 14 came from US-based scientists - and 12 of those went through these routes. The other two were from Japan, one communicated by a Japanese member of the academy.

These numbers are out of proportion to the journal's overall mix - over the same period, just 37 per cent of *PNAS* papers were contributed or communicated by academy members. The fact that the iPS cell papers going through these routes were accepted very quickly compared with those in other journals indicates why these inside channels are attractive in such a competitive field. The papers included three from Jaenisch.

The "communicated" channel is due to be retired, and will accept no further submissions from the end of this month. It's part of a wider effort to "level the playing field", explains the editor-in-chief of *PNAS*, Randy Schekman, of the University of California, Berkeley. There are no plans to abolish the "contributed" channel.

The protest letter having so far failed to get journals to publish anonymised reviewer comments, arguments about bias will continue. But on one point all of the protagonists can agree. "This whole stem cell field is so overheated... so competitive," says Jaenisch.

For details of *New Scientist*'s data, methods and analyses, go to newscientist.com/article/dn18996

The strongest link

Shinya Yamanaka of Kyoto University in Japan is the dominant scientist in cellular reprogramming, but he has stiff competition from a well-linked group of US-based researchers.

To map influence in the field, *New Scientist* constructed a social network diagram (left) based on citations, the references to each scientist's work by their peers. Citations are a measure of a researcher's impact and influence, and are sometimes used to help make decisions on promotions. They can also provide a snapshot of who's who in a field.

Assisted by Henri Schildt of Imperial College London, a specialist in citation analysis, we looked at references between 148 papers published in prominent journals since 2006 - drawing links where the authors cited one another's work four or more times.

Yamanaka's research is referred to by just about everyone. But there are no such links between other scientists outside of the US, and no links to them from any of the US-based researchers. In the US, there is a richer web of connections.

In large part, this reflects the greater number of papers in our sample from scientists in the US. But another tie links the best-connected researchers in the US: the Boston area. Rudolf Jaenisch at the Massachusetts Institute of Technology is Yamanaka's strongest rival, and two of the other main players - Konrad Hochedlinger and Kathrin Plath - used to work in his lab. Plath has moved to the University of California, Los Angeles, while Hochedlinger remains nearby at the Harvard Stem Cell Institute, which also hosts the labs of George Daley and Doug Melton.

The outsider is James Thomson at the University of Wisconsin-Madison, who first isolated human embryonic stem cells in 1998. He owes his prominence in this network to winning the race, in a tie with Yamanaka, to make human iPS cells.

http://www.newscientist.com/article/mg20627643.700-paper-trail-inside-the-stem-cell-wars.html

Studying the elusive fag hag : Women who like men who like men

By Jesse Bering

As a decades-long fan of *The Golden Girls*, I was saddened to learn of the death of Rue McClanahan last week. In fact, I think I genuinely shed a palpable, detectable tear, which is something I can't remember ever doing on the death of a celebrity, with the exception perhaps of Bea Arthur and Estelle Getty. It sounds rather homosexually cliché, I know, but my partner, Juan, and I have gotten into the habit of watching an episode of *The Golden Girls* every night before bed. And along with the other "girls," as we call them, Rue's character Blanche Devereaux—the libidinous southern belle with an insatiable appetite for rich cheesecake and rich men—has become something of an imaginary, smile-inducing friend in our home. Fortunately, Blanche's carnal spirit is burned forever on our DVDs. But the news of McClanahan's death inspired me to read more about her in real life—well, at least to expend enough finger energy to flitter over to her *Wikipedia* entry. I knew she'd been an outspoken advocate of gays and lesbians, as well as animals, but I didn't realize that her support for the former went all the way back to 1971. Just a few short years after the Stonewall Riots, she co-starred in a movie set in a Greenwich gay bar called *Some of My Best Friends Are …* as a "vicious fag hag".

And then my mind switched gears, leaving the inimitable Rue and the issue of gay rights behind and instead focusing my attention on this term, "fag hag". Now I've never seen myself as a "fag"—although I'm sure many other people do see me this way and unfortunately nothing more—but more importantly I've certainly never regarded my many close female friends as "hags." So I was curious to learn more about the unflattering stereotypes lying at the etymological root of this moniker, which describes straight women who tend to gravitate toward gay men. Enter Mount Saint Vincent University psychologist Nancy Bartlett and her colleagues, who just last year published the first quantitative study of fag hags in the journal *Body Image*.

These researchers, too, found the term "fag hag" intriguing. There are plenty of other colorful expressions that capture this distinct demographic rather vividly, some less insultingly so than others, including:

- Fruit fly
- Queen bee
- Queer dear
- Fairy godmother
- Fag shagger
- Queen magnet
- Hag along
- Swish dish
- Faggotina
- Homo honey
- Fairy collector
- Fairy princess

- Fagnet

But it's "fag hag" that resonates in the public consciousness. The researchers note that both in popular media and everyday expression, the term conjures up the image of an unattractive, overweight, desperate woman who seeks out the company of gay men to compensate for her lack of romantic attention from straight guys. Sorting through anecdotes from previous interview studies, television depictions and cheap romance novels, the authors find that other common stereotypes paint the fag hag as being notoriously camp, overly emotional, unstable and as craving attention (e.g., Megan Mullally's character Karen Walker from Will & Grace). What's especially fascinating is the authors' observation that this social category of women who like men who like men may be "cross-culturally robust." The French refer to such women as soeurettes ("Little Sisters"), the German brand them as Schwulen-Muttis ("Gay Moms"), and the Mexicans know them as joteras ("jota" is commonly used for "fag"). In Japan, these women are called okoge, translated literally as "the burnt rice that sticks to the bottom of the pot."

According to the investigators, the "hag" component is essentially the common belief that these women "do not feel good about their bodies, and as a result, take refuge in the 'gay world' to avoid the harsher judgment and emphasis on female physical attractiveness inherent in the heterosexual social scene." The comedienne Margaret Cho, a well-known and self-proclaimed fag hag, states:

The gay man in your life is not concerned with your youth and beauty. He wants to know your soul. He loves you for your courage and intellect. Whether you are lovely or plain, you are beautiful to him for these qualities—and many more.

As "the gay man" in many women's lives, I'm not sure Cho's got it entirely right about us—she seems to be idealizing gay men. Trust me, there's no shortage of superficial gay men out there. She's also apparently never heard of biologist John Maynard Smith's "sneaky f*cker" evolutionary hypothesis for male homosexuality, which posits that gay men in the ancestral past had unique access to the reproductive niche because females let their guards down around them and other males didn't view them as sexual competitors. We're not infertile, after all, just gay. (By the way, another aside: Is it my imagination, or are lesbians and bisexuals strangely overrepresented at the top-most rungs of the female comedy ladder? In addition to bisexual Cho, there are also lesbians Wanda Sykes, Ellen DeGeneres, Lilly Tomlin, Rosie O'Donnell, Sandra Bernhard and—one of my favorites—Jane Lynch.)

But what Bartlett and her co-authors were especially interested in with their 2009 study was if there's any truth to the negative stereotypes surrounding fag hags.

So, they invited 154 heterosexual women to participate in an Internet-based survey on fag-haggery (my term, not theirs). These women ranged from 17 to 65 years of age (with an average of 28 years) and had a varied history of romantic relationships. Some were married, some single, still others divorced, widowed, currently dating and so on—and most were reasonably well-educated, having at least some college education. Each woman was asked to provide certain quantifiable information that would allow the authors to test several key hypotheses about the myth of the fag hag. First, women simply gave the total numbers of gay male, straight male and female friends they had. Also, on a scale of 1 (not that close) to 5 (extremely close) they were asked to rate their degree of "closeness" with their closest gay male, straight male and female friend. Next, the women completed a commonly used instrument called the Body Esteem Scale (BES), a 24-item questionnaire measuring a woman's self-perceived sexual attractiveness and her weight concerns. Finally, each of the participants provided information about their romantic history over the past two years, including whether they'd been the "dumper" or the "dumpee" in recent failed relationships.

The results were analyzed to test the common assumption that women befriend gay men because they have poor body esteem and feel unattractive to straight men. If this were true, the authors reason, then there should be a meaningful statistical association between a woman's number of gay male friends and her body esteem and relationship success—in other words, the more pathetic a woman's romantic life and the more she sees herself as being undesirable to straight men, the more she should seek out gay men as friends. But the data revealed otherwise. In fact, with this sample at least, there was absolutely no link between a woman's relationship status, the number of times she'd been on the receiving end of a breakup, or her body esteem and the number of gay male friends in her life.

Debunking common assumptions in science is nothing new, and that goes for the myth of the fag hag too. But there were also some unexpected findings in this study. For example, the more gay male friends that a woman had, the more sexually attractive she found herself. Now, obviously, this is a correlation, so we can only speculate on causality. It could be—as the authors suggest—that women with gay male friends actually are physically more attractive than those with fewer gay male friends. Perhaps being around gay men offers these women some relief from the constant sexual overtures of straight men. (Bartlett's study only measured perceived self-attractiveness, not actual attractiveness, so this is an open question.) This may be more plausible a causal explanation than simply noting that a woman's body esteem is enhanced the more that she's around flattering gay men. On the other hand, interestingly enough, the longer that a woman has been friends with her closest gay male friend, the lower her perceived sexual attractiveness. On interpreting this unexpected finding, the authors suggest that this may actually reflect some core, but nuanced truth of the "fag hag" stereotype: "Perhaps women who perceive themselves as less sexually attractive develop closer relationships with gay men." The others just go for superficial attachments.

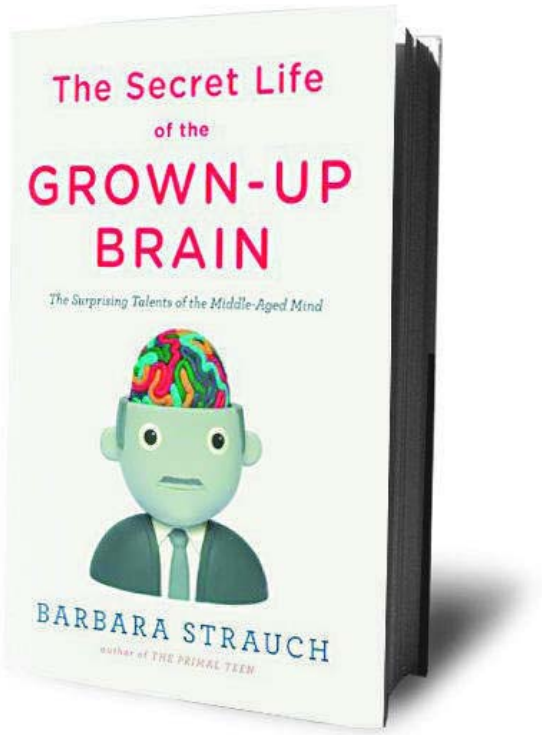
To my own favorite fairy princess, Ginger: This one's for you. I love you. For the rest of you, here's a final thought to scratch your head over. It occurred to me while writing this article that the social category of straight men that like to socialize with lesbians is astonishingly vacant in our society. Sure, you may hear about some random "dyke tyke" or "lesbro" (two terms that, unlike fag hag, are hardly part of the popular slang vocabulary and actually required me to do some intensive googling), but their existence is clearly minimal. Do you have any good guesses on why there's such a discrepancy in frequency between the two cases?

http://www.scientificamerican.com/blog/post.cfm?id=studying-the-elusive-fag-hag-women-2010-06-07

Book finds some good news about aging brain

Rita Beamish, Special to The Chronicle

Monday, June 7, 2010



Despite the cliches of middle-age forgetfulness - hunting for glasses that rest on top of your head or climbing the stairs purposefully only to wonder why - it turns out that the mature brain has dazzling capabilities. And better yet, there's scant reason to believe that all of us will suffer a decline in brainpower as we age.

But even while it outperforms its younger self in many ways, the middle-age brain gets a bad rap. It's true that we can lose our focus or get distracted more easily as we age, but there is plenty of emerging and established science to show that people underestimate the formidable talents of the mature brain, says Barbara Strauch, author of "The Secret Life of the Grown-Up Brain" (Viking, 229 pages, $26.95).

"The world has to wake up to the fact that middle age is not dead. We're wasting the best brains of our lives. We should appreciate them," Strauch said in an interview from her Manhattan office. Strauch, deputy science editor at the New York Times, makes the case for the middle-age brain by delving into the exploding field of brain science and reporting on a spectrum of research and analysis.

Strauch reports that our brain powers up, not down, and grows in cognitive ability as we age, reorganizing itself and using more of its parts to solve problems - even excelling at the teenage art of multitasking. Studies are proving that our brains reach peak performance between the ages of 40 and 68, the period commonly

defined as middle age by researchers. The brain continues to grow even as we yearn for the bygone days when we could remember the movie we saw the weekend before.

While some people do slip mentally in midlife, the message of neuroscience today is that the human brain is highly variable. Even in our early 70s, the average age when cognitive decline is seen, some of us roll along without symptoms of decline, apparently tapping superior repair systems. So, while the brain does slow down, with the growth in cognitive depth and reasoning power, there's a "net gain" in middle age, Strauch said.

Strauch became interested in exploring the grown-up brain after listening to her middle-age friends complain about memory problems. Yet her friends were hardly failing in life. In fact, they excelled in their often complex professions and managed to handle household finances, rear kids, navigate gourmet recipes and organize school auctions. She was curious about what powered their abilities.

She cites a growing acceptance of the idea of a "cognitive reserve," something like an emergency stash of brainpower that helps the mind adapt to greater challenges and resist damage. Tapping that reserve may provide a buffer against the outward symptoms of mental decline, some research shows. Additionally, a beneficial fatty white coating on the brain called myelin continues to grow, insulating the brain's long arms of nerve fibers as we age into our 50s and 60s and, in some cases, beyond.

"Signals move faster and are less likely to leak out of a brain fiber that has been coated with myelin," Strauch writes. One prominent researcher believes this layer of fat "is what makes the whole orchestra play together - and reach its cognitive crescendo - at middle age."

"The Grown-Up Brain" includes studies about measures people can take to stay mentally supple in their later years (see box). Exercise is high on the list because it prompts blood flow to the brain and promotes the birth of new neurons. Mental challenges - the more complex and diverse the better - and social interaction activate the brain's neurons. There are hints that something as simple as education may help protect the brain in later years, although no one suggests it will prevent the pathology of a disease like dementia, Strauch said. Some research shows that a diet rich in omega-3 fatty acids or taking medicine that lowers blood pressure may be beneficial.

However, an independent panel of the National Institutes of Health recently cautioned that studies on preventive strategies are inconclusive and that more research is needed on how to keep our brains healthy.

Our outlook on life may also have a big impact on the health of our brains. Scientists have linked emotional well-being with mental alertness and lower risk of Alzheimer's disease. On a bright note, Strauch said she was surprised to learn that no credible science backs the inevitability of the midlife crisis or the empty-nest syndrome. In fact, the aging brain appears to selectively focus on positive memories rather than on stress or negativity, Stanford psychologist Laura Carstensen found. The brain appears to regulate emotion, with research finding increased feelings of well-being between the ages of 40 and 60.

"We're brought up to think it's going to be doom and gloom" when the kids are grown, Strauch said. But midlife crisis affects only 5 percent of the population, and people in middle age generally feel they have a greater sense of control over their lives. As one researcher in Strauch's book says, "By midlife we are equipped for overload."

Things that help keep the brain fit and alert. **E3**

Gaming the brain helps it, studies show

The search for brain-boosting activities has fueled a boom in commercial brain games. But proving that these games work, especially in real-life situations, is not easy, says Barbara Strauch.

In one study conducted by the University of Southern California, researchers found that a rigorous computer program developed by neuroscientist and former UCSF Professor Michael Merzenich did improve cognitive test results.

"If you challenge your brain in the right ways, it will respond," said Steven Aldrich, CEO of Posit Science (www.positscience.com), a San Francisco company Merzenich co-founded to offer the computer training.

Posit Science's computer program uses sound and image recognition in increasingly difficult patterns to sharpen the brain's cognitive abilities. Incoming signals to the brain can get fuzzy as we age. The aim of Posit's program is to force the brain to focus, thereby stimulating production of beneficial chemicals that sharpen the information stored as memory. The company says people who trained on the driving exercise in its program had fewer real-life accidents than a control group.

- *Rita Beamish*

Keeping your brain alert

Break a sweat: "In one rigorous study after another, exercise has emerged as the closest thing we have to a magic wand for the brain."

Just as physical activity benefits the heart, it also carries oxygen to brain cells and appears to increase brain volume. In one study, mice that exercised on a wheel produced new brain cells.

Challenge the cells: "Most evidence now suggests that we can boost our brain reserve, even when older."

People who push their brains beyond the comfort zone to learn new things and solve new problems exhibited fewer symptoms of dementia in some studies. Crossword puzzles are not enough: They only challenge you to recall words you already know. The brain falls into a rut by repeating the same activities.

Keep talking: "Being sociable is good for both body and mind."

One study in England found that middle-age people who regularly popped into their neighborhood pubs had better cognition than their stay-at-home neighbors. Social complexities and interactions constantly tax the brain.

Mind your mood: "Our moods are surprisingly important to our brains."

People who are less grumpy or happily entwined with others - or a pet - have a lower risk of developing Alzheimer's disease and are more mentally alert. A positive self-image is also linked to better memory. Depression and stress, on the other hand, are linked to shrinkage of the brain's memory-rich hippocampus.

Nutrition confusion: "It's hard to think of a topic more steeped in hope and hype than the brain and food."

Researchers continue to look for clear-cut guidance for humans, but animal studies point to the benefits of fruits, vegetables, nuts and other foods rich in antioxidants. In studies on rats, those that ate dried spinach learned new tasks faster and those on blueberry diets produced new brain neurons. In another study, old dogs learned new tricks better when their diets were fortified with tomatoes, carrots, citrus pulp, spinach and vitamins E and C.

Source: "The Secret Life of the Grown-Up Brain," by Barbara Strauch

E-mail us at datebookletters@sfchronicle.com.

http://sfgate.com/cgi-bin/article.cgi?f=/c/a/2010/06/07/DDR61DL44O.DTL

This article appeared on page **E - 1** of the San Francisco Chronicle

An Ugly Toll of Technology: Impatience and Forgetfulness

By TARA PARKER-POPE

Are your Facebook friends more interesting than those you have in real life?

Has high-speed Internet made you impatient with slow-speed children?

Do you sometimes think about reaching for the fast-forward button, only to realize that life does not come with a remote control?

If you answered yes to any of those questions, exposure to technology may be slowly reshaping your personality. Some experts believe excessive use of the Internet, cellphones and other technologies can cause us to become more impatient, impulsive, forgetful and even more narcissistic.

“More and more, life is resembling the chat room,” says Dr. Elias Aboujaoude, director of the Impulse Control Disorders Clinic at Stanford. “We’re paying a price in terms of our cognitive life because of this virtual lifestyle.”

We do spend a lot of time with our devices, and some studies have suggested that excessive dependence on cellphones and the Internet is akin to an addiction. Web sites like NetAddiction.com offer self-assessment tests to determine if technology has become a drug. Among the questions used to identify those at risk: Do you neglect housework to spend more time online? Are you frequently checking your e-mail? Do you often lose sleep because you log in late at night? If you answered “often” or “always,” technology may be taking a toll on you.

In a study to be published in the journal Cyberpsychology, Behavior and Social Networking, researchers from the University of Melbourne in Australia subjected 173 college students to tests measuring risk for problematic Internet and gambling behaviors. About 5 percent of the students showed signs of gambling problems, but 10 percent of the students posted scores high enough to put them in the at-risk category for Internet “addiction.”

Technology use was clearly interfering with the students’ daily lives, but it may be going too far to call it an addiction, says Nicki Dowling, a clinical psychologist who led the study. Ms. Dowling prefers to call it “Internet dependence.”

Typically, the concern about our dependence on technology is that it detracts from our time with family and friends in the real world. But psychologists have become intrigued by a more subtle and insidious effect of our online interactions. It may be that the immediacy of the Internet, the efficiency of the iPhone and the anonymity of the chat room change the core of who we are, issues that Dr. Aboujaoude explores in a book, “Virtually You: The Internet and the Fracturing of the Self,” to be released next year.

Dr. Aboujaoude also asks whether the vast storage available in e-mail and on the Internet is preventing many of us from letting go, causing us to retain many old and unnecessary memories at the expense of making new ones. Everything is saved these days, he notes, from the meaningless e-mail sent after a work lunch to the angry online exchange with a spouse.

"If you can't forget because all this stuff is staring at you, what does that do to your ability to lay down new memories and remember things that you should be remembering?" Dr. Aboujaoude said. "When you have 500 pictures from your vacation in your Flickr account, as opposed to five pictures that are really meaningful, does that change your ability to recall the moments that you really want to recall?"

There is also no easy way to conquer a dependence on technology. Nicholas Carr, author of the new book "The Shallows: What the Internet Is Doing to Our Brains," says that social and family responsibilities, work and other pressures influence our use of technology. "The deeper a technology is woven into the patterns of everyday life, the less choice we have about whether and how we use that technology," Mr. Carr wrote in a recent blog post on the topic.

Some experts suggest simply trying to curtail the amount of time you spend online. Set limits for how often you check e-mail or force yourself to leave your cellphone at home occasionally.

The problem is similar to an eating disorder, says Dr. Kimberly Young, a professor at St. Bonaventure University in New York who has led research on the addictive nature of online technology. Technology, like food, is an essential part of daily life, and those suffering from disordered online behavior cannot give it up entirely and instead have to learn moderation and controlled use. She suggests therapy to determine the underlying issues that set off a person's need to use the Internet "as a way of escape."

The International Center for Media and the Public Agenda at the University of Maryland asked 200 students to refrain from using electronic media for a day. The reports from students after the study suggest that giving up technology cold turkey not only makes life logistically difficult, but also changes our ability to connect with others.

"Texting and I.M.'ing my friends gives me a constant feeling of comfort," wrote one student. "When I did not have those two luxuries, I felt quite alone and secluded from my life. Although I go to a school with thousands of students, the fact that I was not able to communicate with anyone via technology was almost unbearable."

http://www.nytimes.com/2010/06/07/technology/07brainside.html?ref=technology

After Process, a Return to the Tropics

By ROBERTA SMITH

Thanks to El Museo del Barrio the artist Rafael Ferrer, at 77, is finally having his moment. “Retro/Active: The Work of Rafael Ferrer,” his first large museum survey, spans more than five decades, with nearly 200 works in just about every late-20th-century medium except film and video.

The show has an immediate allure thanks to Mr. Ferrer’s instinctive facility for color and materials of all kinds. The general impression is of someone who would figure out how to make art if confined to a nearly empty room. Calabash gourds appear in several sculptures. Paper bags — a preferred drawing surface for decades — have occasioned an exploration of the human face as mask that is almost encyclopedic in its cultural and emotional allusions. Small, wood-framed slate tablets provide an ideal surface for a series of appropriately grisaille paintings from 2005 and 2006. At El Museo enormous groupings of these works face each other across a gallery, to electrifying effect.

So it is odd that Mr. Ferrer has so far been best known for the markedly ephemeral and temporary Process Art installations he made in the late 1960s and into the ’70s and exhibited alongside the efforts of artists like Alan Saret, Richard Serra and Robert Morris. Documented here in a small gallery lined with photographs, these pieces were sometimes made of materials as slight and transitory as grease, straw, dried leaves and blocks of ice. They did their bit for the dematerialization of the art object, and then Mr. Ferrer moved on.

Mr. Ferrer treated Process Art — the next big thing of the time — as a building block, a way back to his first love in art. That was painting, not to be confused with his first creative love and first profession, jazz drums.

After the early ’70s Mr. Ferrer proceeded to rematerialize his art, working through a succession of mediums, among them assemblages that hang from the ceiling. Especially good is the puppetlike “Marvelous Woman,” whose face is painted on a flattened garbage-can lid and whose feet are a pair of improbably riveting, paint-splattered pumps. It is straight out of Dada, yet somehow fresh. Appropriate to his music background, one of his earliest post-Process oil-on-canvas efforts is the jubilantly toxic “Quartet” from 1980, which depicts Latin musicians, midsong, on a field of hot pinks, oranges and yellows.

By the late 1980s Mr. Ferrer was making what could be his strongest works: visually and emotionally fraught paintings depicting radiant, shadow-pocked scenes of makeshift tropical dwellings and their inhabitants. These update modernism’s calculated faux-primitivism with a vaguely photographic angularity. Image and paint collude uncannily, and the play of light and dark can be almost hallucinatory. Every form has a double life and nature intrudes from all sides.

“Conquering Solitude,” for example, shows four figures — a man on one side and three boys in a clump on the other — almost immobilized by their environment. The ground roils with an aggressive network of ridges that suggest a trap but may only be shadows. On the wall of the cream-colored cabin behind the figures another shadow looms, more solid but wildly irregular, a spectral pelt or Rorschach screech. It is a calm, sunny, disturbing image.

“Retro/Active” has been meticulously assembled by Deborah Cullen, El Museo’s director of curatorial programs. The title telegraphs Mr. Ferrer’s flair for nonconformity with a soupçon of tendentiousness, not to mention his unceasing restlessness. The subtext? He has been and still is working continuously, even if our attention has been focused elsewhere. Also, the past is always up for grabs. Just look back actively, with curiosity.

This show is almost criminally overdue. What was Mr. Ferrer’s sin? Maybe his sometimes bristly personality or his background as a privileged outsider. He was born in Puerto Rico in 1933 to a family that could afford to educate its children on the American mainland. He spent his first summer in college living in Hollywood with his much older half-brother, the actor José Ferrer, and sister-in-law Rosemary Clooney; during his second, he met André Breton and Wifredo Lam in Paris. For years Rafael Ferrer divided his time between Philadelphia, where he taught, and his vacation home-studios in Puerto Rico and the Dominican Republic. And as he drew closer to his Caribbean roots, it was without joining the “identity art” bandwagon.

In any case, Mr. Ferrer’s art lends credence to Barnett Newman’s often-quoted declaration, “We are making it out of ourselves.” As seen here, Mr. Ferrer’s work bespeaks an artist working from a complex, imperfect, driven self — a self that is a cultural sponge, an opportunistic sieve and a tightly wound synthesizer all in one. Grist for this creative mill has included the modernisms of Europe and both Americas; the vocabularies of various forms of folk and so-called primitive art; and an impressive range of art history, music and the literature of two tongues, English and Spanish.

Mr. Ferrer’s career is one of peripatetic consistency in which ideas, motifs and even materials continually circulate among different mediums or phases. He stumbled on art almost by chance in the early 1950s, while studying at Syracuse University and heading, he thought, for a life in music. A friend showed him a book on modern art and he decided to try his hand, covering pieces of cardboard with shards of waxy color. Tucked away in a vitrine along with some early sketchbooks and drawings, these little works exude promise. Hanging nearby are several of his map drawings from the late 1970s, in which the same colors expand into wandering concentric lines whose fuzziness brings to mind the feathered textiles of pre-conquest Peru.

In a similar way the Process Art works haunt some of the paintings, a point Ms. Cullen makes by pairing images in the catalog. Even in the show the photograph of "Niche," an especially appealing, relatively substantial Process piece, can remind you of the shanties and sheds and campsite-like arrangements in the paintings. It consists of a large sheet of corrugated galvanized steel, functioning as flooring for assorted strands of neon tubing, sheets of glass, buckets and logs. Behind these a vertical sheet of the steel implies a wall; a canvas tarp is stretched overhead, like a roof. Other paintings feature piles of leaves, scattered logs and tarps.

The show's main weakness is that it is installed thematically rather than chronologically, which obscures the fact that Mr. Ferrer's evolution has a fascinating logic. It has centered on a rebuilding of form and narrative that has gained speed and complexity as it has gone along. Seeing its progress would be more illuminating than having to piece it together. The piecing is helped by reading Mr. Ferrer's brisk, opinionated if sometimes self-serving account of his life and artistic development that is a marvelous self-portrait of a young artist finding himself. It takes the form of an e-mail interview with the poet and writer Vincent Katz. Mr. Ferrer began thinking about taking up painting again while watching Vincent's father, Alex Katz, paint on the beach, when the Katzes visited the Ferrer family in Puerto Rico in the mid-1970s.

Mr. Ferrer is not a paragon of originality who has changed the history of art, but something almost as good, and maybe in the end more inspirational: an artist driven by curiosity, passion and instinct who has worked flat-out for more than half a century. The parting impression of this show is that Mr. Ferrer has used everything within him and also around him to the fullest. His art is a picture of efficiency that could not have been made by anyone else. That is no small achievement.

http://www.nytimes.com/2010/06/11/arts/design/11ferrer.html?ref=design

Lichtenstein, After the Funny Papers

By KAREN ROSENBERG

By now it's no surprise to find a museum-worthy show of a major artist at a Chelsea gallery. The spoils of this season are such that a large trove of 1970s and '80s Lichtensteins arrived last month without much fanfare at the Gagosian Gallery on West 24th Street, overshadowed by another Gagosian coup — Monet's late paintings — a few blocks away.

At the Lichtenstein exhibition it's harder to forget that you're in a place of business. The bulk of the more than 50 works in "Roy Lichtenstein: Still Lifes" comes from unnamed private collections, not museums, and some are for sale. The very idea of Lichtenstein, who died in 1997, as a studious genre painter may seem like a market-generated fiction; certainly the show is less inviting than the gallery's "Roy Lichtenstein: Girls" in 2008.

Still, this one delivers fresh insights about Lichtenstein in the 1970s. He had moved from the Bowery to Southampton, N.Y., and had stopped using comic-book sources. He continued to identify with commercial art and illustration, but his painting had become less campy and more cerebral. His best-known work from this period is the series "Mirrors," which breaks down reflections into abstract components. Still lifes, assortments of generic objects — as opposed to Warholian, brand-name products — offered him a way out of Pop.

The still lifes at Gagosian date from 1972 to 1988, though the early '70s are the focus. They show that Lichtenstein was deeply engaged with the Cubists Juan Gris and Fernand Léger, as well as the early American trompe l'oeil painters Charles Willson Peale and his son Raphaelle Peale. He was also adding stripes, crosshatches and comblike spikes to his signature device, the Benday dot.

Other elements of his 1960s art remained. Lichtenstein had moved away from Mickey Mouse and Bazooka gum wrappers, but he continued to work from newspaper advertisements, postcards and other printed images. He tore out and pasted into notebooks illustrations of silver teapots, faceted-crystal goblets, fruit, garden plants, office furniture. A few of these pages are reproduced in the show's catalog, a typically lavish but accessible production. It includes an essay by the Princeton art history professor John Wilmerding, a conversation between the dealer and collector Joe Helman and the Gagosian director Mark Francis, a series of still-life photographs by the artist Louise Lawler and some great black-and-white shots from the 1970s of Lichtenstein in his Southampton studio.

The earliest works on view have a clip-art quality: punchy yellow-and-black images of grapefruits and bananas, with graphic backgrounds of dots or parallel lines. They're a visual and sexual tease, like the peel-and-stick banana that Warhol made in 1966 for the Velvet Underground's first album. Larger, slightly later paintings introduce vessels — cups and saucers, wine glasses, pitchers — and invoke traditional still-life setups with drapery and mirrors. As Mr. Wilmerding argues, Lichtenstein was looking not only at 17th-century Dutch still lifes but also at early-19th-century American "deception" paintings by William Michael Harnett and others. Sometimes the Americana is hard to miss, as in "Still Life With Cow's Skull" and a pair of Cape Cod scenes with lobsters, lanterns and driftwood.

For the most part Lichtenstein wasn't setting up his own still lifes; he was painting from other paintings that happened to be still lifes. As Mr. Helman says of the work "Cubist Still Life With Lemons," "This is a Cubist still life, but it's not Roy doing still life; it's Roy doing Cubism."

He did Cubism, all right — paring down already streamlined forms by Gris, making Léger's "mechanical" compositions even more machinelike. He did Purism too, further sanitizing the cleaned-up version of Cubism espoused by Le Corbusier and Amédée Ozenfant.

At the same time he obsessed over a less schematic painter, Matisse. He gave the famous "Red Studio" a makeover, with pale peach walls, a chair rail of Morse-code-like dots and dashes, and his own paintings propped against the wall.

A few years later, in a suite of large-scale paintings, he proposed a working man's alternative to the artist's studio: a bunkerlike office with a metal desk and lockers in a drab palette of gray and navy blue. He titled them "Still Lifes," as in "Still Life With Locker, Bottle and Tray," even though the contents of these rooms seem less pertinent than the general mood. A few years later, as Neo-Expressionism became faddish, Lichtenstein's still lifes revived one of his motifs from the '60s: the faux-gestural brush stroke. Some of these modestly scaled paintings from the early '80s, depicting apples and flowers with steam-rollered squiggles, have been cloistered in the small gallery behind the reception area.

In all of these still lifes Lichtenstein was trying to hold onto the formal vocabulary and popular appeal of the comics while letting go of the comic-book image. As Mr. Helman observes, "He finally liberated his style from the cartoon and became this classical painter, which he had always been, but the style had originally lent itself to the cartoon, or the cartoon had lent itself to the style."

"Roy Lichtenstein: Still Lifes" continues through July 30 at the Gagosian Gallery, 555 West 24th Street, Chelsea; (212) 741-1111, gagosian.com.

http://www.nytimes.com/2010/06/11/arts/design/11lichtenstein.html

Lester Johnson, Expressionist Painter, Dies at 91

By WILLIAM GRIMES

Lester Johnson, an admired artist whose expressionist brushwork lent vigor and force to the human figure — isolated and embattled, or alive with the joy of movement in crowds — died on May 30. He was 91 and lived in Southampton on Long Island.

His death, at a nursing home in Westhampton, N.Y., was confirmed by his son, Anthony.

Mr. Johnson, a maverick associate of the Abstract Expressionists in New York, found his subject matter in the joys and sorrows of ordinary people on the street. His boxy figures of the 1960s, somberly painted in thick impasto, their features often scratched into the surface, faced the viewer squarely with an air of stoicism or grim defiance.

Some were self-portraits. Others, like “Bowery Patriarch” (1963) and “Three Men Sitting” (1969), enlisted the stumbling, broken men he saw on the Bowery from his second-floor studio window.

Pulsing with a dark energy and compressed into taut masses by brutal external forces, Mr. Johnson’s subjects, presented singly or in groups, seemed like hostages to fate. The art critic Harold Rosenberg called them “golem-like,” a reference to the manlike creature of Jewish folklore created from inanimate matter. “Johnson’s grim dolls seem to push forward out of a background darkness which they bring with them to the painting surface,” he wrote in Art News in 1966.

In the 1970s, Mr. Johnson shifted gears. “I get into a theme, and I get into it until I don’t like it,” he told The Hartford Courant in 2005. He began painting women in colorful print dresses and men wearing bowler hats,

crowding the canvas and moving ebulliently through the city's streets. Their flattened, stylized forms, and the often friezelike arrangement of the figures, suggested Greek vase art set to a jazz soundtrack. "It was a real pleasure to use color," he told The Courant. "From then on, I had another world."

"If there is such as thing as the poetry of congestion, Mr. Johnson invented it," John Russell wrote in The New York Times in 1977. "The people in his painting just love company. They can't get enough of it. No matter how he packs them in we feel that both he and they would gladly find room for someone else."

Lester Frederick Johnson was born on Jan. 27, 1919, in Minneapolis. After graduating from high school he began an apprenticeship at the Cosmopolitan Art Company, where he learned to make frames and copy calendar landscapes.

Determined to become a fine artist, he enrolled at the Minneapolis School of Art, where he studied with Alexander Masley, a former student of Hans Hofmann in Munich.

When Mr. Masley was dismissed because of political infighting at the school, Mr. Johnson moved to the St. Paul School of Art to study with another Hofmann protégé, Cameron Booth. He later studied at the School of the Art Institute of Chicago.

In 1947 he moved to New York, where he shared a studio, at different times, with Larry Rivers and Philip Pearlstein. Two years later he married Josephine Valenti, who survives him. In addition to his son, an architect who lives in Manhattan, he is survived by his daughter, Leslie Lowery, of Greenwich, Conn., and four grandchildren.

Mr. Johnson started out painting small urban landscapes and abstract paintings but gradually moved toward the human figure, developing a style heavily influenced by the painterly techniques of the Abstract Expressionists and the existential atmosphere in the Giacometti paintings he saw in a show at the Pierre Matisse Gallery in 1948. What he took from Giacometti, the critic Hilton Kramer noted in a 2004 review of Mr. Johnson's work in The New York Observer, was not a style but "an attitude of interrogation and anxiety in dealing with the figure."

He became the only figurative artist voted into the Eighth Street Club, the famous weekly gathering of the Abstract Expressionists. They regarded him as talented but misguided. He regarded drips and gestural brushstrokes as an avant-garde signature that could easily descend into empty cliché. "I was into human content and I used it, and I found it a very, very exciting thing to do," Mr. Johnson said in an interview in 1988. "I did a lot of paintings at the time where you can hardly see the figure, but it's there."

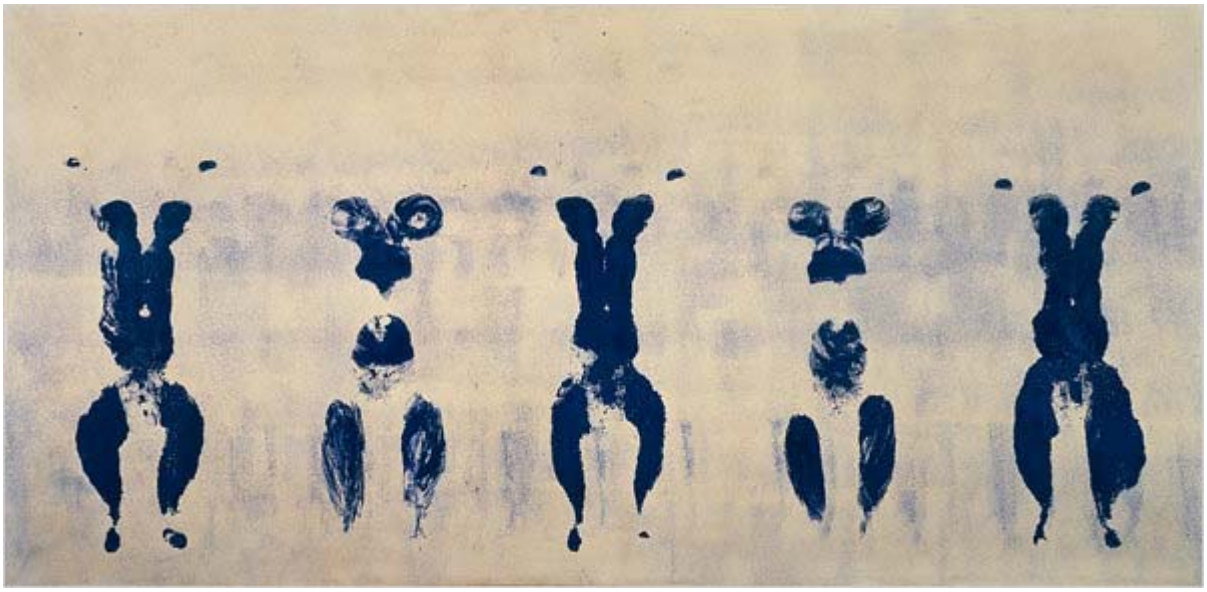
He had his first solo show at the Artists Gallery in 1951. In 1964, Jack Tworkov, the chairman of the graduate art department at Yale, recommended Mr. Johnson for a job. He taught figure drawing at Yale until his retirement in 1989, and from 1969 to 1974 was the director of studies for the graduate painting program.

The James Goodman Gallery in Manhattan surveyed his work in 2004 in the exhibition "Lester Johnson: Four Decades of Painting." In 2005, the University of Connecticut in Storrs mounted a 50-year retrospective of his work, "People Passing By: Paintings, Drawings and Prints by Lester Johnson," at the William Benton Museum of Art.

http://www.nytimes.com/2010/06/09/arts/design/09johnson.html

Painting Thin Air, Sometimes in Bright Blue

By ROBERTA SMITH



WASHINGTON — By now, hero worship of the French artist Yves Klein (1928-62) should be a thing of the past. Sure, he was charismatic, movie-star handsome and a black belt in judo, and he had a gift for provocative gestures. At the age of 19, on the beach with two friends, a poet and an artist, Klein "signed the sky" as his first work of art. In the mid-1950s he developed a smoldering ultramarine pigment that in a stroke of branding genius, he patented and named International Klein Blue.

He also made all kinds of important art. His gloriously retinal blue monochromes are among the cornerstones of Minimalism; other works foreshadow Conceptual, performance, body and environmental art, not to mention the dematerialization of art. In an early version of commodity art, he sold collectors chunks of "invisible pictorial sensibility" (thin air) and then converted the purchase price into gold leaf that he frittered into the Seine while the buyer watched and a photographer took pictures.

He was the first artist to exhibit an art gallery as a work of art, in Paris in 1958. And in 1959 he lectured at the Sorbonne on "Art's Evolution Toward the Immaterial."

All this in a period of maturity that lasted slightly more than seven years.

Still, in the nearly five decades since Klein died of a heart attack at 34, miles of print have been devoted to demystifying, deconstructing and generally letting the air out of the myth of the artist as genius. Which makes it slightly unsettling that the two extremely intelligent co-curators of the dazzling retrospective of Klein's work at the Hirshhorn Museum and Sculpture Garden here sometimes sound completely smitten in their catalog essays.

Kerry Brougher, the Hirshhorn's deputy director and chief curator, calls Klein an "involuntary painter" who depicted "the invisible" and wonders if Klein wasn't "some strange object who came, only for a short time,

from the heavens to open our eyes and minds." Then Philippe Vergne, the director of the Dia Art Foundation in New York and a former curator at the Walker Art Center in Minneapolis — which has organized the show with the Hirshhorn — frets about whether it is possible even to capture his extraordinary essence in exhibition form. "Klein's gaze was cosmic and spiritual," Mr. Vergne writes, noting that Klein was "barely older than Jesus when he died," and that his "imprint on the creative landscape of the second half of the last century is as deep as that of a stigmata."

A grip needs to be gotten here. Klein was a complicated creature, given to hyperbole, adept at self-mythology, guided by an overweening narcissism and full of contradictions. He also had great style, which gave everything he did a kind of show-biz glamour.

Klein rejected paintbrushes as "too excessively psychological" but used naked women smeared with International Klein Blue as "human brushes" for his "Anthropometry" paintings. These were made in public performances at which he wore white tie and tails. Why is all this not excessive or psychological — or simply par for the course in the age of Brigitte Bardot?

Klein's "no-hands" approach to painting was probably inspired by Jackson Pollock's drip technique, but was quite a bit more sensational. He would later use a blow torch — along with nude models and lots of water — and also the wind in the making of his work.

The famous photograph of Klein leaping from the ledge of a roof — "Into the Void" (1960) — may suggest a yearning for total freedom and Zen-like nothingness. But he also loved institutional pomp and dress-up so much that he joined the Order of St. Sebastian and was married in the order's regalia, which included a cape, a Maltese cross and a navy admiral's bicorn hat, feather trimmed. Even after deducting for irony, questions remain.

To their credit the curators have organized an exhibition that presents both Klein's achievement and his foibles with a minimum of fuss and a fitting sense of clarity, concentration and elegance. Seeing his work spaciously arrayed in the circle of the Hirshhorn's second-floor galleries adds a wonderful momentum to his manic trajectory.

Above all, the curators let Klein himself speak. The show is almost entirely devoid of explanatory texts; whatever words appear on the walls are Klein's own. In the opening gallery a three-minute film of "The Void," the empty-gallery-as-art staged at Galerie Iris Clert in 1958, gives a good sense of the man's charms and contradictions.

With the passage of time "The Void" has acquired a reputation for Minimalist austerity, but in the film it looks surprisingly quaint. Outside, a huge swag of dark blue velvet is draped over the gallery's entrance, as if heads of state are expected. Inside, Klein, in his white tie and tails, shows us around, gesturing toward various walls as if toward invisible paintings. He's a sweetly smiling mime, part magician, part maître d'. The title of the Hirshhorn show — "Yves Klein: With the Void, Full Powers" — comes from a note that Albert Camus left at Clert's gallery after visiting "The Void" and is included here.

This show makes clear the extent of Klein's artistic "propositions," as he frequently called them. It ends in a flurry of drawings concerning his "architecture of the air," which involved walls of fire and water and a roof of blown air that would deflect precipitation, and created an Edenic locale where people could walk around naked, like the women used as human brushes.

But the blue monochromes remain his most singular achievement, and his preparation seems to have started early. Klein was the precocious only child of two painters. His Dutch father, Fred Klein, who was partly Indonesian, was a figurative painter; his mother, Marie Raymond, was an abstractionist active on the Paris art scene. Young Yves pretty much began his career with abstraction, which may help explain how he went so far beyond it. In a touchingly cartoonish watercolor from 1954, one of the earliest works in the Hirshhorn show, three rectangles — of solid yellow, red and green — are grouped together on a proscenium stage, like actors in a play. (It is strikingly reminiscent of works by the contemporary painter Hiroshi Sugito.)

More grown-up monochromes, in different colors and on canvases of different sizes, follow quickly, and by 1957 the blue monochromes have developed. The most voluptuous are dotted with the sponges that Klein used in making them, and the high point of the Hirshhorn show is a large painting blooming with sponges and surrounded by sculptures made of individual sponges on stone and wire pedestals.

Donald Judd, whose extensive use of fiery cadmium red light in his early painted wood pieces was partly if not wholly indebted to Klein, wrote admiringly that Klein's paintings were "the only ones that are unspatial." (Frank Stella's were the next closest.)

Half a century on, these paintings still shock, especially in the way their matte, implacably physical surfaces seem paradoxically to leak color into the air around them. Intense to the point of assault — in a velvet-gloved sort of way — they rivet the attention and open the mind and eye to everything that Klein did subsequently, in part by establishing the sense of purity and concentration underlying all his best work. They remain some of the most nonreferential paintings in the history of Western art, possibly the first to go beyond traditional abstraction and become objects in their own right.

We live in a period when artists who reject art objects are often turned into fetishes themselves. This has happened to Klein. His blue paintings have the distinction of revealing him at his most glamorous but also his deepest. They don't reflect the artist, and they don't picture the world: they are simply in it, part of the vast, riveting not-us and not-him.

http://www.nytimes.com/2010/06/04/arts/design/04klein.html

Cleopatra's Underwater Kingdom

By EDWARD ROTHSTEIN

PHILADELPHIA — It may be best to dispel any illusions immediately. The only certain images we seem to have of the last queen of Egypt, Cleopatra VII, have no discernible resemblance to the painted faces of Elizabeth Taylor or Claudette Colbert or Sarah Bernhardt. Those visages can be contemplated with far more sensuous contentment than the Egyptian queen's bulbous, knotty and eroded features stamped on gold coins from the first century B.C.

But by the time we see the cinematic, romanticized faces of Cleopatra from films and paintings in the final gallery of the new exhibition "Cleopatra: The Search for the Last Queen of Egypt," opening Saturday at the Franklin Institute here, we are prepared to acknowledge the virtue of at least some idealization. The wonder we feel is not at Cleopatra's beauty (which Plutarch reports was "in itself not altogether incomparable") but at the extraordinary cultural universe that preceded her and surrounded her before Egypt submitted to the Romans in 30 B.C. and Cleopatra — Egypt's last pharaoh and the end of the Ptolemaic dynasty — committed suicide.

The exhibition is powerful. But that is not really because of Cleopatra; it is because a lost world is resurrected here. There are some 150 artifacts on display, and the vast majority were found buried in the silt and clay of the Bay of Aboukir, off the coast of Alexandria, Egypt. Since 1992 those waters have been explored by Franck Goddio and his European Institute of Underwater Archaeology. Using a nuclear magnetic resonance magnetometer, Mr. Goddio mapped the geographic fault lines beneath the clouded waters and has brought to the surface a small fraction of what lies below.

He has identified the relics and ruins as remnants of the ancient cities of Canopus and Heracleion, submerged by tidal waves, earthquakes and wars; he has also discovered palaces and temples of the nearby eastern port of Alexandria, the city that the Macedonian conqueror Alexander the Great made his capital, and that Cleopatra

imagined could rival Rome. The first half of the exhibition shimmers in atmospheric blue light, the artifacts accompanied by videos of their excavation by red-suited divers maneuvering through opaque waters.

The sense of a lost and mythical world brought into the half-light would be irrelevant, though, if the resurrected objects didn't live up to the promise — and they do. We are led through a sequence of discoveries, coming to learn along the way how the Ptolemaic heirs to Alexander's conquest created a hybrid religion and culture, Greek styles overlaying Egyptian allusions, transformed gods worshiped in new temples, ancient ideas given fresh, sensuous form.

Here, for example, from Canopus, is a great life-size head of the god Serapis that was mounted in his most famous temple; the Egyptian god Osiris with his healing powers is transmuted into a Grecian deity, his eroded face framed by flowing locks. The glories of Heracleion can be glimpsed in two towering 16-foot figures of pink granite: images of Ptolemaic royalty. And, even if we are not prepared to testify to Cleopatra's beauty, here is a third century B.C. statue of a queen, whose draped garment is sculptured to seem translucent, clinging to the textured stone flesh, posing an unmatchable challenge to even the most idealized image of Cleopatra.

Mr. Goddio has also put these objects into a geographic and cultural context, assisted by the University of Pennsylvania Egyptologist and guest curator David Silverman (who is also curator of the Egyptology section of the Penn Museum, which is offering a ticket tie-in with the Franklin show). Mr. Goddio has found stone pieces that nearly complete earlier finds (one of which was acquired by the Louvre in 1817). When fit together, as is shown here, they form a naos — a stone shrine or ark that once held the temple god. Their carvings contain what may also be the world's first astrological chart, along with a creation myth not found elsewhere.

Mr. Goddio has also mapped the submerged harbors of these once thriving cities and found that a canal linking Canopus and Heracleion that, he suggests, would have been used in a ritual watery journey paying homage to Osiris's powers, connecting the newer religious celebrations with older beliefs in the centrality of the Nile. This was the realm within which Cleopatra (along with Julius Caesar and then Mark Antony) moved.

But because this exhibition, like the King Tut show now in New York, is a production of Arts and Exhibitions International, which has specialized in large-scale cultural attractions, it is meant to attract big audiences both here and in other cities in the United States it is expected to visit after it leaves the Franklin Institute on Jan. 2; the National Geographic Society is also involved. So there is a certain amount of slick packaging that comes along with the substance. My biggest misgiving is a sense that Cleopatra herself is a lot less important to these discoveries than it seems here.

There are some traces attributed to her, of course, aside from gold coins with her less-than-sensuous profile. We see fragments of a papyrus, on loan from the Neues Museum in Berlin, that we are told shows Cleopatra's own signature to a royal decree; she has written the Greek word "ginesthoi": "make it happen."

Every visitor also gets an audio tour in which an actress speaking as Cleopatra recounts the oft-retold tale of her life and death while trying to explain the artifacts before us. Here too the temptation is to silence the story, which can end up distracting from the sights. It seems imposed on the actual objects rather than growing directly from their importance.

Cleopatra's role also seems to be a bit overbearingly insisted upon in the last part of the exhibition, which is devoted to the excavations overseen by Zahi Hawass, the secretary general of Egypt's Supreme Council of Antiquities, whose patronage is required for any exploration of Egyptian antiquities.

Convinced by the arguments of the archaeologist Kathleen Martinez, Mr. Hawass says he believes that the tomb holding the remains of both Mark Antony and Cleopatra may lie not in Alexandria but in a temple near the city at Taposiris Magna. In a video he is far more definitive about the excavations there than the evidence we are shown fully justifies; more explanation is needed. But by that time there has already been enough justifiable excitement in the show, so suspicions of its inflation here do not really interfere. (Mr. Hawass may also be proven correct.)

Besides, though Cleopatra is the selling point, the catalog for the exhibition, along with Mr. Goddio's discoveries, make it clear that notions of her beauty and power, and even Shakespeare's imagining of her clasping the slithering poisonous adder to her breast, lulling her to sleep like a nurse sucking an infant, are representations not just of an individual but of something larger.

Cleopatra saw herself as the incarnation of a god, in this case of Isis, the sister of the murdered Osiris. She finds his body parts, which have been dispersed through Egypt's waterways, pieces them together, brings him back to life, and ultimately gives birth to his child. It is an act combining creation, resurrection and procreation, and something of that creative spirit seems evident throughout the artifacts here. They are relics of an energetic hybrid culture that still inspires idealization.

In this show Mr. Goddio and his team have done something similar. Like Isis they have pieced together the scattered remnants of a long-lost world, resurrecting them from watery depths. In the process they have very nearly brought them back to life.

"Cleopatra: The Search for the Last Queen of Egypt" runs Saturday through Jan. 2 at the Franklin Institute, 222 North 20th Street, Philadelphia; (215) 448-1200, fi.edu

http://www.nytimes.com/2010/06/04/arts/design/04cleo.html

To Err Is Human. And How! And Why.

By DWIGHT GARNER

BEING WRONG

Adventures in the Margin of Error

By Kathryn Schulz

405 pages. Ecco. $26.99.

WRONG

Why Experts Keep Failing Us — And How to Know When Not to Trust Them

By David H. Freedman

295 pages. Little, Brown & Company. $25.99.

Despite their titles, the two books in front of us today — "Being Wrong," by Kathryn Schulz, and "Wrong," by David H. Freedman — are not biographies of Alan Greenspan. They're not accounts of the search for Saddam Hussein's W.M.D. They're not psychological profiles of Nickelback fans or the imbibers of chocolate martinis, either.

Here's what they are instead: investigations into why, as Ms. Schulz writes, with a Cole Porterish lilt in her voice, "As bats are batty and slugs are sluggish, our own species is synonymous with screwing up."

Bookstores will shelve these two volumes side by side, and critics like me will think, bingo!, and set them up for a blind date too. But they could not be more unalike. Ms. Schulz's book is a funny and philosophical meditation on why error is mostly a humane, courageous and extremely desirable human trait. She flies high in the intellectual skies, leaving beautiful sunlit contrails. God isn't her co-pilot; Iris Murdoch seems to be.

Mr. Freedman's book is a somewhat cruder vehicle. It's a John Stossel-like exposé of the multiple ways that society's so-called experts (scientists, economists, doctors) let us down, if not outright betray us. It's a chunk of spicy populist outrage, and it can be a hoot to watch Mr. Freedman's reading glasses steam up as he, like Big Daddy in "Cat on a Hot Tin Roof," sniffs mendacity around the plantation. But Ms. Schulz's book is the real find here; forgive me if I spend more time with it.

Ms. Schulz is a young writer — this is her first book — whose work has appeared in The Nation, Rolling Stone and Slate. She argues in "Being Wrong" that, of all the things we're wrong about, our ideas about error are probably our "meta-mistake: we are wrong about what it means to be wrong." She continues, "Far from being a sign of intellectual inferiority, the capacity to err is crucial to human cognition."

This is not a bulletin from the scientific or epistemological frontier. Thinkers have toyed with theories of error since Plato's time, many of them generally agreeing with Albert Einstein, who said, "If we knew what we were doing, it wouldn't be called research, would it?"

But it's lovely to watch this idea warm in Ms. Schulz's hands. Her book is filled with diverting and sometimes heartbreaking examples of error, but it is not, in her words, a "wrongology slide show." She is interested "in error as an idea and as an experience: in how we think about being wrong, and how we feel about it."

The idea that error can be eradicated, she writes, can lead to frightening and reactionary impulses. (Gulags, purges.) She charts the three stages of our disbelief at other people's ideas when they differ from our own. (We first assume that they are ignorant, then idiotic, finally evil.) She observes how much we adore being right, and how we blithely assume that we nearly always are. Then she pulls the rug out, noting that being wrong, because we're blithely unaware of it, "feels like being right."

She is epigrammatic. ("No one plans to end up on the wrong side of history.") She has gobbled books and culture like Ms. Pac-Man. She's comfortable with everyone from Jonathan Franzen to Heidegger, and from Pliny the Elder to Beyoncé.

I don't bring this up because it's rare to find a range of reference in a work of popular philosophy. I bring it up because when she takes a detour into, say, "Hamlet," it's time not to groan but time to sit up. She's thought about the play and has alert, persuasive and counterintuitive things to say about it.

Ms. Schulz notes how many of our beliefs are accidents of fate, hinging on things like our places of birth. She is pro argument, pro talking it out. She quotes the comedian Penn Jillette as saying, "One of the quickest ways to find out if you are wrong is to state what you believe."

Most of all she is for skepticism. But she also points out that the ability to interrogate our beliefs is (in the words of a writer named William Hirstein), a "cognitive luxury." It takes time, brains and patience.

"Being Wrong" is optimistic. "Error, even though it sometimes feels like despair, is actually much closer in spirit to hope," Ms. Schulz writes. "We get things wrong because we have an enduring confidence in our own minds; and we face up to that wrongness in the faith that, having learned something, we will get it right next time."

Mr. Freedman, the author of “Wrong,” is a science and business journalist whose previous books include “A Perfect Mess: The Hidden Benefits of Disorder — How Crammed Closets, Cluttered Offices, and On-the-Fly Planning Make the World a Better Place.” (On-the-fly planning? Speaking of getting things wrong, didn’t we try that in Iraq?) His book looks outward, where Ms. Schulz’s looks inward.

He points out that most expert wisdom, especially about health issues, isn’t just sometimes but nearly always ultimately proved wrong. He is diligent about explaining the “disconcerting reasons” why this is so. He examines how the sausage that is major health studies is actually made. It’s not pretty.

Mr. Freedman observes the way that very small (and hence unreliable) surveys, often based solely on animal testing, are used to make extravagant claims about cancer or our diets. He notes how scientists discard data that doesn’t fit their theses. He talks about measurement errors and the academic pressures of publish-or-perish.

He finds that the science world, frighteningly, does not take kindly to whistleblowers. He blames scientific journals for printing the sexiest and most eye-popping studies, instead of the most careful ones. “Wrong” bristles with examples and lists. It’s as utilitarian as a rake; it’s news you can use.

Ms. Schulz’s “Being Wrong” is news you probably can’t use, at least in any immediate sense. But if admiring it is wrong, I don’t want to be right.

http://www.nytimes.com/2010/06/11/books/11book.html?ref=books

Military Still Failing To Diagnose, Treat Brain Injuries

T. Christian Miller and Daniel Zwerdling

June 8, 2010

ProPublica is a nonprofit investigative news organization.

Based on dozens of interviews and access to previously unreleased military studies, documents and e-mails, NPR and ProPublica have found that from the battlefield to the homefront the military's doctors and screening systems routinely miss brain trauma in soldiers. As a result, soldiers haven't been getting treatment.

The military medical system is failing to diagnose brain injuries in troops who served in Iraq and Afghanistan, many of whom receive little or no treatment for lingering health problems, an investigation by NPR and ProPublica has found.

So-called mild traumatic brain injury has been called one of the wars' signature wounds. Shock waves from roadside bombs can ripple through soldiers' brains, causing damage that sometimes leaves no visible scars but may cause lasting mental and physical harm.

Officially, military figures say about 115,000 troops have suffered mild traumatic brain injuries since the wars began. But top Army officials acknowledged in interviews that those statistics likely understate the true toll. Tens of thousands of troops with such wounds have gone uncounted, according to unpublished military research obtained by NPR and ProPublica.

"When someone's missing a limb, you can see that," said Sgt. William Fraas, a Bronze Star recipient who survived several roadside blasts in Iraq. He can no longer drive, or remember simple lists of jobs to do around the house. "When someone has a brain injury, you can't see it, but it's still serious."

In 2007, under enormous public pressure, military leaders pledged to fix problems in diagnosing and treating brain injuries. Yet despite the hundreds of millions of dollars pumped into the effort since then, critical parts of this promise remain unfulfilled.

Over four months, we examined government records, previously undisclosed studies and private correspondence between senior medical officials. We conducted interviews with scores of soldiers, experts and military leaders.

Among our findings:

- From the battlefield to the homefront, the military's doctors and screening systems routinely miss brain trauma in soldiers. One of the military tests fails to catch as many as 40 percent of concussions, a recent unpublished study concluded. A second exam, on which the Pentagon has spent millions, yields results that top medical officials call about as reliable as a coin flip.
- Even when military doctors diagnose head injuries, that information often doesn't make it into soldiers' permanent medical files. Handheld medical devices designed to transmit data have failed in the austere terrain of the war zones. Paper records from Iraq and Afghanistan have been lost, burned or abandoned in warehouses, officials say, when no one knew where to ship them.
- Without diagnosis and official documentation, soldiers with head wounds have had to battle for appropriate treatment. Some received psychotropic drugs instead of rehabilitative therapy that could help retrain their brains. Others say they have received no treatment at all, or have been branded as malingerers.

In the civilian world, there is growing consensus about the danger of ignoring head trauma: Athletes and car accident victims are routinely tested for brain injuries and are restricted from activities that could result in further blows to the head.

NPR and ProPublica uncovered previously unreleased military studies, documents and e-mails.

'We Still Have A Big Problem'

But the military continues to overlook similarly wounded soldiers, a reflection of ambivalence about these wounds at the highest levels, our reporting shows. Some senior Army medical officers remain skeptical that mild traumatic brain injuries are responsible for soldiers' troubles with memory, concentration and mental focus.

Civilian research shows that an estimated 5 percent to 15 percent of people with mild traumatic brain injury have persistent difficulty with such cognitive problems.

"It's obvious that we are significantly underestimating and underreporting the true burden of traumatic brain injury," said Maj. Remington Nevin, an Army epidemiologist who served in Afghanistan and has worked to improve documentation of TBIs and other brain injuries. "This is an issue which is causing real harm. And the

senior levels of leadership that should be responsible for this issue either don't care, can't understand the problem due to lack of experience, or are so disengaged that they haven't fixed it."

When Lt. Gen. Eric Schoomaker, the Army's most senior medical officer, learned that NPR and ProPublica were asking questions about the military's handling of traumatic brain injuries, he initially instructed local medical commanders not to speak to us.

"We have some obvious vulnerabilities here as we have worked to better understand the nature of our soldiers' injuries and to manage them in a standardized fashion," he wrote in an e-mail sent to bases across the country. "I do not want any more interviews at a local level."

Tell Us Your Story

Did you or a loved one suffer a traumatic brain injury while serving? ProPublica and NPR want to hear your story. **Tell us about your experiences with TBI.**

When confronted with the findings later, however, he acknowledged shortcomings in the military's diagnosing and documenting of head traumas.

"We still have a big problem and I readily admit it," said Schoomaker, the Army's surgeon general. "That is a black hole of information that we need to have closed."

Brig. Gen. Loree Sutton, who oversees brain injury issues for the Pentagon, said the military had made great strides in improving attitudes towards the detection and treatment of traumatic brain injury.

The military is considering implementing a new policy to mandate the temporary removal from the battlefield of soldiers exposed to nearby blasts. Later this year, the Pentagon expects to open a cutting-edge center for brain and psychological injuries, which will treat about 500 soldiers annually.

"This journey of cultural transformation, it is a journey not for the faint of heart," Sutton said. "At the end of our journeys, at the end of our travels, what we must ensure is, we must ensure that we have consistent standards of excellence across the board. Are we there yet? Of course we're not there yet."

Left Behind

Soldiers like Michelle Dyarman wonder what's taking so long. Dyarman, a former major in the Army reserves, was involved in two roadside bomb attacks and a Humvee accident in Iraq in 2005.

William Fraas during occupational therapy at Mentis Neuro Rehabilitation Center in El Paso. Fraas survived several roadside blasts in Iraq, but suffered brain damage.

Today, the former dean's list student struggles to read a newspaper article. She has pounding headaches. She has trouble remembering the address of the farmhouse where she grew up in the hills of central Pennsylvania.

For years, Dyarman fought with Army doctors who did not believe that she was suffering lasting effects from the blows to her head. Instead, they diagnosed her with an array of maladies from a headache syndrome to a mood disorder.

"One of the first things you learn as a soldier is that you never leave a man behind," said Dyarman, 45. "I was left behind."

In 2008, after Dyarman retired from the Army, Veterans Affairs doctors linked her cognitive problems to her head traumas.

Dyarman has returned to her civilian job inspecting radiological devices for the state, but colleagues say she turns in reports with lots of blanks; they cover for her.

Dyarman's 67-year-old father, John, looks after her at home, balancing her checkbook, reminding her to turn the oven on before cooking. The joyful, bright child he raised, the first in the family to attend college, is gone, forever gone.

"It hurts me, too," he said, growing upset as he spoke. "That's my daughter sitting there, all screwed up. She's not the kid she was."

Walkie Talkies

Better armor and battlefield medicine mean troops survive explosions that would have killed an earlier generation. But blast waves from roadside bombs, insurgents' most common weapon, can still damage the brain.

The shockwaves can pass through helmets, skulls and through the brain, damaging its cells and circuits in ways that are still not fully understood. Then, secondary trauma can follow, such as sending a soldier tumbling inside a vehicle or hurling into a wall, shaking the brain against the skull.

Not all brain injuries are alike. Doctors classify them as moderate or severe if patients are knocked unconscious for more than 30 minutes. The signs of trauma are obvious in these cases and medical scanning devices, like MRIs, can detect internal damage.

But the most common head injuries in Iraq and Afghanistan are so-called mild traumatic brain injuries. These are harder to detect. Scanning devices available on the battlefield typically don't show any damage. Recent studies suggest that breakdowns occur at the cellular level, with cell walls deteriorating and impeding normal chemical reactions.

Doctors debate how best to categorize and describe such injuries. Some say the term mild traumatic brain injury best describes what happens to the brain. Others prefer to use concussion, insisting the word carries less stigma than brain injury.

Whatever the description, most soldiers recover fully within weeks, military studies show. Headaches fade, mental fogs clear and they are back on the battlefield.

For a minority, however, mental and physical problems can persist for months or years. Nobody is sure how many soldiers who suffer mild traumatic brain injury will have long-term repercussions. Researchers call the 5 percent to 15 percent of civilians who endure persistent symptoms the "miserable minority."

A study published last year in the *Journal of Head Trauma Rehabilitation* found that, of the 900 soldiers in one battle-hardened Army brigade who suffered brain injuries, almost 40 percent reported having at least one symptom weeks or months later.

The long-term effects of mild traumatic brain injuries can be devastating, belying their name. Soldiers can endure a range of symptoms, from headaches, dizziness and vertigo to problems with memory and reasoning. Soldiers in the field may react more slowly. Once they go home, some commanders who led units across battlefields can no longer drive a car down the street. They can't understand a paragraph they have just read, or comprehend their children's homework. Fundamentally, they tell spouses and loved ones, they no longer think straight.

Such soldiers are sometimes called "walkie talkies" — unlike comrades with missing limbs or severe head wounds, they can walk and talk. But the cognitive impairments they face can be severe.

Dr. Keith Cicerone works in neuropsychology and cognitive rehabilitation at the JFK-Johnson Rehabilitation Institute in New Jersey. All of his patients have suffered traumatic brain injuries. Doctors at the institute highly recommend cognitive rehabilitation over other forms of treatment.

"These are people who go on to live with a lifelong chronic disability," said Keith Cicerone, a leading researcher in the field. “It is going to be terrifically disruptive to their functioning."

An increasing number of brain-injury specialists say the best way to treat patients with lasting symptoms is to get them into cognitive rehabilitation therapy as soon as possible. That was the consensus recommendation of 50 civilian and military experts gathered by the Pentagon in 2009 to discuss how to treat soldiers.

Such therapy can retrain the brain to compensate for deficits in memory, decision-making and multitasking.

A soldier whose injuries are not diagnosed or documented misses out on the chance to get this level of care — and the hope for recovery it offers, say veterans advocates, soldiers and their families.

"Talk is cheap. It is easy to say we honor our servicemen," said Cicerone, who has helped the military develop recommendations for appropriate treatments for soldiers with brain injuries. "I don’t think the services that we are giving to those servicemen honors those servicemen."

Missing Records

The military’s handling of traumatic brain injuries has drawn heated criticism before.

ABC News reporter Bob Woodruff chronicled the difficulties soldiers faced in getting treatment for head traumas after recovering from one himself, which he suffered in a 2006 roadside bombing in Iraq. The following year, a Washington Post series about substandard conditions at Walter Reed Army Medical Hospital described the plight of several soldiers with brain injuries.

Members of Congress responded by dedicating more than $1.7 billion to research and treatment of traumatic brain injury and post-traumatic stress, a psychological disorder common among soldiers returning from war. They passed a law requiring the military to test soldiers' cognitive functions before and after deployment so brain injuries wouldn't go undetected.

But leaders' zeal to improve care quickly encountered a host of obstacles. There was no agreement within the military on how to diagnose concussions, or even a standardized way to code such incidents on soldiers' medical records.

Good intentions banged up against the military's gung-ho culture. To remain with comrades, soldiers often shake off blasts and ignore symptoms. Commanders sometimes ignore them, too, under pressure to keep soldiers in the field. Medics, overwhelmed with treating life-threatening injuries, may lack the time or training to recognize a concussion.

The NPR and ProPublica investigation, however, indicates that the military did little to overcome those battlefield hurdles. They waited for soldiers to seek medical attention, rather than actively seeking to evaluate those in blasts.

The military also has repeatedly bungled efforts to improve documentation of brain injuries, the investigation found.

Several senior medical officers said soldiers' paper records were often lost or destroyed, especially early in the wars. Some were archived in storage containers, then abandoned as medical units rotated out of the war zones.

Lt. Col. Mike Russell, the Army's senior neuropsychologist, said fellow medical officers told him stories of burning soldiers' records rather than leaving them in Iraq where anyone might find them.

"The reality is that for the first several years in Iraq everything was burned. If you were trying to dispose of something, you took it out and you put it in a burn pan and you burned it," said Russell, who served two tours in Iraq. "That's how things were done."

To improve recordkeeping, medics began using pricey handheld devices to track injuries electronically. But they often broke or were unable to connect with the military's stateside databases because of a lack of adequate Internet bandwidth, said Nevin, the Army epidemiologist.

"These systems simply were not designed for war the way we fight it," he said.

In 2007, Nevin began to warn higher-ups that information was being lost. His concerns were ignored, he said. While communications have improved in Iraq, Afghanistan remains a concern.

That same year, clinicians interviewed soldiers about whether they had suffered concussions for an unpublished Army analysis, which was reviewed by NPR and ProPublica. They found that the military files showed no record of concussions in more than 70 percent of soldiers who reported such injuries to the clinicians.

Nevin said that without documentation of wounds, soldiers could have trouble obtaining treatment, even when they report they can't think, or read, or comprehend instructions normally anymore.

Doctors might say, "there's no evidence you were in a blast," Nevin said. "I don't see it in your medical records. So stop complaining."

Problems documenting brain injuries continue.

Russell said that during a tour of Iraq last year, he examined five soldiers the day after they were injured in a January 2009 rocket attack. The medical staff had noted shrapnel injuries, but Russell said they failed to diagnose the soldiers' concussions.

The symptoms were "classic," Russell said. The soldiers had "dazed" expressions, and were slow to respond to questions.

"I found out several of them had significant gaps in their memory," Russell said. "It wasn't clear how long they were unconscious for, but the last thing they remember is they were playing video games. The next thing they remember, they are outside the trailer."

Another doctor told NPR and ProPublica of finding soldiers with undocumented mild traumatic brain injuries in Afghanistan as recently as February 2010.

Sgt. Victor Medina suffered brain damage when an IED hit his truck in Iraq. As part of a rehabilitation exercise, Jimmy Moody times how long Victor can balance at the Mentis rehabilitation facility in El Paso, Texas.

Sgt. Victor Medina suffered brain damage when an IED hit his truck in Iraq. As part of a rehabilitation exercise, Jimmy Moody times how long Victor can balance at the Mentis rehabilitation facility in El Paso, Texas.

"It's still happening, there's no doubt," said the military doctor, who did not want to be named for fear of retribution

Screened Out

After the Walter Reed scandal, the military instituted a series of screens to better identify service members with brain injuries. Soldiers take an exam before deploying to a war zone, another after a possible concussion in theater, and a third after returning home.

But each of these screens has proved to have critical flaws.

The military uses an exam called the Automated Neuropsychological Assessment Metrics, or ANAM, to establish a baseline for soldiers' cognitive abilities. The ANAM is composed of 29 separate tests that measure reaction times and reasoning capabilities. But the military, looking to streamline the process, decided to use only six of those tests.

Doubts immediately arose about the exam, which had never been scientifically validated. Schoomaker, the Army surgeon general, recently told Congress that the ANAM was "fraught with problems" and that "as a screening tool," it was "basically a coin flip."

Military clinicians have administered the exam to more than 580,000 soldiers, costing the military millions of dollars per year, but have accessed the results for diagnostic purposes only about 1,500 times.

Rep. Bill Pascrell Jr., D-N.J., who has led efforts to improve the treatment and study of brain injuries, accused the military of ignoring the Congressional directive.

"We are not doing service to our bravest," Pascrell said. "There needs to be a sense of urgency on this issue. We are not doing justice."

Once in theater, soldiers are supposed to take the Military Acute Concussion Evaluation, or MACE, to check for cognitive problems after blasts or other blows to the head.

But in interviews, soldiers said they frequently gamed the test, memorizing answers beforehand or getting tips from the medics who administer it.

Just last summer, Sgt. Victor Medina was leading a convoy in southern Iraq when a roadside bomb exploded. He was knocked unconscious for 20 minutes.

Afterwards, Medina had trouble following what other soldiers were saying. He began slurring his words. But he said the medic helped him to pass his MACE test, repeating questions until he answered them correctly.

"I wanted to be back with my soldiers," he said. "I didn't argue about it.".

Senior military officials said problems with the MACE were common knowledge.

"There's considerable evidence that people were being coached or just practicing," said Russell, the senior neuropsychologist. "They don't want to be sidelined for a concussion. They don't want to be taken out of play."

If cases of brain trauma get past the battlefield screen, a third test — the post-deployment health assessment, or PDHA — is supposed to catch them when soldiers return home.

But a recent study, as yet unpublished, shows this safety net may be failing, too.

When soldiers at Fort Carson, Colo., were given a more thorough exam bolstered by clinical interviews, researchers found that as many as 40 percent of them had mild traumatic brain injuries that the PDHA had missed.

In a 2007 e-mail, a senior military official bluntly acknowledged the shortcomings of PDHA exams, describing them as "coarse, high-level screening tools that are often applied in a suboptimal assembly line manner with little privacy" and under "huge time constraints."

Col. Heidi Terrio, who carried out the Fort Carson study, said the military's screens must be improved.

"It's our belief that we need to document everyone who sustained a concussion," she said. "It's for the benefit of the Army and the benefit of the family and the soldier to get treatment right away."

Gen. Peter Chiarelli, the Army's second in command, acknowledged that the military has not made the progress it promised in diagnosing brain injuries.

"I have frustration about where we are on this particular problem," Chiarelli said.

Frontline: The Wounded Platoon

This Frontline documentary follows Charlie Company's Third Platoon in Iraq. When the soldiers return home, some adjust well to civilian life, while others struggle with post traumatic stress and traumatic brain injuries. One is in prison, having pleaded guilty to participation in the murder of another soldier.

Fundamentally, he said, soldiers, military officers and the public needed to take concussions seriously.

"We've got to change the culture of the Army. We've got to change the culture of society," he said, adding later, "We don't want to recognize things we can't see."

Skeptics

The shift Chiarelli envisions may be impossible without buy-in from senior military medical officials, some of whom are skeptical about the long-term harm caused by mild traumatic brain injuries.

One of Schoomaker's chief scientific advisors, retired Army psychiatrist Charles Hoge, has been openly critical of those who are predisposed to attribute symptoms like memory loss and concentration problems to mild traumatic brain injury.

In 2009, he wrote a opinion piece in the *New England Journal of Medicine* that said the "illusory demands of mild TBI" might wind up hobbling the military with high costs for unnecessary treatment. Recently, Hoge questioned the importance of even identifying mild traumatic brain injury accurately.

"What's the harm in missing the diagnosis of mild TBI?" he wrote to a colleague in an April 2010 e-mail obtained by NPR and ProPublica. He said doctors could treat patients' symptoms regardless of their underlying cause.

In an interview, Hoge said, "I've been concerned about the potential for misdiagnosis, that symptoms are being attributed to mild traumatic brain injury when in fact they're caused by other" conditions. He noted that a study he conducted, published in the *New England Journal of Medicine*, "found that PTSD really was the driver of symptoms. That doesn't mean that (mild) TBI isn't important. It is important. It's very important."

Other experts called Hoge's posture toward mild TBI troubling.

To be sure, brain injuries and PTSD sometimes share common symptoms and co-exist in soldiers, brought on by the same terrifying events. But treatments for the conditions differ, they said. A typical PTSD program, for instance, doesn't provide cognitive rehabilitation therapy or treat balance issues. Sleep medication given to someone with nightmares associated with PTSD might leave a brain-injured patient overly sedated, without having a therapeutic effect.

"I'm always concerned about people trivializing and minimizing concussion," said James Kelly, a leading researcher who now heads a cutting-edge Pentagon treatment center for traumatic brain injury. "You still have to get the diagnosis right. It does matter. If we lump everything together, we're going to miss the opportunity to treat people properly."

The Fight For Treatment

At her family farm outside Hanover, Pa., Michelle Dyarman has a large box overflowing with medical charts, letters and manila envelopes. They are the record of her fight over the past five years to get diagnosis and treatment for her traumatic brain injury.

After her last roadside blast in Baghdad, which killed two colleagues, Dyarman wound up at Walter Reed for treatment of post-traumatic stress.

Over the course of two and a half years, she received drugs for depression and nightmares. She got physical therapy for injuries to her back and neck. A rehabilitation specialist gave her a computer program to help improve her memory.

But it wasn't until she began talking with fellow patients that she heard the term mild traumatic brain injury. As she began to research her symptoms, she asked a neurologist whether the blasts might have damaged her brain.

Records show the neurologist dismissed the notion that Dyarman's "minor head concussions" were the source of her troubles, and said her symptoms were "likely substantially attributable" to PTSD and migraine headaches.

"It was disappointing," she said. "It felt like nobody cared."

When she was later given a diagnosis of traumatic brain injury by Veterans Affairs doctors, she said she felt vindicated, yet cheated all at once.

"I always put the military first, even before my family and friends. Now looking back, I wonder if I did the right thing," she said. "I served my country. Now what's my country doing for me?"

http://www.npr.org/templates/story/story.php?storyId=127402993&sc=nl&cc=hh-20100614

First replicating creature spawned in life simulator

- 16 June 2010 by **Jacob Aron**
- Magazine issue 2765.

The elusive self-replicator may provide insight into how life on Earth began (Image: Jacquelyn Martin/AP/PA)

IF YOU found a self-replicating organism living inside your computer, your first instinct might be to reach for the antivirus software. If, however, you are Andrew Wade, an avid player in the two-dimensional, mathematical universe known as the Game of Life, such a discovery is nothing short of an epiphany.

When Wade posted his self-replicating mathematical organism on a Life community website on 18 May, it sparked a wave of excitement. "This is truly ground-breaking work," wrote a fellow Life enthusiast, Adam Goucher, on the website Game of Life News. "In fact, this is arguably the single most impressive and important pattern ever devised."

A first for the game, the replicator demonstrates how astounding complexity can arise from simple beginnings and processes - an echo of life's origins, perhaps. It might help us understand how life on Earth began, or even inspire strategies to build tiny computers.

The Game of Life is the best-known example of a cellular automaton, in which patterns form and evolve on a grid according to a few simple rules. You play the game by choosing an initial pattern of "live" cells, and then watch as the configuration changes over many generations as the rules are applied over and over again (see "Take two simple rules").

The rules of the game were laid down by mathematician John Conway in 1970, but cellular automata first took off in the 1940s when the late mathematician John von Neumann suggested using them to demonstrate self-replication in nature. This lent philosophical undertones to Life, which ended up attracting a cult following.

Life enthusiasts have since catalogued an entire zoo of interesting patterns, such as "spaceships" that travel across the grid, or "guns", which constantly spawn other patterns. But a pattern that spawned an identical copy of itself proved elusive.

A programmer living in Toronto, Canada, Wade first dabbled with Life during the 1990s but eventually lost interest and moved on. It wasn't until 2009 that he began to experiment anew, spurred on by discoveries in the previous decade.

One such discovery was the universal constructor, a pattern of cells that can be programmed to spit out a variety of others in subsequent generations. In an effort to create a replicator, Life enthusiasts had tried connecting this constructor to a second pattern known as a "computer" because it is capable of arithmetic. But the result ran too slowly to be of any practical use.

Wade's breakthrough came after his real-life child was born. The duties of fatherhood limited the time he could spend playing the game, so he replaced the "computer" with a much simpler pattern called an "instruction tape", made up of smaller patterns known as "gliders". By placing these at precise intervals, he created a program that feeds into the constructor and dictates its actions, much like the punched rolls of tape once used to control the first computers.

This proved a smart move. "I wanted to see it working as soon as possible," he says. "I stripped out as much as I could, which cut out leads that could have taken me a long time to pursue."

Dubbed Gemini, his creature is made of two sets of identical structures, which sit at either end of the instruction tape. Each is a fraction of the size of the tape's length but, made up of two constructor arms and one "destructor", plays a key role. Gemini's initial state contains three of these structures, plus a fourth that is incomplete.

As the simulation progresses the incomplete structure begins to grow, while the structure at the start of the tape is demolished. The original Gemini continues to disassemble as the new one emerges until after nearly 34 million generations, new life is born (see diagram).

The "offspring" is identical to its parent, but it has shifted up and slightly to the left - another first for Life: every other known pattern moves along one of the eight compass points, but Gemini travels across the grid in a north by north-west direction.

As a result of this, and the ability to program universal constructors using simple tape, Gemini has reinvigorated Life. Players are now looking forward to creating ever more novel and complex patterns. "Another milestone might be a self-replicating pattern that creates increasing copies of itself, or a space-filling replicator that can make multiple copies to eventually fill an arbitrarily large area of the Life plane," says Dave Greene, who helped create the universal constructor Wade used.

Simple complexity

Gemini's implications extend to the real world. "There's a fascination with the complexity that is coming out of these incredibly simple rules," says Susan Stepney, a computer scientist at the University of York, UK, who ran Gemini inside Life, at *New Scientist*'s behest. "Eventually that leads on to biology, putting simple atoms together to make complex life."

Because Wade's replicator copies itself piece by piece, it is analogous to a photocopier rather than a living cell, she says. But it still has implications for understanding life. "The fact that it's doing it differently from biology is in itself interesting, because it shows there are multiple ways of solving the same problem. It's a very impressive technical achievement."

It's doing it differently from biology, showing there are multiple ways of solving the same problem

Stephen Wolfram, famous for championing cellular automata as a replacement for scientific equations, disputes Gemini's relevance to living cells. He says that feeding a program to a universal constructor merely to create a self-replicating creature - Wade's approach, and Von Neumann's original suggestion - is overkill. He points to a much simpler example, a one-dimensional cellular automaton known as "rule 90" that will duplicate any starting line of cells after a certain number of steps.

Rather than contributing to our understanding of life, Wolfram says Wade's discovery could help devise ways to build a molecular-scale computer, starting from tiny components like the cells in Life. "This discovery is helping us understand the world of constructing things from dumb components," he says.

Whatever role Gemini ends up playing in the wider world of science, Stepney stresses the importance of those like Wade who experiment with Life in their spare time. "People are making real contributions to the subject through their interest."

Take two simple rules...

The Game of Life, created in the 1970s by mathematician John Conway has garnered a cult following. It consists of an infinite grid of square cells that can either be live or dead. It might not sound like much but such humble beginnings can give rise to a zoo of astoundingly complex patterns and processes, which now include self-replicating organisms (see main story).

How is this possible? As a player you only get one move: choosing an initial pattern of live cells. After that, you sit back, relax and watch as your pattern evolves, according to two simple rules.

1. Any live cell with two or three live neighbours continues to live, but those with less than two or more than three die.

2. Any dead cell with exactly three live neighbours springs to life.

These "births" and "deaths" happen simultaneously, forming a new generation of the original pattern. Then the rules are applied again to produce the next generation.

See Gemini in action

You can run Gemini on your own computer: just follow these simple instructions.

First, install Golly, a Game of Life simulator, by downloading and unzipping this folder from SourceForge. This will give you a folder called golly-2.1-win, which contains a number of sub-folders.

Next, get a copy of Gemini by downloading and unzipping this document from Google Docs. Save the resulting file, which is called gemini.rle, inside the golly-2.1-win/Patterns sub-folder.

Now double-click "Golly" in the golly-2.1-win folder to start the software. The program icon should be a yellow square with patterns of blue dots on it.

Go to File/Open Pattern and select the Gemini file. You should end up with a white diagonal line, going from top-left to bottom-right, on a black background.

You'll need to choose an algorithm with which to run the Game of Life. Simply go to Control/Set Algorithm and choose "HashLife".

Next, set the speed at which the simulation will run. To do this, press the "+" key four times. In the blue bar at the top, you should see "Step = 8^0" change to "Step = 8^4".

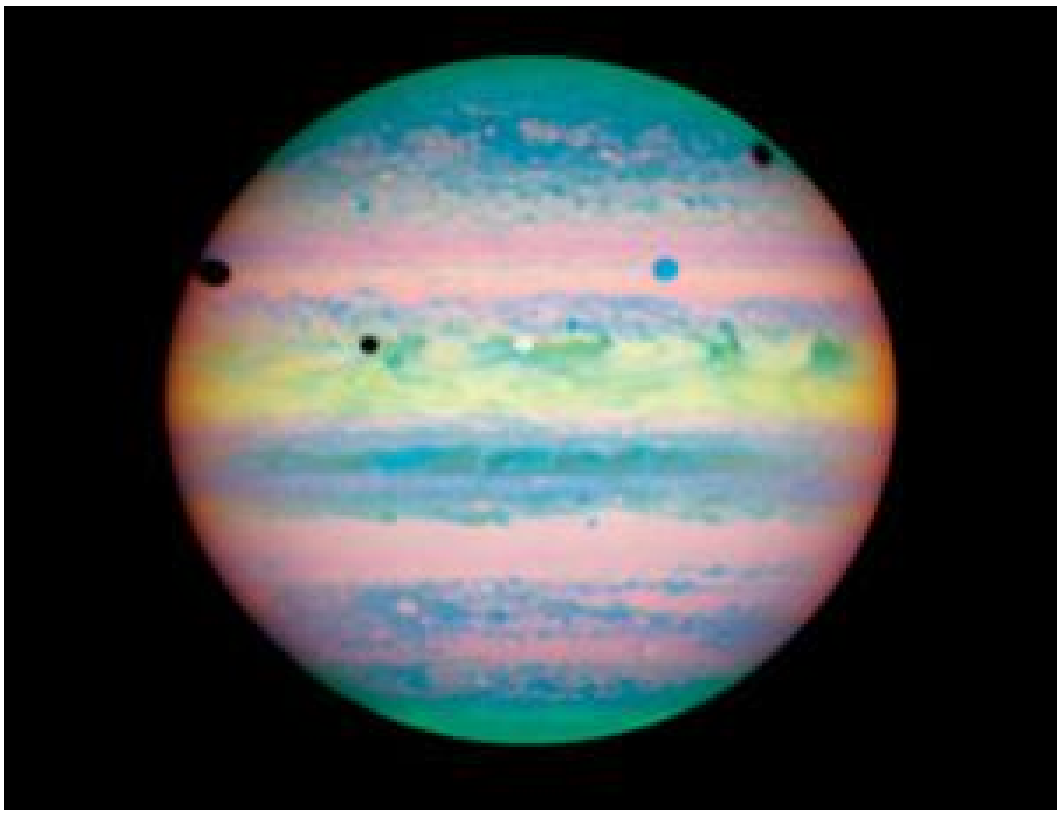
Now you're all set: just click the play button in the top-left corner to start the simulation.

If you hover your mouse over the top-left corner of the screen, Golly will give you controls allowing you to zoom in and out, and to move around. All the interesting stuff is at the top-left and bottom-right of the white diagonal line, and you'll need to zoom in a few steps.

http://www.newscientist.com/article/mg20627653.800-life-simulation-spawns-its-first-replicator.html?DCMP=NLC-nletter&nsref=mg20627653.800

Has Jupiter sent cosmology down a false trail?

- 11 June 2010 by **Eugenie Samuel Reich**
- Magazine issue 2765.



Unreliable? But why? (Image: NASA/ESA/E. Karkoschka (University of Arizona))

It's supposed to be the "gold standard" of evidence supporting the standard model of cosmology – including dark matter, dark energy and the exponential expansion after the big bang known as inflation.

But could it be wrong? Might misleading measurements by NASA's Wilkinson Microwave Anisotropy Probe (WMAP) have been leading us towards the wrong theory of cosmology? One astrophysicist thinks so, and he says the planet Jupiter is to blame – though others insist that there is nothing amiss.

WMAP detects photons of the cosmic microwave background, the "echo" of the big bang, and these measurements are used to map the temperature of the sky. Ripples in the map are used to calculate a spectrum that produces a near-perfect fit to the standard model of cosmology.

Since 2007, Tom Shanks at the University of Durham, UK, who is a critic of the standard model, has been tracking a discrepancy between measurements from WMAP and X-ray measurements of some of the same

star clusters made by ground-based telescopes. He initially assumed that the problem was with measurements from the ground and that the WMAP data was "pristine".

To calibrate the microwave data, WMAP scientists use the planet Jupiter, which they assume to be a steady source of microwaves. Observations of Jupiter show how much the cosmic ripples are being blurred by the instrument's optics, allowing the WMAP team to correct for this.

Now Shanks and his PhD student Utane Sawangwit have recalibrated the data using objects such as radio galaxies observed by WMAP that also emit microwaves. The result is a spectrum that is compatible with a host of theories that the WMAP team claims to have ruled out. For example, one-dimensional cosmic strings – defects in the fabric of space-time – or modified laws of gravity might explain the clumping of matter that is currently attributed to the dark matter and dark energy of the standard model. "If we're right, that would be incredibly important for cosmology," says Shanks.

However, he adds that it remains unclear why Jupiter would produce an unreliable calibration. "That problem is not understood as yet," he says. The paper (arxiv.org/abs/0912.0524) will appear in *Monthly Notices of the Royal Astronomical Society: Letters*.

The WMAP team isn't taking the challenge lying down. They claim that the radio sources observed by WMAP coincide with spots of the sky where the temperature is slightly higher, making the calibration inaccurate. "We're happy to defend WMAP," says team member Gary Hinshaw of NASA Goddard Space Flight Center in Greenbelt, Maryland.

http://www.newscientist.com/article/mg20627650.201-has-jupiter-sent-cosmology-down-a-false-trail.html?full=true&print=true

Hayabusa: The falcon has landed – what's it caught?

- 14:12 14 June 2010 by **Wendy Zukerman**

Touchdown (Image: JAXA)

Only the Millennium Falcon could rival the journey this bird has travelled. A capsule from the spacecraft Hayabusa – Japanese for peregrine falcon – has landed in one piece in the Woomera test range, South Australia. It hopefully contains the first samples of an asteroid ever brought back to Earth by human effort.

Hayabusa entered the atmosphere on schedule at 11.21 pm local time yesterday, according to the Japan Aerospace Exploration Agency (JAXA). Three hours earlier, the capsule, which should contain the samples from the asteroid Itokawa, had separated from the spacecraft to begin its slower descent to the surface.

Some feared that the capsule's parachute would not deploy. When Hayabusa awkwardly landed on Itokawa to collect samples in November 2005, the controls to deploy a parachute could have been destroyed. A second concern was that a beacon antenna needed to find the capsule in the Australian outback wouldn't work.

Yoshiyuki Hasegawa of JAXA announced earlier today that the parachute had deployed as hoped and the capsule had had a soft landing. "So we are very happy," he said.

The beacon antenna had also worked, transmitting a signal stronger than expected, said Hasegawa, and by 12.26 am local time the capsule had been located. Tomorrow, it will be flown to the Sagamihara Curation Center near Tokyo, Japan, where it will be opened.

Wait and see

If the capsule contains asteroid samples, they will give us clues as to how the Earth formed, and will also help us work out what to do if we find that an asteroid is on a collision course with our planet. But Hasegawa said we will only know for sure what is in the capsule after it has been cleaned and tested, which will take a couple of months.

The spacecraft was destroyed as it entered the atmosphere, creating a spectacular explosion (see above) that was recorded in a video by NASA.

Hayabusa was expected to return to Earth in 2007. But upon landing on Itokawa it hit several snags, including fuel leakage, engine breakdown, communication loss and possibly failure to deploy the mechanisms needed to collect the samples.

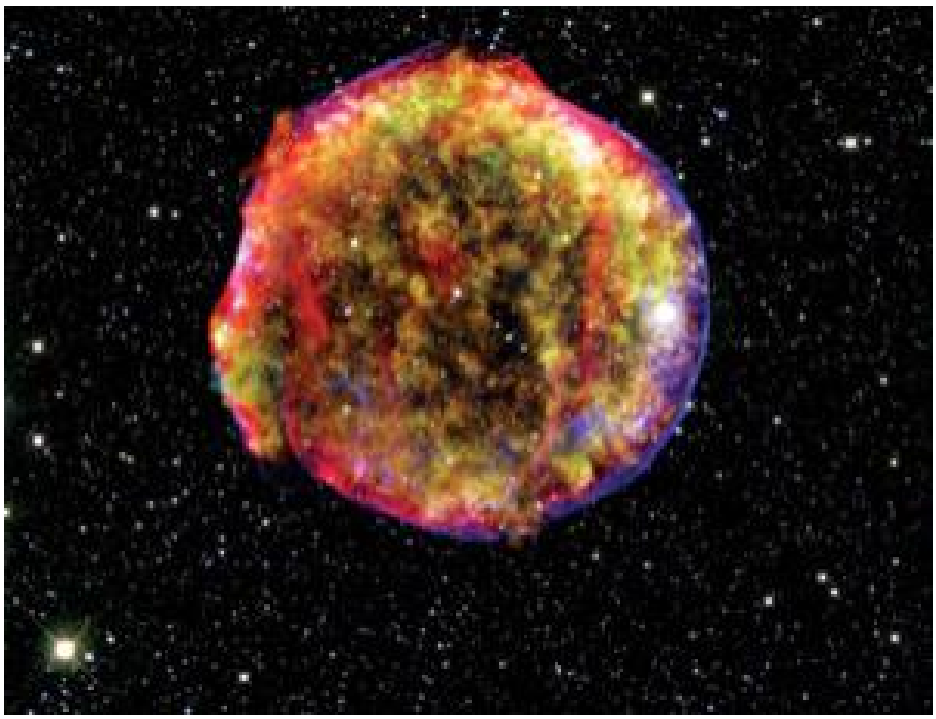
JAXA engineers eventually managed to nurse Hayabusa back to life. Among other feats, they cobbled together two broken engines to create a functional one.

In 2006, NASA's Stardust spacecraft beat Hayabusa in the race to bring back material from elsewhere in the solar system. Stardust's samples came from the comet Wild 2.

http://www.newscientist.com/article/dn19036-hayabusa-the-falcon-has-landed--whats-it-caught.html

Did a 'sleeper' field awake to expand the universe?

- 11 June 2010 by **Anil Ananthaswamy**
- Magazine issue 2764.



Supernovae point to expansion (Image: NASA/CXC/JPL-Caltech/Calar Alto O. Krause et al)

IT'S the ultimate sleeper agent. An energy field lurking inactive since the big bang might now be causing the expansion of the universe to accelerate.

In the late 1990s, observations of supernovae revealed that the universe has started expanding faster and faster over the past few billion years. Einstein's equations of general relativity provide a mechanism for this phenomenon, in the form of the cosmological constant, also known as the inherent "dark energy" of space-time. If this constant has a small positive value, then it causes space-time to expand at an ever-increasing rate. However, theoretical calculations of the constant and the observed value are out of whack by about 120 orders of magnitude.

To overcome this daunting discrepancy, physicists have resorted to other explanations for the recent cosmic acceleration. One explanation is the idea that space-time is suffused with a field called quintessence. This field is scalar, meaning that at any given point in space-time it has a value, but no direction. Einstein's equations show that in the presence of a scalar field that changes very slowly, space-time will expand at an ever-increasing rate.

Now Christophe Ringeval of the Catholic University of Louvain (UCL) in Belgium and his colleagues suggest that a quintessence field could be linked to a phase in the universe's history called inflation. During this phase, fractions of a second after the big bang, space-time expanded exponentially. Inflation is thought to have occurred because of another scalar field that existed at the time. But what if a much weaker quintessence field was also around during inflation?

According to the UCL team's models, inflation would have induced quantum fluctuations in the quintessence field. When the universe began its more sedate expansion after inflation ended, the field and its fluctuations would have been frozen into the fabric of space-time, so that the energy density of the field did not change with time.

This field would have had no impact on the early universe, which would have been dominated by matter and radiation. But eventually, as the universe grew, its expansion rate slowed down and the influence of matter and radiation diminished, the relative strength of the quintessence field increased, causing the expansion of space-time to accelerate, says Ringeval (arxiv.org/abs/1006.0368).

"The idea of mixing inflation with the dark energy problem is especially attractive," says Jérôme Martin of the Paris Institute of Astrophysics in France. But he adds that the "scenario needs additional calculations to be confirmed".

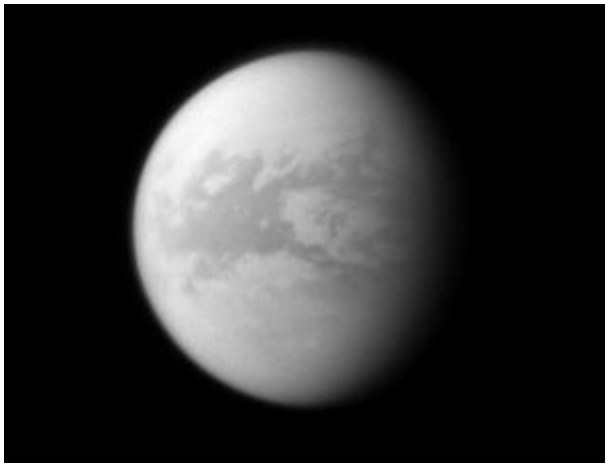
The first test of the idea could come as early as next year. The European Space Agency's Planck satellite is looking for signs of gravitational waves - fluctuations in the fabric of space-time caused by inflation. These would be imprinted in the cosmic microwave background (CMB), the radiation left over from the big bang, which the satellite will measure.

Ringeval and colleagues calculated what the strength of a quintessence field should be today, and worked backwards to estimate when inflation should have occurred. They found that it must have happened when the energy of the universe was in the teraelectronvolts (TeV) range. That would produce gravitational waves too weak to be detected by Planck, so if it does find evidence of them "our model will be destroyed", says Ringeval.

http://www.newscientist.com/article/mg20627643.500-did-a-sleeper-field-awake-to-expand-the-universe.html

Life on Titan? Maybe – but only a lander will tell us

- 14:15 10 June 2010 by **Rachel Courtland**



Take a deep breath of hydrogen (Image: NASA/JPL/Space Science Institute)

Hints of unexpected chemical activity on Saturn's moon Titan have sparked speculation that there may be alien life there. The new measurements, reported earlier this week, are intriguing. Taken alone, however, they don't constitute evidence of extraterrestrials. *New Scientist* examines what it will take to settle the question of life on Titan.

What's all the fuss about?

Titan's surface is a frigid -178 °C, too cold to sustain liquid water. But life may have been able to find a toehold nevertheless. In 2005, researchers suggested that organisms might survive in this inhospitable environment by breathing hydrogen and eating organic molecules such as acetylene and ethane. Now the Cassini spacecraft has found evidence that there's less acetylene on Titan than we would expect, and that levels of hydrogen may be actively being depleted at the surface – raising the possibility that exotic life forms are consuming these substances.

Sounds like evidence of life to me…

It is consistent with the existence of a proposed life form that might conceivably eke out an existence on icy Titan. That's a far cry from evidence that there is life on the moon.

So what else could be causing the unexpected chemical activity?

The mostly likely explanation is that the model used to estimate the flow of hydrogen in Titan's atmosphere from the Cassini measurements did not accurately simulate conditions on the moon, says Chris McKay of NASA's Ames Research Center in Moffett Field, California, one of the researchers who first proposed the acetylene-munching organisms.

This may mean the model overestimated the amount of hydrogen reaching the surface of Titan, which would make it seem that something is consuming hydrogen when it isn't. Another alternative is that Cassini's measurements are more uncertain than we think.

OK, but what if further models suggest hydrogen really is disappearing?

This still wouldn't be evidence of life. There is also the possibility, says McKay, that hydrogen is being consumed through a non-biological process, such as a reaction with acetylene to make methane. It seems unlikely, because catalysts such as copper and iron, which are needed for this reaction, are not thought to be present on icy bodies like Titan, nor very effective in extreme cold. But it's certainly a possibility.

So what are the next steps?

So far, only one model has been used to estimate hydrogen flow on Titan. Once others are used and more Cassini data comes in, we'll have a better idea about whether hydrogen really is being depleted at the surface.

If it is, experiments that simulate Titan conditions on Earth could show whether catalysts that help hydrogen and acetylene react with one another might work on Titan.

Would *that* be evidence for life?

No. Several missions to Titan's surface would be needed to find unambiguous evidence for life. One of the first steps may be to send a robotic lander equipped with a mass spectrometer, which could look for complex organic molecules – Titan analogues of molecules like ATP and chlorophyll – that could provide additional evidence of life.

A team of researchers is asking NASA to fund one such spacecraft, the Titan Mare Explorer. If accepted, it will launch in 2017. A larger Titan mission that would include a balloon and lander was deferred by NASA last year in favour of first sending two probes to explore Jupiter and its moons. These will lift off in 2020.

http://www.newscientist.com/article/dn19026-life-on-titan-maybe--but-only-a-lander-will-tell-us.html

Space shuttle's rudder could cut aircraft noise

- 12:31 16 June 2010 by **Paul Marks**

Airliners could be made quieter as they come in to land if designers took a crinkly leaf out of the space shuttle's book, Airbus suggests.

In a US patent filed last week, Airbus notes that the space shuttle's rudder – the hinged steering surface on the rear of the tail fin – splits to present two large surfaces to the airstream, helping to brake the craft as it glides back to Earth

Airbus engineer Klaus Bender in Hamburg, Germany, says such a "spreading rudder" could slow airliners down too, reducing the need to deploy the noisy, flat air brakes on top of the wing, which howl like the reed in a clarinet.

Airbus is not cheekily trying to patent the space shuttle's rudder. Its claimed innovation is a way to make the spread rudder work without making more of a racket than the air brakes.

Serrated edge

The idea is to carve serrations into the rudder's trailing edge to help break up the noise-producing vortex that would otherwise be generated there.

As well as increasing braking drag in a novel, low-noise way, the idea avoids the loss of lift that occurs when ordinary air brakes are deployed. With more lift from the wings, less engine power is needed as the aircraft approaches the runway, further reducing the noise.

But does the physics hold up? "It seems plausible," says Trevor Cox, an acoustics engineer at the University of Salford in the UK. When a serrated edge moves through a fluid it produces eddy currents which are more disorganised than those produced by a straight edge. That reduces the pressure difference, "and that in turn creates less noise", Cox says.

The concept of serrated edges is also being studied for wind turbine blades, in the hope that they will produce less noise to annoy nearby residents, Cox says.

http://www.newscientist.com/article/dn19050-space-shuttles-rudder-could-cut-aircraft-noise.html

Pulses of darkness let digital data travel farther

- 18:57 15 June 2010 by **Colin Barras**

Optical fibres can carry digital data for much longer distances without distortion if it is encoded in pulses of darkness, rather than pulses of light. To exploit this, Steven Cundiff, a physicist at the University of Colorado, Boulder, and colleagues have developed a device that has been dubbed the dark laser.

A standard laser can send out millions of picosecond-long light pulses each second, separated by longer dark intervals. The dark laser operates in reverse: it generates short pulses of darkness separated by relatively long intervals of brightness.

At the heart of Cundiff's dark laser is a chunk of material that emits light when an electric current is passed through it. This light bounces back and forth inside a mirrored chamber, in a similar manner to the way light is reflected back and forth in the resonance cavity of an ordinary laser to generate concentrated pulses of light.

The difference in the dark laser is that one of the mirrors has a light-absorbing coating. In this arrangement, with light of the right frequency, the chamber emits short pulses characterised by an absence rather than presence of light. The pulses, produced at a rate of up to 400 million per second, are 70 per cent less intense than the background light.

Dark pulse

This is not the first laser capable of transmitting dark pulses. Han Zhang and his team at the Nanyang Technological University, Singapore, built their own last year. But Zhang notes that one obvious advantage of Cundiff's dark laser is the high rate at which it produces dark pulses.

Jeremy Baumberg at the University of Cambridge points out that it has long been possible to generate dark pulses using external devices attached to a standard laser to intermittently shut off the beam. "I showed that such dark pulses were possible while I was working at Hitachi here in Cambridge about 10 years ago," he says. What makes this work interesting is that it spontaneously generates dark pulses, he adds.

However, Baumberg is unsure of how dark lasers might be used. In the same way that lasers were initially regarded as a solution looking for a problem, the dark laser is "a curiosity looking for an application", he says.

Cundiff says the dark pulse could prove useful in long-distance optical communications. There are limits to how far a coherent light pulse can travel along a fibre-optic cable without "smearing" and distorting, as different wavelengths within the pulse travel at slightly different speeds. That's not a problem for a pulse defined by an absence of light, says Cundiff.

Journal reference: *Optics Express*, DOI: 10.1364/OE.18.013385

http://www.newscientist.com/article/dn19049-pulses-of-darkness-let-digital-data-travel-farther.html

Phone sensor predicts when thoroughbreds will go lame

- 15 June 2010 by **Paul Marks**
- Magazine issue 2764.
-

Sore Point? (Image: Paper Giraffe/Alamy)

YOU might think it would be easy to spot when a horse is going lame. But an inability to walk, trot, canter or gallop with a regular motion on all four hooves can produce subtle or intermittent symptoms, making it hard to decide whether a valuable racehorse or showjumper needs treatment. Now a sensor more often found in smartphones could help provide an early diagnosis.

The use of technology to study equine locomotion has a distinguished history. Back in 1877, the photography pioneer Eadweard Muybridge used a high-speed camera to show that a galloping horse at times has all four hooves off the ground. The new scheme aims to detect incipient lameness by focusing on the movement of a horse when it is trotting.

"An objective measure of lameness is needed because it's not always obvious visually," especially in the early stages of a condition, says Maj Halling Thomsen of the large animal sciences unit at the University of Copenhagen in Denmark. So Thomsen and his colleagues have turned for help to the miniature accelerometers that were originally developed for use by the cellphone industry.

At the heart of these devices are three piezoelectric cantilevers, set at right angles to each other. Each one produces a voltage when it is compressed by forces due to acceleration or gravity, so the three together can detect forces in three dimensions. Phones use these signals to orient information displayed on the screen, or to produce a response when the user shakes the device.

Thomsen knew that when a horse is about to go lame it starts to move with an asymmetric gait as it trots, and reasoned that such an accelerometer, mounted on the animal's back above its centre of gravity at the base of the neck, might be able to detect this.

In a set of preliminary tests on 12 healthy trotting horses they found that the accelerations detected by the device were, as the team expected, symmetrical (*Journal of Biomechanics*, DOI: 10.1016/j.biomech.2010.05.004).

"All we need to do is check vertical accelerations of the trunk during trot, because the symmetry decreases with lameness," says Thomsen. The team now plans to conduct further tests on lame horses to see if deviations from the "symmetry indices" they have drawn up can help predict the onset of lameness.

The Danes will have their work cut out, says equine surgeon Henry Tremaine of the University of Bristol in the UK. Many biomechanical systems have been proposed for lameness detection, he says, "but none has been translated into practical aids".

That said, Tremaine reckons Thomsen's results are encouraging because the accelerometer seems well able to monitor movement of the animals' centre of gravity - so it may be able to help diagnose problems in other gaits, too. "We will have to wait for their subsequent studies to see if they get consistent, clinically useful results," he says.

http://www.newscientist.com/article/mg20627645.100-phone-sensor-predicts-when-thoroughbreds-will-go-lame.html

Recycled batteries boost electric cars

- 15:30 15 June 2010 by **Helen Knight**

Batteries can keep on giving (Image: Glenn Copus/Evening Standard/Rex Features)

It's a common complaint: we'd like to be greener, but the cost is exorbitant. When it comes to plug-in hybrids and all-electric cars, it's an argument that has some justification – largely because of the cost of the powerful lithium-ion batteries they run on. So how can we reduce the cost of batteries without curtailing their performance?

Let's rule out just waiting: battery costs are expected to fall, but not fast enough to bring electric cars into the mainstream. But there may be a way for batteries to offset their cost by earning some money for their owners.

Some electricity utility companies and car makers are investigating the possibility of using electric cars to store power for the grid when they are in the garage, with some form of financial incentive for the car owner. But all the additional discharging and charging would shorten the life of the battery – and if you've just paid out $40,000 on an electric car, that may not appeal.

Life after death

There may be a more palatable version of this so-called vehicle-to-grid idea. Used lithium-ion batteries that no longer hold charge well enough to power a car could provide electricity storage for the grid, says Sankar Das Gupta at battery maker Electrovaya, based in Mississauga, Ontario, Canada.

Currently the car industry considers a battery to have reached the end of its life when repeat use means it can only be charged to 80 per cent of its original capacity. That would still be perfectly acceptable for grid-scale storage, says Das Gupta.

His company is involved in a project with partners including Eric Bibeau at the University of Manitoba in Winnipeg, Canada, in which they will combine used lithium-ion batteries from demonstration vehicles to build a 150 kilowatt-hour prototype storage system and monitor how it performs when connected to the grid.

Saving for later

With hopes for future energy supply pinned on intermittent sources of electricity generation such as wind and solar power, it has become more important to be able to store electricity. These sources cannot be turned on or off to match demand, so only storage can ensure that over-capacity is not wasted, and that the power stays on when the wind stops blowing and the sun sets. Utilities and researchers are already investigating a range of ways to solve this dilemma, including flywheels and compressed air.

So using second-hand lithium-ion car batteries would kill two birds with one stone, says Brett Williams at the Transportation Sustainability Research Center at the University of California, Berkeley: helping car owners recoup some of the expense of their vehicle's battery, while simultaneously benefitting producers of renewable energy.

These repurposed batteries are likely to appeal more to energy companies than leasing time on ones still housed in a car, says Williams. "The stationary device can commit to be connected and available throughout the day," he says.

Das Gupta will present his idea at the Clean Technology conference in Anaheim, California, next week.

http://www.newscientist.com/article/dn19047-green-machine-recycled-batteries-boost-electric-cars.html

David de Rothschild: At sea in a soda-bottle boat

- 15 June 2010 by **Jessica Griggs**

Magazine issue 2764.

Plastic, plastic, everywhere (Image: Scott Gries/Getty Images)

You have been on the ocean for 54 days now. How is it going?

Really well. I have to keep pinching myself that we are floating on a boat made out of 12,500 2-litre reclaimed plastic bottles.

Why is your boat, the Plastiki, built out of these bottles?

We thought they would make a tough hull but we also wanted to highlight the bottle's status as one of the most disposable plastic items we buy. This project is about taking a symbol of dumb plastic 1.0 - the single-use, throwaway kind - and making it functional. The Plastiki gets 68 per cent of her buoyancy from the bottles.

Environmentalists' knee-jerk reaction is often to vilify plastics. Instead we need to differentiate between the throwaway kind - the bottle, the bag, the polystyrene foam - and the smarter materials like the laptop I'm using now or the lifesaving machinery in hospitals. The latter have a valued place in our society and a longer life cycle but we need to re-engineer them to have a closed-loop life cycle, so that they are recycled over and over.

Is this kind of smarter plastic incorporated into the design too?

Yes. The structure of the boat is made out of a material called self-reinforced polyethylene terephthalate (srPET). It is a single-substance material which means it is easily recycled.

What is srPET used for today?

Not much. It has been around since the 1980s but there hasn't been the desire to take it out of the laboratory. It is slightly more expensive than less green alternatives, but I think the market is starting to move on. People want to know where their materials come from and how they affect the health of the planet.

Did you offset the carbon footprint of manufacturing the boat?

Our footprint was a lot smaller than it could have been because we manufactured a lot of the boat ourselves off-grid, using solar power. When we got into tracing the carbon footprint of all the stuff we had ordered, it actually became financially restrictive for us to do the analysis. We got a quote from one company that was of the order of $100,000 to do a full analysis of our carbon footprint.

A lot of firms brand themselves carbon neutral but they don't say when their neutrality began - you have to go all the way down the supply chain.

Have you seen more plastic than fish in the water during your time at sea?

Yes, by a long way. The issue is far more ominous than people imagine, as the Pacific garbage patches are not just floating islands of trash. They are mainly subsurface - tiny pieces of material in the process of breaking down and floating in the top layer of the ocean where most species live and breed. When we look underneath the boat, the hull is covered in a fine, extra layer of plastic. It is tragic. From above, the oceans still look beautiful and untouched but just below the surface is this toxic stew that could quickly end up on our dinner plates.

Profile

David de Rothschild is an explorer and environmentalist. He is head of the climate-change awareness company Adventure Ecology, and expedition leader on the boat Plastiki

http://www.newscientist.com/article/mg20627645.400-david-de-rothschild-at-sea-in-a-sodabottle-boat.html?full=true&print=true

Computerised critics could find the music you'll like

- 14 June 2010 by **MacGregor Campbell**
- Magazine issue 2764.

Never easy to categorise (Image: Michael Ochs Archives/Getty Images)

MOST of us know better than to accept advice from an ignoramus. Yet we are content to listen to music playlists or even to buy tracks based on a computer's assessment of what we might enjoy, despite the software not knowing the first thing about music. The plan now is to make this less of a hit-and-miss affair by giving computers a course in musical appreciation.

Online music stores base their recommendations on similarities in buying or browsing patterns: when you buy a song, for example, the system might highlight music purchased by others who have bought the same song as you. Other online music services, such as Pandora, combine this so-called crowd-filtering approach with human labelling - where users assign descriptive terms to a song. The system can then choose songs for you whose descriptions match those of a track you have already selected, for example.

These services work up to a point, but they tend to favour artists who already have significant sales data to work with, or else they rely purely on the opinions of human labellers, says Luke Barrington, an artificial intelligence researcher at the University of California, San Diego. Could we improve such services by teaching computers the rudiments of music?

Barrington is building software that can analyse a piece of music and distil information about it that may be useful for software trying to compile a playlist. With this information, the software can assign the music a genre or even give it descriptions which may appear more subjective, such as whether or not a track is "funky", he says.

The software can give the music a more subjective description, such as whether or not it is funky

Before any software can recommend music in this way, it needs to be capable of understanding what distinguishes one genre of music from another. Early approaches to this problem used tricks employed in speech recognition technology. One of these is the so-called mel-frequency cepstral coefficients (MFCC) approach, which breaks down audio into short chunks, then uses an algorithm known as a fast Fourier transform to represent each chunk as a sum of sine waves of different frequency and amplitude. In speech recognition, the nature of the sum arrived at can help a computer distinguish between phonemes, the units of sound that make up speech. When applied to music, the technique can be used to assign loose categories to songs.

The technique is useful for determining which instruments are being used in a piece but is otherwise pretty basic, says Dan Ellis, who researches computer audio analysis at Columbia University in New York. "It's like taking a 10-megapixel image and representing it as a blurry thumbnail," he says.

Luciano da F. Costa and colleagues at the University of São Paolo in Brazil take a different approach. Their software looks at rhythm to assign a genre to music.

Unlike melody, rhythm is potentially a useful way for computers to find a song's genre, da F. Costa says, because it is simple to extract and is independent of instruments or vocals. Previous efforts to analyse rhythm tended to focus on the duration of notes, such as quarter or eighth-notes (crotchets or quavers), and would look for groups and patterns that were characteristic of a given style. Da F. Costa reasoned that musical style might be better pinpointed by focusing on the probability of pairs of notes of given durations occurring together. For example, one style of music might favour a quarter note being followed by another quarter note, while another genre would favour a quarter note being succeeded by an eighth note.

By analysing a collection of MIDI files - electronic transcriptions of music - da F. Costa's team was able to establish models of the note transitions characteristic of rock, blues, reggae and bossa nova songs. They then tested these models against a selection of tracks available on last.fm that users had already suggested a genre for. For tracks that had been placed in a single genre by users, the team's results agreed with the user-suggested genre in 71 per cent of cases (*New Journal of Physics*, DOI: 10.1088/1367-2630/12/5/053030). While not perfect, the result does suggest that rhythm can play a useful role in categorising songs, says da F. Costa.

Barrington, however, believes that assigning genres to entire tracks suffers from what he calls the *Bohemian Rhapsody* problem, after the 1975 song by Queen which progresses from mellow piano introduction to blistering guitar solo to cod operetta. "For some songs it just doesn't make sense to say 'this is a rock song' or 'this is a pop song'," he says.

Barrington wanted to create a system that could distinguish between different styles of music within a single song. He started out using the MFCC approach on songs that did not vary in style, breaking these songs down into overlapping 5-second chunks and constructing a profile of how the MFCC features evolved in the course of each song. This was used to create a genre "fingerprint" for whole songs by matching the profile to those in songs volunteers had labelled. Last year he showed that this system was capable of taking a "seed" song and producing a related playlist that users rated as highly as one generated from buying patterns.

Now Barrington has applied that approach to identify styles within a single song. If a user has chosen a song with a mellow verse and a raucous chorus, for example, the system can recommend songs that follow a similar pattern, rather than merely being in the same genre. The work will be presented at the International Society for Music Information Retrieval Conference in Utrecht, the Netherlands, this August.

While such efforts show that computerised music analysis is making progress, it also highlights how unsophisticated these systems are today, says Ellis. "What they're doing is much less than what any reasonably musically literate human can get out of the sound," he says. "What's amazing, though, is that we can build these incredibly crude systems and still do these tasks."

http://www.newscientist.com/article/mg20627644.900-computerised-critics-could-find-the-music-youll-like.html

Intensive farming 'massively slowed' global warming

- 20:00 14 June 2010 by **Andy Coghlan**

Climate hero or climate villain? (Image: Sunset Avenue Productions/Getty)

Fertilisers, pesticides and hybrid high-yielding seeds saved the planet from an extra dose of global warming. That, at least, is the conclusion of a new analysis which finds that the intensification of farming through the green revolution has unjustly been blamed for speeding up global warming.

Steven Davis of the Carnegie Institution of Washington in Palo Alto, California, and colleagues calculated how much greenhouse gases would have been emitted over the past half-century if the green revolution had not happened.

The study included carbon dioxide and other gases such as methane emitted by rice paddies. It found that, overall, the intensification of farming helped keep the equivalent of 600 billion tonnes of CO_2 out of the atmosphere – roughly a third of all human greenhouse-gas emissions between 1850 and 2005.

The emissions were avoided because the green revolution boosted crop yields – for instance by promoting hybrid varieties that had higher yields, and through widespread distribution of pesticides and fertilisers. This meant that more food could be produced without having to slash vast swathes of forest to expand farmland.

Land spared

"I think our results show the danger of focusing on one part of a complex system," says Davis, in response to environmentalists' claims that intensive agriculture has boosted emissions of greenhouse gases because it involves making and adding more fertiliser and agrochemicals.

"While it's certainly true that emissions from the manufacture of fertiliser have grown as a result of the green revolution," says Davis, "we show that these and other direct emissions from agriculture are outweighed by the indirect emissions avoided by leaving unmanaged lands as they are."

And by enabling farmers to produce more on existing farmland, the green revolution spared 1.5 billion hectares – an area one-and-a-half times that of the US – from being turned over to agriculture.

"We argue that it's very important to continue boosting yields, while also using agricultural resources such as fertiliser and water as efficiently as possible," says Davis.

More downsides

"This paper makes an impressive case that agricultural intensification was a key process allowing for increases in food supply while limiting the area required for food production," says Helmut Haberl, who studies the effect of agriculture on global resources at Klagenfurt University in Vienna, Austria. "It shows that agricultural intensification can have positive environmental effects, along with its well-known downside."

But Haberl cautions that the study fails to acknowledge other societal and environmental harm from intensification, such as the degradation of soil, loss of biodiversity, toxic effects of pesticides on farm workers and animal suffering.

David Pimentel of Cornell University in New York, an authority on organic agriculture, disputes some of Davis's conclusions. He cites a 22-year experiment by his team which showed that organically produced maize and soybeans generated yields equivalent to conventional agriculture, but consumed 30 per cent less energy from fossil fuels, at the same time doubling the amount of carbon in the soil.

Pimentel also claims to have shown that organic production in Indonesia and India consumes far less energy per calorie of rice or maize than intensive production in the US.

Journal reference: *Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.0914216107

http://www.newscientist.com/article/dn19042-intensive-farming-massively-slowed-global-warming.html

How endangered are the Gulf's brown pelicans?

- 18:28 11 June 2010 by **Phil McKenna**

Workers for the Louisiana Department of Wildlife and Fisheries and the US Fish and Wildlife Service prepare to net an oiled pelican in Barataria Bay, Louisiana, last Saturday (Image: Petty Officer 2nd Class John Miller/US Coast Guard)

Brown pelicans dripping with oil are quickly becoming the poster children of the ongoing Deepwater Horizon oil spill. As oil slicks continue to lap at the pelicans' breeding grounds in coastal Louisiana, armies of wildlife rehabilitators are frantically trying to catch and scrub the contaminated birds clean. What does it all mean for the long-term survival of the species – just months after they were taken off the US endangered species list?

How endangered is the brown pelican?

The species as a whole isn't about to go extinct as a result of the oil spill: as 400,000 out of a total global population of 650,000 live in Peru. Roughly 60 per cent of the subspecies *Pelecanus occidentalis carolinensis* breed along the Gulf coast, where many nest on the barrier islands off Louisiana that have already been exposed to oil.

The slicks threaten the birds and their fragile wetland habitat only a few months after brown pelicans were removed from the US federal endangered and threatened species list in November last year. The birds had been on the list since 1970 after the pesticide DDT poisoned and nearly wiped out pelicans across the country. At the time Louisiana, where the pelican is the official state bird, lost its entire population. After years of resettling individual birds from Atlantic coast populations, Louisiana was able to boast the largest brown pelican population of any Gulf state, with 16,000 nesting pairs in 2004.

Will the spill cause brown pelican populations to crash and require them to be relisted?

It's still too early to say, simply because no one knows how much oil will have been spilt by the time the leak is finally plugged. The US Endangered Species Act requires federal biologists to keep close tabs on pelican populations for the first five years after delisting. If populations drop significantly in the Gulf, brown pelicans could be relisted, even if populations along the Pacific and Atlantic coasts remain stable.

"It isn't rocket science," says Roger Helm, chief of environmental quality for the US Fish and Wildlife Service. "If you have a small population and you whack it hard, there is going to be a significant impact."

How are oiled birds rescued from the spill and cleaned?

Only a small fraction of oiled birds are ever found – many die at sea or on remote shores. Those that are found and can be approached are covered with vegetable oil to loosen up the crude oil before being cleaned with dishwashing liquid.

Wildlife rehabilitators continually make subtle tweaks to this process to try to increase survival rates, such as minimising stress with the help of improved enclosures and longer rest periods.

Birds are also given water and electrolytes while they are cleaned to keep them hydrated. Those thought to have swallowed oil may be given coal or indigestion medication to reduce the amount of oil absorbed by their digestive system.

Do the cleaned birds stand a chance of survival or should they be killed humanely?

The International Bird Research Rescue Center, one of two organisations heading up the treatment of oiled birds in the Gulf, claims that 50 to 80 per cent of the birds treated survive at least to the point of where they can be released back into the wild. This is a major improvement from just 4 per cent during the organisation's first oil spill response in 1971.

The survival rate following release is more difficult to determine and is subject to controversy. The biologist Silvia Gaus recently called for oiled birds to be killed humanely, claiming 99 per cent of released animals die within days or a few weeks due to stress or kidney and liver damage from ingesting oil. But several reports, including a pair of recent small-scale radio-tracking studies, suggest cleaned birds have a good chance of long-term survival even compared with birds that were never oiled. Survival prospects also vary depending on the species and spill conditions.

What will happen to the pelicans once they are released?

The US Fish and Wildlife Service is releasing rehabilitated pelicans on Florida's Atlantic coast. Federal biologists hope the birds will remain in their new locations as reintroduced birds from the Atlantic coast formed new colonies in Louisiana in recent decades. While this may work for young birds, breeding adults are likely to make their way back to their nest sites and, depending on how quickly they return, they could be exposed to oil once again.

To ensure the long-term survival of brown pelicans along the Gulf coast, significant work may be needed in coming years to restore the wetlands and fisheries that the birds depend on for breeding and feeding. At the time of posting 442 oiled birds had been captured and roughly a dozen brown pelicans had been released while a large number remained in holding pens.

What are the costs of the rehabilitation programme, and who foots the bill?

Figures from the clean-up of the 1989 Exxon Valdez oil spill put the cost at $15,000 per marine bird for a total of 627 birds released. This covers building rehabilitation centres, staff and helicopters and private boats. The cost of caring for wildlife after recent oil spills has amounted to roughly 1 per cent of the total clean-up costs.

http://www.newscientist.com/article/dn19035-how-endangered-are-the-gulfs-brown-pelicans.html

Doubts over safety tests on Gulf oil dispersants

- 18:30 16 June 2010 by **Peter Aldhous**

Dispersants clear the visible oil, but what happens to the marine life? (Image: Petty Officer 2nd Class Andrew Kendrick/US Coast Guard)

As arguments rage over how to clean up the Deepwater Horizon oil spill, an examination of toxicity tests reveals flaws in the data used to determine the safety of dispersants.

The US Environmental Protection Agency and BP have locked horns over the toxicity of the dispersants being used to break up the oil spewing from the Deepwater Horizon well. Now, *New Scientist* has learned that huge variability in the safety test results submitted by different manufacturers makes it very difficult to judge which of the available dispersant chemicals poses the least threat to marine life.

"It screams to me that I can't make a judgement on any of these data," says Carys Mitchelmore, a toxicologist at the University of Maryland's Chesapeake Biology Laboratory in Solomons, and co-author of a 2005 National Research Council report on the use of oil dispersants.

The EPA commissioned a new round of tests in late May, but it remains unclear when these will be completed.

As of 14 June, more than 3.34 million litres of dispersant had been sprayed onto oil on the sea surface. At least a further 1.52 million litres had been pumped into the oil gushing from the stricken well some 1500 metres below sea level. The use of such large volumes at depth is unprecedented, and marine biologists are concerned about possible toxicity to organisms, including shrimp and fish larvae.

BP vs EPA

So far BP has used a dispersant called Corexit EC9500A made by Nalco Energy Services of Sugar Land, Texas. But on 20 May, the EPA ordered BP to find a less toxic alternative.

The company quickly responded, stating that only five dispersants met the EPA's requirements. Only one, called Sea Brat #4, made by Alabaster of Pasadena, Texas, was stockpiled by BP. This contained a chemical that would degrade into nonylphenol; this is a hormone disrupter likely to harm the reproductive systems of marine organisms. "BP continues to believe that Corexit EC9500A remains the best alternative," the company concluded.

Since then, there has been an uneasy stand-off, with the EPA telling BP on 26 May to stop surface spraying, and limit its subsea use of dispersant to a maximum of some 57,000 litres on any given day.

Toxicity tests

However, a close examination of the EPA's website reveals that the agency's assumptions about dispersant toxicity are based on unreliable data.

When it demanded that BP find less toxic dispersants, the EPA referred to a table summarising experiments in which a fish called *Menidia beryllina* and *Mysidopsis bahia* shrimp were exposed to a mixture of dispersant and diesel fuel oil in a ratio of 1:10.

These are standard experiments that must be submitted for inclusion on the EPA's National Contingency Plan Product Schedule, which lists products authorised for use on an oil spill. They determine the concentrations in parts per million (ppm) required to kill half of the animals in a given time.

But they are only part of a series of tests that are required by the EPA: the dispersant must also be tested alone, the fuel oil must be tested alone, and finally the lab must run controls testing a "reference toxicant" known as dodecyl sodium sulphate (DSS).

Looking across all the listed dispersants, test results for the fuel oil alone are highly variable, with the concentrations required to kill half of the fish varying from 5.95 to 201.8 ppm. This could indicate that some of the tested oil samples had lost their most toxic volatile components.

This is a major problem. The tests reveal varying toxicity for the different dispersant-oil mixes. But given the significant differences between results for samples of oil alone, it becomes very difficult to compare the results for the mixes. "It's absurd," says Joannie Docter, president of GlobeMark Resources in Atlanta, Georgia, which makes a dispersant called JD-2000.

Incomplete data

The DSS control experiments pose even bigger problems, says Mitchelmore. The concentrations of DSS required to kill half of the fish, for example, vary from 1.14 ppm for the tests submitted for Sea Brat #4, to 159.6 ppm for the controls submitted for Nokomis 3-F4, made by Mar-Len Supply of Hayward, California.

Presumably, this huge variation reflects inconsistencies in the testing procedures used by the labs hired by manufacturers to run the tests. If so, it throws the EPA's conclusions about the products' relative toxicities into serious doubt.

Docter has complained to the EPA about its reliance on "incomplete and misleading" data; Nalco has similarly drawn the agency's attention to the huge variability in the results supplied by different dispersant manufacturers. "They acknowledged that there are some shortcomings," says David Horsup, vice-president for research and development with Nalco Energy Services.

Mitchelmore argues that the EPA should also run tests on the growth and reproduction of shrimp and fish, to judge the dispersants' longer-term effects. Those tests are not yet being run.

The EPA says it has commissioned a single laboratory to retest all the authorised dispersants, running the standard tests but using Louisiana crude rather than fuel oil. Establishing uniform conditions and ensuring the animals are all of the same age takes time, the agency told *New Scientist*. "These tests take more than a few days to run."

http://www.newscientist.com/article/dn19053-doubts-over-safety-tests-on-gulf-oil-dispersants.html

Is it time to say goodbye cool world?

- 15 June 2010 by **Fred Pearce**, Bonn
- Magazine issue 2765.

What hope is there for a deal on climate change based on science? The answer seems to be "not much".

Climate negotiators meeting over the past two weeks in Bonn, Germany, enjoyed a new spirit of bonhomie as they worked to heal the rifts created by the failure of UN talks in Copenhagen, Denmark, last December. At the close of talks on 11 June, they believed they were back on track to deliver a new climate agreement by the end of 2011.

But diplomatic harmony has come at a price: sacrificing a cool future for planet Earth.

Until Copenhagen, the aim was to set targets for major emitters of greenhouse gases that would limit warming to 2 °C. That required, as a first step, that by 2020 industrialised countries cut emissions by 25 to 40 per cent compared with 1990 levels.

While that target remains an option in draft deals, most negotiators say they will have to accept whatever pledges industrialised countries are prepared to make. Right now those pledges add up to cuts of between 12 and 19 per cent, according to the UN climate secretariat. And there are loopholes that could mean even these pledges amount to virtually nothing.

"As things stand now, we will not be able to halt the increase in global greenhouse gas emissions in the next 10 years," UN chief negotiator Yvo de Boer said in Bonn. "The 2-degree world is in danger. The door to a 1.5-degree world is rapidly closing." De Boer is stepping down at the end of this month, and his successor, Costa Rican diplomat Christiana Figueres, said her priority was "rebuilding trust" rather than setting objectives.

There is as yet no agreement on whether countries want a direct successor to the Kyoto protocol – which set out a global target to cut emissions and shared the burden among signatories – or a new and looser agreement based on national pledges, such as that outlined in the Copenhagen Accord that US president Barack Obama attempted to put together in December.

The only elements of the old Kyoto regime that received widespread support from industrialised countries in Bonn were those that would, if retained, further undermine promises of emissions cuts. Russia and Ukraine will have large stocks of unused emissions permits when the Kyoto protocol ends in 2012, and want to "bank" them so they can sell them later. The new mood of putting diplomacy before science means they are likely to be allowed to do this – enabling countries that buy them to emit more.

A second loophole concerns emissions from forests in rich nations such as Canada, Austria and Finland, which could allow an extra 200 to 400 million tonnes of CO_2 a year to be emitted. According to John Lanchbery of BirdLife International, a long-time observer of climate talks, the negotiators in Bonn put little effort into eliminating this loophole. Several countries said that if they were held to account for their forests, they would cut their emissions pledges.

An analysis by the European Union published in March showed that the combination of banking Kyoto permits and discounting forest emissions will effectively reduce promised cuts from industrialised countries from between 12 and 19 per cent to "almost zero". That could be the price of a diplomatic deal.

A new Kyoto deal by the back door

The demise of a global, UN-negotiated deal on emissions caps need not sound the death knell for a low-carbon future. Regional trading schemes could provide the impetus.

The largest international emissions trading scheme operating so far is the one run by the European Union. Its cap is set by the EU's Kyoto protocol pledge to cut emissions by 8 per cent relative to 1990 levels by 2012, and its future was made independent of UN talks when the EU declared it would cut emissions by 20 per cent by 2020.

The EU scheme may not be alone for much longer. "I think we will see parallel trading schemes emerge," says David King, director of the Smith School of Enterprise and the Environment at the University of Oxford. The American Power Act, if adopted, would establish a US emissions trading scheme, and Asian nations have also discussed a regional cap-and-trade scheme.

King argues that the emergence of several parallel schemes could bring about a global cap on emissions, albeit by a roundabout route (see editorial comment, page 3). Initially, regional schemes would lead to industries in different parts of the world paying different prices for emitting carbon. This would give an advantage to manufacturers in regions where the price of polluting is low. So to level things up, high-price countries would impose tariffs on imports from low-price regions, King predicts.

But such measures would run contrary to the WTO's principles of free trade. "It spells deep trouble for trade treaties and organisations," says economist William Nordhaus at Yale University. King argues that this would force the WTO to step in and "persuade nations to get their act together". Because the WTO has strict rules that member nations must abide by, it may turn out to be a more persuasive forum for talks than the halls of the UN.

Catherine Brahic

http://www.newscientist.com/article/mg20627650.401-is-it-time-to-say-goodbye-cool-world.html

Don't waste lab animals

- 10 June 2010 by **Simon Festing**

Magazine issue 2763.

Will their results even see the light of day? (Image: Grey Villet/Getty)

THOSE of us who support the careful and well-regulated use of animals for scientific and medical advancement are well aware that it remains controversial. Animal experiments are essential for the development of new medicines, and for safety testing, but are vocally opposed by some.

So it is with growing concern that we read the latest in a string of scientific papers highlighting problems with the way animal research is conducted. The accusation is that animal experiments are too often poorly designed, conducted, reported and reviewed.

Not only does this give ammunition to the opposition, it allows some to claim that animal studies are a misleading guide to what might happen in humans, and also that animals are suffering needlessly in useless experiments.

The use of animals is a privilege, and must always be undertaken responsibly. We must therefore face up to these criticisms and assess what needs to be done.

The use of animals in research is a privilege and must always be undertaken responsibly

One of the papers causing concern is an analysis of more than 1350 animal experiments on the treatment of stroke (*PLoS Biology*, vol 8, p e1000344). The authors used statistical tools to predict that a further 214 experiments had been conducted but the results never published - the so called "file drawer problem".

That is 1 in 7 studies that never see the light of day. The authors concluded that this publication bias has probably distorted the collective findings of the published studies, as research usually remains unpublished because it failed to find any positive effect of a treatment.

Although the results cannot necessarily be applied across all animal research, it is nonetheless cause for concern. The danger is that humans may be put at risk because potential new medicines are moved into clinical trials prematurely.

Another paper reveals perhaps an even bigger problem. The authors chose 217 animal studies at random and analysed their quality in terms of experimental design, statistical analysis and reporting of results. Only 59 per cent of the studies stated the objective of the study and the number and types of animals used. More than 80 per cent failed to say whether the researchers used randomisation or blinding - standard tools in much biomedical research (*PLoS One*, vol 4, p e7824).

There have been other papers suggesting that many animal studies are poorly designed, using too few animals to be statistically valid, for example.

One note of caution is that animal studies are highly diverse. Most are part of basic or applied medical research, but animals are also used in pre-clinical safety testing, veterinary development, environmental studies and various types of fundamental research. It would be wrong to suggest that these different types of research should be designed and analysed the same way.

Even so, these various problems need to be tackled. Doing so will require a willingness to confront the issues and improve practices.

The first area that needs to be dealt with is publication bias. The non-publication of negative results is a serious problem in many fields of research. Reducing it in animal research would bring clear benefits, not least ensuring a sound basis to move from animal studies into clinical trials.

The recognition of publication bias in clinical trials involving humans led to the introduction of registration systems to keep track of all relevant trials. It is not inconceivable that we might move towards a similar registration system for animal studies. Initiatives are already under way in some fields of research, with stroke studies a notable example. Collaboration would need to be international, since the missing papers could come from anywhere.

Journals can help. One prominent publication, the *British Medical Journal*, now welcomes studies with negative results as long as their research questions are important and relevant. Open-access online publishing also presents opportunities for wider access to the buried data.

Another area where weaknesses exist and improvements are needed is the way animal studies are written up in journals - failure to report the number of animals used, for example. The UK National Centre for the Replacement, Refinement and Reduction of Animals in Research (NC3Rs) has been working with scientists, journal editors and research funders to develop guidelines. These will set out the basic information that should be included, based on successful guidelines for reporting human clinical research developed by an international group of biomedical researchers and journal editors called CONSORT.

The design and statistical analysis of individual experiments also need to be improved. While there are plenty of well-conducted studies out there, ideally every research project - whether using animals or not - should be well-designed and the results analysed using the most appropriate statistical method.

Funders have a role to play here by checking experimental design. Regulatory authorities could also require the panels who evaluate proposed projects to include sufficient statistical expertise. This measure has been included in the newly revised European Union regulations on animal experiments.

Many of the initiatives in these areas come from researchers themselves. Far from accepting the status quo, they strive to achieve better scientific results. With effort and education, these difficult issues should be eminently solvable.

Animal research remains a small but vital part of the biomedical research endeavour. Let's make sure we get it right so that the greatest good is achieved for the least harm to animals.

Simon Festing is chief executive of Understanding Animal Research, a London-based organisation which seeks to promote understanding and acceptance of the need for humane animal research

http://www.newscientist.com/article/mg20627635.500-dont-waste-lab-animals.html

Male voices reveal owner's strength

- 00:01 16 June 2010 by **Ewen Callaway**

Magazine issue 2765

It's in his voice (Image:Charles Gullung/Corbis)

You can tell a lot about a man by his handshake, but his voice may give away even more. Both men and women can accurately assess a man's upper body strength based on his voice alone, suggesting that the male voice may have evolved as an indicator of fighting ability.

A team led by Aaron Sell at the University of California, Santa Barbara, recorded the voices of more than 200 men from the US, Argentina, Bolivia and Romania, who all repeated a short phrase in their native tongue. Sell's team also put the men through a battery of tests of upper body strength.

Do I sound strong?

When university students listened to the recordings, they accurately predicted the strength of the men, based on a seven-point scale from "weak" to "strong" – regardless of the language used. The voice analysis provided just as much information about a speaker's strength as photographs.

What aspects of voice we link with strength remain unknown, since there was no correlation between a man's strength and the pitch or timbre of his voice. That's surprising, says David Puts at Pennsylvania State University in University Park, since previous research showed deeper voices were rated as coming from stronger men.

Journal reference: *Proceedings of the Royal Society B*, DOI: 10.1098/rspb.2010.0769 (in press)

http://www.newscientist.com/article/dn19045-male-voices-reveal-owners-strength.html

Sea snail venom provides potent pain relief

- 12:49 15 June 2010 by **Jessica Hamzelou**
- Magazine issue 2765.

Sea snail venom could become the gold standard for the relief of nerve-related pain following the development of a pill that is 100 times as potent as leading treatments.

Current treatments for neuropathic pain include morphine, which is highly addictive, and gabapentin, which both act on nerve receptors. Sea snail venom had been suggested as a good alternative because it consists of a cocktail of peptides, known as conotoxins. These act to immobilise prey by blocking nerve-cell conduction, but in mammals the peptides are an effective analgesic.

The only conotoxin-derived drug approved for human use is ziconotide. Unfortunately, the drug is susceptible to breakdown by enzymes in the saliva and gut, so it is administered by a pump surgically inserted into the abdominal wall, making it an invasive and expensive treatment.

Circle of strength

To solve this problem, David Craik and his team at the University of Queensland in Australia have developed the first "orally active" conotoxin drug.

They started with a synthetic version of conotoxin. Since the enzymes that break down the drug usually act at the ends of the conotoxin molecule, the team used a chain of amino acids to join up these ends to form a circular structure. They found this version to be resistant to enzymes in the body.

Craik's team tested the conotoxin in rats with neuropathic pain. They found that a single oral dose significantly reduced pain using a standard test – how much pressure the rat could withstand before withdrawing its paw. Compared with gabapentin, conotoxin was judged to be 100 times more potent.

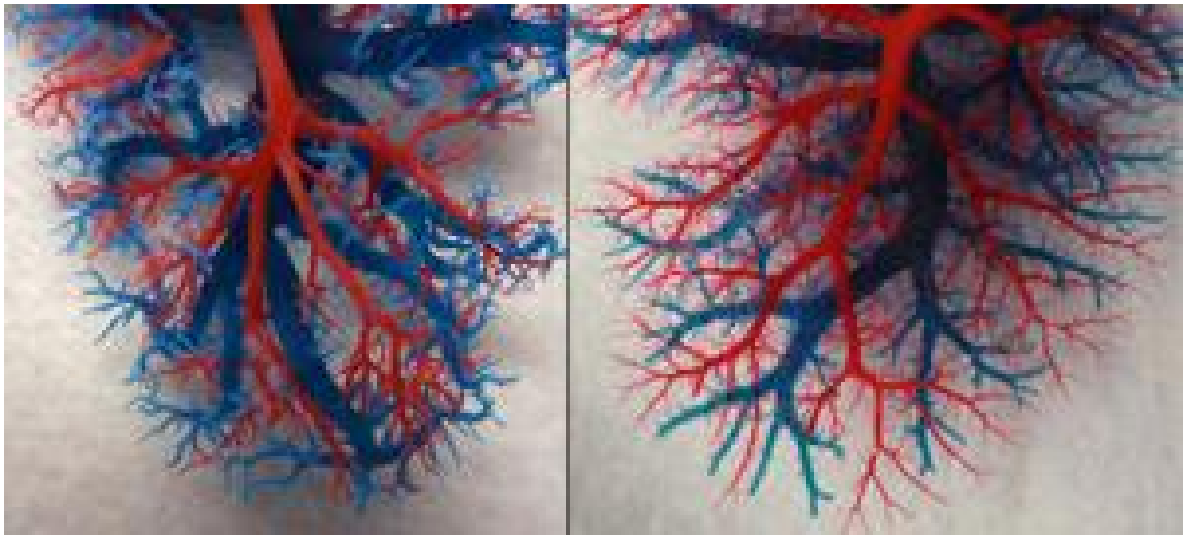
Because the conotoxin is so powerful, only very small doses are needed, reducing the risk of side effects, says Craik. His team has applied for approval from the US Food and Drug Administration for a trial in humans.

Journal reference: *Angewandte Chemie*, DOI: 10.1002/anie.201000620

http://www.newscientist.com/article/dn19044-sea-snail-venom-provides-potent-pain-relief.html

Refashioned rat livers could boost transplants

- 14:23 14 June 2010 by **Andy Coghlan**
- Magazine issue 2765.



An artificial liver scaffold (left), just like the real thing (right) (Image: B.E. Uygun and O.B. Usta)

Livers stripped bare of their original tissue then recoated with new cells have been successfully transplanted into rats for the first time.

Korkut Uygun at the Massachusetts General Hospital in Boston and his colleagues stripped rat livers of their original tissue by exposing them to a powerful detergent. What remained were cell-free "scaffolds" of collagen, but with the overall architecture of the liver intact, including channels for blood vessels, chambers and ducts.

The team pumped around 50 million rat liver cells into each of five bare scaffolds, then incubated the organs in culture for two weeks. Finally, they plumbed the reconstituted organs into genetically similar rats, where they functioned normally.

If the procedure works in humans, it would enable donated livers from humans, and possibly even from pigs, to be re-coated with a patient's own cells, reducing the likelihood of organ rejection.

It would also enable doctors to make use of donated livers that are otherwise rejected because they are too fatty or damaged in transport.

Journal reference: *Nature Medicine*, DOI: 10.1038/nm.2170

http://www.newscientist.com/article/dn19037-refashioned-rat-livers-could-boost-transplants.html

I'm smiling, so I know you're happy

- 13 June 2010
- Magazine issue 2764.

TO FULLY understand what emotion a person is experiencing, it may help to be able to imitate their facial expressions.

So says Luigi Trojano of the Second University of Naples, Italy, after working with patients with locked-in syndrome, who are conscious but unable to move any part of their body except their eyes, which they use to communicate. He discovered that such people often fail to identify specific emotions in others.

Trojano's team asked seven locked-in people and 20 healthy controls to view and respond to pictures of famous actors portraying six basic emotions, such as happiness or fear. When asked to identify each emotion, the locked-in patients were wrong 57 per cent of the times they viewed fear. They were also more likely than controls to misidentify anger, sadness and disgust (*The Journal of Neuroscience*, DOI: 10.1523/jneurosci.6300-09.2010).

Trojano says that the inability to physically imitate facial expressions may be responsible for the deficits in emotion recognition, implying that people subconsciously imitate others to interpret their emotions.

http://www.newscientist.com/article/mg20627644.500-im-smiling-so-i-know-youre-happy.html

Snails on speed shed light on human memory

- 12:41 28 May 2010 by **Jessica Hamzelou**

Magazine issue 2763.

This place reminds me of something (Image: Colin Milkins/Getty)

Pond snails make unlikely speed freaks. But dosing the gastropods on methamphetamine is helping us understand how certain "pathological memories" form in human addicts.

Meth users develop long-term memories of their highs, which is why the sight of places and people connected with a high can cause recovering addicts to relapse into taking the drug. "It's hard to get rid of those memories in addicts," says Barbara Sorg at Washington State University in Pullman. So potent is meth's effect on memory that, in low doses, the drug can be used as a "cognitive enhancer" in kids with attention-deficit hyperactivity disorder.

To probe the drug's effect on memory, Sorg's team placed pond snails in two pools of low-oxygen water, one of which was laced with meth. In low-oxygen conditions snails will surface and use their breathing tubes to access more oxygen. By poking the snails, Sorg's team trained them to associate using the tubes with an unpleasant experience, and so keep them shut. Only the snails on speed remembered their training the following morning, and in a separate experiment it took longer for them to "unlearn" the memory.

Humans are obviously more complicated, says Sorg, but "the snails still provide a model of how meth affects memory". The team's goal is to work out how to diminish specific memories, helping addicts recover.

Journal reference: *Journal of Experimental Biology*, DOI: 10.1242/jeb.042820

http://www.newscientist.com/article/dn18975-snails-on-speed-shed-light-on-human-memory.html

Long haul: How butterflies and moths go the distance

- 08 June 2010 by **Bea Perks**
- Magazine issue 2763

On the move (Image: Frans Lanting/Corbis)

DEEP in a wood in southern England, tucked under a pile of dead leaves, a neatly folded "silver Y" moth is struggling to emerge from its chrysalis. Watching this delicate creature take its first faltering steps, you would never think it was about to set off on a journey that could take it as far south as north Africa. That's a long way for a moth whose adult life lasts only a week or two.

With their blink-and-they're-gone lifespans, migratory butterflies and moths like the silver Y need some pretty smart strategies to cover distances rivalling those of many migratory birds. So how do they manage to cover such large distances? And how do they know which direction to fly when it's a journey they make only once in a lifetime? The answers are of more than academic interest as many of these creatures' larvae are crop pests, and in a changing global climate we need to know where they will next turn up.

Migrating lepidoptera routinely reach altitudes of over a kilometre, so studying them in mid-flight is far from straightforward. Samples trapped by aircraft or tethered helium balloons have provided a glimpse of their migrations, but this is expensive, not suited to long-term studies and not easy in the dark - which is when moths prefer to fly.

Fortunately, a UK team of entomologists led by Jason Chapman at Rothamsted Research in Hertfordshire have found a way to sidestep these problems. What's more, they can make their observations without leaving the ground. Since 2000, the entomologists have been using two radar scanners, one at Rothamsted and the other at Chilbolton in Hampshire, to sweep the skies day and night.

Insects flying through the radar beam bounce back signals that reveal much more than can be gleaned by simply trapping them. Each blip on the radar readout records an insect's altitude, the speed and direction of travel, body alignment, shape, size and wing-beat frequency. The radar can detect insects weighing as little as 15 milligrams - far smaller than most migrating moths, which can weigh all of 500 milligrams - flying at altitudes up to 1200 metres. An insect's species can be deduced from its size, shape and wing beat.

This year, Chapman published the results of seven years' worth of radar data, providing information on more than 100,000 individual insects. The observations show migrating moths to be masters at choosing the most favourable wind, setting off only on nights when it blows close to the direction they need to travel (*Science*, vol 327, p 682). On such nights, silver Ys, for example, can hit speeds over the ground of 90 kilometres per hour by finding the fastest-flowing high-altitude airstream and angling their flight to correct for any crosswind drift. Chapman has shown that by using these strategies the insects are able to travel about 40 per cent further than if they were simply blown along in the wind.

Sensing south

For butterflies, there is less of a rush. Painted lady butterflies travel just as far as the silver Ys, but the adults live for weeks rather than days. Painted ladies and related species such as the red admiral tend to fly closer to the ground than moths, and they rely mainly on their wing power rather than the wind. The migration distance record for lepidoptera goes to the monarch butterfly of North America, which over the course of a couple of months at the end of summer travels from as far north as the Canadian border to overwinter in central Mexico (see "Marathon migration").

Feats like this raise the question of how high-flying insects know where they are heading. They seem to have an inbuilt compass, but how it is set remains controversial. Is it based on the position of the sun - a "sun compass" - or does a magnetic compass like those possessed by migratory birds play a part? Moths are well known to fly towards the light, and butterflies do too. The sun can't be the whole story, though, because butterflies don't only fly on clear, sunny days, and moths fly at night.

It is a question that interests Robert Srygley's team at the Smithsonian Tropical Research Institute in Panama. They have found that altering the direction of the local magnetic field changes butterfly behaviour. For example, insects released into a large cage in which the magnetic field had been reversed tend to fly in the opposite direction to their usual migratory route. However, some of the control insects, released when magnetic north was unaltered, also fly in the opposite direction - so whether they use magnetic fields for migration remains uncertain (*Animal Behaviour*, vol 71, p 183). "Although we could show that they were sensitive to the magnetic field, we were not able to show that they use a magnetic compass to orient when migrating," Srygley says. "Butterflies are problematic to study because they have an escape behaviour towards the sun."

Experiments with insects less distracted by light have produced clearer results. Srygley has teamed up with physicists in Rio de Janeiro, Brazil, to test whether leafcutter ants respond to magnetic fields by making use of magnetite (iron oxide) crystals in their bodies. The ants do appear to use a magnetic compass to set a

direction home (*Animal Behaviour*, vol 75, p 1273), a finding that adds to a steady build-up of data suggesting that insects possess a magnetic compass.

Steve Reppert at the University of Massachusetts Medical School in Worcester is working on a theory that says butterflies and moths sense magnetic fields using photoreceptors known as cryptochromes, which are also found in birds, other insects and even in plants. Reppert has shown that fruit flies can use their cryptochromes to detect magnetic fields, and had a hunch that monarch butterflies might do the same. To test his hypothesis, he inserted monarch cryptochrome genes into fruit flies whose own cryptochromes don't work - and sure enough, the flies' response to magnetic fields was restored (*Nature*, vol 463, p 804). One oddity about cryptochromes' magnetic sensitivity is that it only occurs when the photoreceptors are illuminated by blue light; why blue light is required remains unclear.

Chapman reckons that lepidoptera might use a combination of cues to navigate. Butterflies are known to use a sun compass to determine their direction. Even when the sun itself is obscured, its position can be inferred from the polarisation of light from patches of clear sky. What's more, polarised light remains visible for up to 2 hours after sunset, so Chapman suspects that as moths take off at twilight they use polarised light to set their direction compass. During the night, a magnetic compass could take over, he says.

The team is also using the radar data to build predictive models that will tell us when, where, and in what numbers different migrating insects are likely to arrive. To do this, Chapman used a modified version of the UK Met Office's model of how airborne particles are dispersed by the wind; this is the model that was recently applied to predict the position of the cloud of ash from an Icelandic volcano as it drifted across Europe. "This new version treats the insects as active flyers with specific behaviours, rather than passively transported particles that just travel downwind," Chapman says.

As many migratory insects are damaging crop pests, working out where their extraordinary journeys will take them has practical implications. The silver Y's caterpillars are cabbage and pea-munching pests, and the caterpillars of another migratory moth, the large yellow underwing, are among the group of infamous crop pests better known as the cutworms that cause fatal damage at the base of virtually any herbaceous plant they choose to chew.

Insects are not the only creatures that migrate over long distances; birds do too. But insects have one big advantage over migrating birds: they can afford to make mistakes (see "Moths with maps?"). The two or three offspring of a mating pair of migratory birds have got to land in the right place, otherwise the future of the species is in trouble. The more robust reproductive strategy of butterflies and moths stands them in good stead in the face of climate change, as this year's "right place" might not be the same as last year's. Chapman thinks this is giving insects the upper hand. "That's probably one reason why migratory insects are becoming more common, but many migratory birds are declining."

Read more: *Zoologger: Globetrotters of the animal kingdom*

Moths with maps?

When migratory moths and butterflies emerge from their chrysalises in autumn in northern Europe, they immediately start flying south. When the next generation emerges on the Mediterranean coast the following spring, they start flying north. How do these creatures know where their breeding grounds are, when none of them lives to make the return trip?

It seems they don't. After the adults emerge, they simply travel in a hard-wired direction until they become sexually mature. How far an insect migrates depends on the length of this genetically determined phase. Migrants don't decide where to land based on the weather or the vegetation: they land when they reach the insect equivalent of puberty.

Many will land in unsuitable locations and fail to breed, but that's not a huge problem as long as a few of them end up somewhere sensible. A mating pair of insects produces thousands of eggs. The offspring that migrate to inhospitable climes will die, but the chances are that hundreds of their siblings will land somewhere more appropriate. Insects only need about 1 per cent of their offspring to survive to sustain the species.

There is evidence that climate change is already altering insect migration patterns. Steadily increasing numbers of migratory moth and butterfly species are being recorded arriving in a cliff-top garden at the Portland Bird Observatory in Dorset, on England's south coast. From data collected between 1982 and 2005, it appears that for every 1 °C increase in temperature, an extra 15 species will arrive (*European Journal of Entomology*, vol 104, p 139).

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http://www.newscientist.com/article/mg20627631.200-long-haul-how-butterflies-and-moths-go-the-distance.html

Family values: Why wolves belong together

- 16 June 2010 by **Sharon Levy**
- Magazine issue 2764.

Few places remain where wolves can live as nature intended (Image: Layne Kennedy/Corbis)

GORDON HABER was tracking a wolf pack he had known for over 40 years when his plane crashed on a remote stretch of the Toklat river in Denali national park, Alaska, last October. The fatal accident silenced one of the most outspoken and controversial advocates for wolf protection. Haber, an independent biologist, had spent a lifetime studying the behaviour and ecology of wolves and his passion for the animals was obvious. "I am still in awe of what I see out there," he wrote on his website. "Wolves enliven the northern mountains, forests, and tundra like no other creature, helping to enrich our stay on the planet simply by their presence as other highly advanced societies in our midst."

His opposition to hunting was equally intense. He excoriated the "heavy government-sanctioned killing" and "Mengele-like experiments" with wolf sterilisation in Alaska, which, as he saw it, threaten to transform the very nature of the wolf. And he did not pull his punches when identifying the enemy. "Perhaps worst of all, these problems originate primarily from biologists," he wrote on his website, referring to the fact that many wildlife managers work on the assumption that wolves can withstand heavy culling because they breed quickly.

In Alaska, up to 50 per cent of wolves are shot or trapped every year, with little effect on their numbers. But Haber argued that by focusing on population size, the establishment has ignored the fact that the hunting of wolves warps their social structure, ripping apart the family ties and traditions that define wolf society.

"Gordon was an aggressive personality, and he took on the scientific dogma about wolves," says Douglas Smith, leader of the Yellowstone Wolf Project. Despite many thousands of hours spent in the field, Haber published little peer-reviewed documentation of his work. Now, however, in the months following his sudden death, Smith and other wolf biologists have reported findings that support some of Haber's ideas.

Once upon a time, folklore shaped our thinking about wolves. It is only in the past two decades that biologists have started to build a clearer picture of wolf ecology (see "Beyond myth and legend"). Instead of seeing rogue man-eaters and savage packs, we now understand that wolves have evolved to live in extended family groups that include a breeding pair - typically two strong, experienced individuals - along with several generations of their offspring.

Building on this insight, Haber argued that older wolves pass knowledge down to younger pack members, and that human hunting disrupts this natural order. Lone survivors or pairs without supporting family members behave more unpredictably and kill more large prey animals than wolves living in stable packs, so hunting is often a counterproductive way of trying to manage wolf populations. His claims have been difficult to prove, partly because few corners of the Earth hold undisturbed wolf habitat where they can be tested.

Yellowstone National Park, located primarily in Wyoming and also in parts of Idaho and Montana, is one of the exceptions. Grey wolves were reintroduced here in 1995, following a 70-year absence that resulted from intense predator control measures in the early 20th century. The population now thrives, and in recent years it has become clear that packs there are different from those in areas where wolves are regularly killed because of conflicts with people or their livestock. Outside the protective boundaries of the park, few wolves live more than three or four years, and a pack seldom includes more than five or six individuals. Within Yellowstone, wolves tend to live longer - some have survived to be more than 10 years old - and they sometimes stick with their natal pack into their fourth or fifth year, a phenomenon never before recorded. As a result, packs are multigenerational and typically include about 11 wolves, though the biggest have more than 20 (*Reintroduction of Top-order Predators*, edited by Matt W. Hayward and Michael Somers, Wiley-Blackwell, 2009).

"Such packs do things very differently than the much simpler packs found in human-dominated landscapes," says Smith. When it comes to hunting, for example, there is a division of labour between the sexes. The fleeter females test herds of elk by rushing them at high speed, to find the weakest targets. Then the heftier males attack and kill the prey. Such skills clearly require practice: during a decade of intense wolf-watching, Smith and his colleagues have documented a learning curve among young wolves (*Ecology Letters*, vol 12, p 1). Yearlings are already at 80 per cent of full size, but the ability to take down an elk peaks at age 2, while the ability to choose the right elk to go after - the greatest intellectual challenge for wolves on the hunt - doesn't peak until age 3. Smith believes hunting skills are learned by watching older pack members, and from experience.

Comparisons between Yellowstone and areas where wolves are not protected also support Haber's contention that smaller packs tend to kill more prey animals per wolf. A group of five or six wolves cannot eat an entire elk or moose in one sitting. They will fill their bellies and then rest and digest, leaving scavengers such as ravens, eagles, coyotes and grizzly bears to attack the carcass. "They only get one feeding on it," says Smith, "so they will go and kill another animal to feed themselves again at the same pace as a pack that's got twice as many animals."

A new order

The contrast in behaviour between hunted and protected wolves is emerging from studies in another area too. In Algonquin Provincial Park, Ontario, Canada, eastern wolves have been protected for more than a century. Nevertheless, hunting in the surrounding townships was causing around two-thirds of total wolf deaths, primarily in winter when their main prey, white-tailed deer, roamed outside the park in search of forage. Then

in 2001, hunting on the outskirts of the park was banned. Since then, Linda Rutledge, a geneticist at Trent University in Peterborough, Ontario, has led a team tracking changes in the wolf population.

Their recently published results reveal that following the 2001 ban, the number of wolves in the park held steady as more animals died of natural causes (*Biological Conservation*, vol 143, p 332). The team also observed a rapid shift in wolf social structure. Before the ban, few animals survived to the age of 5 and a typical pack comprised a handful of unrelated animals. A decade on, packs are now made up of a breeding pair - an unrelated male and female - and two or three generations of their offspring, just as in Yellowstone.

This transition to more stable, family-based packs has been accompanied by a shift in diet. Before 2001, wolves would seldom attempt to take down a moose, even though moose are abundant in Algonquin and a single adult can provide as much meat as six deer. That has changed, to the extent that moose is now the primary food source for some packs. This suggests that younger wolves are learning sophisticated hunting strategies from their elders, just as Haber thought. "Taking larger prey likely requires more skill, experience and social learning on the part of the predators," says Rutledge's colleague Karen Loveless.

Protected from hunting, the Algonquin wolves have clearly altered their behaviour. Haber argued that allowing wolves to express their natural social behaviour benefits the wider ecosystem as well as the wolves themselves. Studies from Yellowstone and Banff national park in Alberta, Canada, have shown that intact wolf packs boost the diversity of plants and songbirds, and increase populations of beaver and amphibians, all by limiting the numbers and grazing patterns of elk and other large herbivores.

Allowing wolves to express their natural social behaviour benefits ecosystems

Haber believed there was seldom a valid reason to kill wolves, and that managers make a serious mistake when they treat the deeply social wolf in the same way as elk or caribou, based solely on the numbers of animals. He wrote about a "gradient of sociality" that should be considered in wildlife management, pointing to a growing body of research on other social animals. Female red howler monkeys living with close kin, for example, raise more young than those living among unrelated animals (*Behavioral Ecology and Sociobiology*, vol 48, p 253). Breeding opportunities for orca whales depend on the social traditions passed down from their mothers (*Animal Behaviour*, vol 63, p 1103). And studies of African elephants reveal that when poaching is rife, families are disrupted and young males tend to run amok (*New Scientist*, 18 February 2006, p 39).

As wolf numbers in North America gradually grow and historical hunting bans are lifted, Haber's ideas will increasingly be tested. He had been a strong advocate for a buffer zone around Denali national park, but on 6 March, the Alaska Board of Game removed a ban on wolf trapping outside the park's eastern boundaries.

Meanwhile, an equally controversial situation has arisen around Yellowstone. Last year, grey wolves were removed from the federal endangered species lists in Idaho and Montana, and state officials authorised the first legal wolf hunts in decades. On 3 October, a Montana hunter shot a radio-collared wolf that had been tracked by Smith's team for five of her seven years. Wolf 527F, the alpha female of the Cottonwood pack, which had long occupied a remote northern corner of Yellowstone, died 2 kilometres outside the park boundary. Over the next four weeks, her mate and two other Cottonwood wolves were also shot. All the collared animals and some of the pack's most experienced wolves are now dead; the fate of the remaining members is unknown.

The reaction has been heated. "There should be a large buffer zone around Yellowstone so park wolves are not shot," says ecologist William Ripple of Oregon State University in Corvallis. "Reintroduced wolves are

helping to rebalance the park's ecosystem. If park wolves are hunted at all, they are bound to change their behaviour."

Meanwhile, Rutledge and her team are now advocating that conservation policies should "look beyond numbers" and take into account the social dynamics of wild creatures. "The family-based wolf social structure evolved over millions of years," says Rutledge. The benefits of this behaviour to wolves and the world around them can be cryptic and difficult to track, but they are nonetheless an integral part of the natural wolf.

Haber would have approved. "Sophisticated family groups are what set wolves apart," he told a reporter for *Backpacker* magazine in an article published in January 2009. "Which is why it burns me up when people say it's the population, not individual wolves, that matter."

Long viewed as a gang of competitive thugs, a wolf pack is actually an extended family

Beyond myth and legend

Popular ideas about wolves are shaped more by fairy tales than reality. Humanity has persecuted the wolf so aggressively that survivors became elusive and near-impossible to observe. For decades, scientific understanding of wolf society was based on studies of captive animals, whose lives seemed ruled by a rigid pecking order. Wolves were thought to be born genetically programmed to fit into a role in an unbending hierarchy, in which the more dominant personalities - the alpha wolves - are the only ones destined to mate.

That vision shifted in the late 1980s, when David Mech of the US Geological Survey began to publish his studies of packs on Ellesmere Island in Canada's remote high Arctic. The Ellesmere wolves have never been hunted, and so are fearless enough to allow researchers into their midst. Based on decades of close observation on Ellesmere, Mech has transformed the popular vision of the wolf pack, long viewed as a gang of competitive thugs. He argues that the pack is actually an extended family.

Wolf families are as diverse and changeable as human ones, says ethologist Jane Packard at Texas A&M University in College Station, who has worked with Mech. Packs are shaped by environment and chance: the established order can be shattered by a shortage of food or the death of a parent. In times of change, it is common for the classic pack structure to be disrupted. Monogamous packs are the norm only in areas where prey is abundant and humans do not hunt wolves. In other situations, all kinds of new family conformations have been observed, from polygamy to single mothers.

Packard also reinterprets wolf social behaviour. Rather than seeing it as a dance of dominance choreographed by successful bullies, she views it as a dramatic saga of intelligent creatures learning to coexist. So a socially submissive wolf may be more savvy than oppressed: often its behaviour successfully gains a share of meat, when being pushier would only bring on a fight. What's more, a submissive wolf may later grow to become a pack leader. In other words, the wolves that survive in a tough environment are those that possess the intelligence to know when to fight and when to defer to a companion. Such animals display emotional resilience - a skill also vital to humans in times of stress, and one that clinical psychologists say can be learned.

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http://www.newscientist.com/article/mg20627641.000-family-values-why-wolves-belong-together.html

The biggest living thing with teeth

- 00:01 16 June 2010 by **Michael Marshall**

Killer teeth (Image: Hiroya Minakuchi/FLPA)

Species: *Physeter macrocephalus*

Habitat: oceans throughout the world, especially where there are lots of big animals to eat

In the chill darkness 2 kilometres below the surface of the Southern Ocean, one of nature's greatest battles is being fought. One of the combatants is a kraken – the largest invertebrate known to exist, a colossal squid, over 12 metres in length. The other is its predator.

Sperm whales can grow up to 20 metres, making them the largest living animal with teeth (blue whales are bigger, but are toothless baleen whales).

Named after the creamy sperm-like fluid found in its head, sperm whales are one of the few animals that can hunt and kill adult colossal squid. It may be bad news for the Antarctic's krakens, but it is good news for us: the whales' deep-sea depredations function as a carbon sink, slightly easing the effects of anthropogenic climate change.

Poop power

Almost all marine life is found within 200 metres of the surface, the so-called photic zone. In this sunny region there is enough light for microscopic plants called phytoplankton to photosynthesise, absorbing carbon dioxide. In turn, the phytoplankton support a network of animals that feed on them and each other.

Earlier this year it was shown that Southern Ocean baleen whales help keep this process going by releasing huge amounts of iron in their faeces.The Southern Ocean is short of iron, limiting the amount of life it can sustain, but these injections of iron help out.

Now Trish Lavery of Flinders University in Adelaide, South Australia, and her colleagues have gone a step further. They have found that while the baleen whales merely help keep the iron cycle going, sperm whales actually inject iron into it by hunting their prey at great depths and then defecating when they return to the photic zone. In effect they ferry iron from the depths of the sea to the surface, where the phytoplankton can use it.

Based on existing studies of sperm whale behaviour and anatomy, Lavery and colleagues calculated that the 12,000 sperm whales living in the Southern Ocean collectively eat 2 million tonnes of prey each year – including 60 tonnes of iron.

Of this, about 36 tonnes ends up in the photic zone. That keeps swathes of phytoplankton going there, taking in CO_2 from the atmosphere, that otherwise couldn't make a living.

Of all the carbon taken in by the phytoplankton, between 20 and 40 per cent ultimately sinks to the bottom of the ocean as various forms of waste. Lavery's team calculated that 400,000 tonnes of carbon gets dumped in this way every year as a result of the sperm whales' activities – far more than the estimated 160,000 tonnes the whales release by breathing.

Deep hunter

All of which raises the question, how do sperm whales bring down such monstrous prey? No one has ever seen a sperm whale attack a colossal squid, but we can still work some of it out.

The whales have one advantage: in the cold Antarctic, colossal squid are rather slow-moving, lying in wait and ambushing their prey rather than actively hunting them. A hungry sperm whale might not have to chase very hard.

Similarly, the rather less enormous jumbo squid of the eastern Pacific actually go deeper to cool off, and the local sperm whales may hunt them at depth because they are slower and thus more vulnerable down there. And the even tinier giant squid is something of a weakling despite its fearsome reputation.

Big head

Still, a weapon or two might be handy. And this could be where the sperm comes in. The spermaceti fluid is used to focus loud clicks, which the whales use for echolocation. The clicks can be over 230 decibels, making them the loudest sound produced by any living thing. It's been suggested that the whales use these clicks to stun their prey – but when they were played to prey animals in the lab there was no effect.

The spermaceti also cushions the whales' heads, particularly in males, which have much more of the stuff than females do. This allows fighting males to ram each other (or, in *Moby-Dick*, ships). However, there is no evidence of them ramming prey.

Females have their own hunting method. They live in tightly knit groups called pods, communicating with loud clicks and sharing the care of their calves. A tracking study earlier this year suggested that females hunt in packs, herding jumbo squid into "bait balls" just as dolphins do with fish. Young males live in "bachelor" pods and may therefore do the same thing, but as they get older they become solitary.

But if we really want to find out how they win their titanic battles, we need to get a video camera down there.

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http://www.newscientist.com/article/dn19046-zoologger-the-biggest-living-thing-with-teeth.html

Want to find your mind? Learn to direct your dreams

- 15 June 2010 by **Jessica Hamzelou**

Magazine issue 2764.

Dream catcher (Image: David Bray)

AM I awake or am I dreaming?" I ask myself for probably the hundredth time. I am fully awake, just like all the other times I asked, and to be honest I am beginning to feel a bit silly. All week I have been performing this "reality check" in the hope that it will become so ingrained in my mind that I will start asking it in my dreams too.

If I succeed, I will have a lucid dream - a thrilling state of consciousness somewhere between waking and sleeping in which, unlike conventional dreams, you are aware that you are dreaming and able to control your actions. Once you have figured this out, the dream world is theoretically your oyster, and you can act out your fantasies to your heart's content.

Journalistic interest notwithstanding, I am pursuing lucid dreaming for entertainment. To some neuroscientists, however, the phenomenon is of profound interest, and they are using lucid dreamers to explore some of the weirder aspects of the brain's behaviour during the dream state (see "Dream mysteries"). Their results are even shedding light on the way our brains produce our rich and complex conscious experience.

It's a central issue in the study of consciousness. In 1992, Gerald Edelman at the Scripps Research Institute in La Jolla, California, proposed that there are two possible states of consciousness, which he called primary and secondary consciousness. Primary consciousness is the simple subjective experience of sensory perception and emotions, which could be applied to most animals. It's a state of "just being, feeling, floating", according to Ursula Voss at the University of Frankfurt in Germany.

The mental life of your common or garden human, however, is a lot more complicated. That's because we are "aware of being aware". This allows us to reflect upon ourselves and our feelings and, in an ideal world, make insightful decisions and judgements. This state, dubbed secondary consciousness, is thought to be unique to humans.

"When you're awake, you have both primary and secondary consciousness. Secondary consciousness is that reflective awareness that determines a great part of waking consciousness," says Voss.

Pinning down how our brain produces these two, subjective, states of consciousness is a tough challenge, because it's difficult to isolate the different aspects of consciousness in fully awake subjects from other neural processes unrelated to awareness.

Which is where dreams come in. When we dream, we experience events (albeit imagined) and emotions but, crucially, we lack certain aspects of self-awareness that we normally feel when we are awake, particularly those involved in the rational reflection on what we are experiencing. You could easily see an outrageous event - a fluorescent pink kitten flying past on golden wings, to name but one - without batting a dream eyelid. "If we can accept really weird and bizarre events as perfectly normal happenings, that means there's something wrong with our reflective, rational consciousness," says Patrick McNamara of Boston University.

For this reason, some researchers, like Allan Hobson at Harvard Medical School, believe that dreams are akin to Edelman's definition of primary consciousness. Comparing the dream state with the waking state could let us explore the way the brain generates the self-awareness of secondary consciousness.

Some headway had already been made in this direction by the late 1990s. In 1997, Eric Nofzinger and his colleagues at the University of Pittsburgh, Pennsylvania, compared the brain activity of awake individuals with dreamers using PET scans, which reveal how much energy parts of the brain are using. The team identified three main regions that showed more activity during dream sleep, which is characterised by rapid eye movement (REM). The areas were along the midline of the brain, the insula and the left amygdala. Together, these regions are thought to be involved in motivation and reward mechanisms, and processing emotions, which Nofzinger reckons might explain why dreams are often so emotional.

Surprisingly, given the irrationality of the dream experience, many of the frontal areas of the brain involved in advanced cognition such as reasoning and forward planning were also active in the dreamers. But there was one notable exception: the dorsolateral prefrontal cortex (DLPFC) was remarkably subdued in REM sleep, compared with during wakefulness. To Hobson, that strongly suggests that this particular area, above other frontal regions, is crucial for the critical reflective awareness present in waking, and therefore secondary, consciousness (*Trends in Cognitive Sciences*, vol 6, p 475).

Could this one brain region alone explain our secondary consciousness? It's here that lucid dreams enter the picture. With their increased self-awareness, lucid dreams share certain aspects of secondary consciousness, so researchers are now vying to observe what happens in the brain when someone "wakes up" within their dream, and whether they exhibit any further signatures of consciousness. "It's a very interesting leap because it can show you exactly what occurs if you jump from limited consciousness to very high consciousness," says Victor Spoormaker of the Max Planck Institute of Psychiatry, Munich, Germany. "This should be one of the main themes of lucid dream research."

Lucidity on demand

Voss and her colleagues made tentative steps towards using lucid dreams to study consciousness in 2009. She trained a group of students to become lucid dreamers using a number of tips and tricks (see "Lessons in lucidity"). Once they had "woken up" within their dream, the subjects were then asked to signal to Voss that they were lucid by moving their eyes in a previously agreed pattern, which was measured with an electro-oculograph. "We have no other way of knowing they're really in a lucid dream," says Voss. "It's a great effort to make these eye movements because normally you're in that dream and you're busy with other things; you don't want to communicate with the outside world." At the same time, Voss used EEG - a cap of electrodes placed on the scalp - to record their brain activity.

Unfortunately, the team only managed to capture three lucid dreams, an indication of just how tricky they are to study. But it was enough to reveal a couple of intriguing differences between the lucid and non-lucid dreaming brain that may contribute to the secondary state of consciousness. Firstly, the team observed an

increase in a specific brainwave - oscillating at 40 hertz - in the frontal regions during the lucid dreams compared to the non-lucid dreams, which tended to have slower brain waves. They also found greater synchronised activity between the frontal and parietal regions of the brain than in normal REM sleep, though less than would be expected in a fully awake subject (*Sleep*, vol 32, p 1191). Importantly, the overall brain activity was still significantly different to the waking state, meaning the subjects couldn't have been awake and simply pretending to lucid dream (see diagram).

What was the DLPFC up to? If it really were key to the self-awareness of secondary consciousness, you would expect it to "light up" during the lucid dreaming state. Unfortunately, EEG is not sensitive enough to measure the neural activity in such a small, specific area. However, preliminary work by Michael Czisch at the Max Planck Institute of Psychiatry in Munich, Germany, hints at the answer. He used high-resolution fMRI scans to investigate the brain state of lucid dreamers. Although the results are currently being peer-reviewed, so many of the details are still under wraps, Czisch has hinted that the scans again reveal highly coordinated activity in the frontal regions of the brain, and also in the parietal and temporal zones, once the dreamers became lucid. The DLPFC was also more active than in a usual REM dream - providing tantalising evidence that it really is a crucial ingredient of secondary consciousness.

The million dollar question, of course, is how these specific patterns of electrical activity could give rise to our conscious experience. The DLPFC's role certainly makes sense, given laboratory studies that have shown it retrieves and analyses information in our working memory, and that it plays a key part in decision making.

What of the other signatures of lucidity? The coordinated neural activity may help the various brain regions communicate more effectively, "binding" together all the different thoughts and feelings being processed separately across the brain into a single unified experience, which we perceive as "the present". One might expect more binding - and therefore greater synchrony - in secondary consciousness compared with primary consciousness, simply because the experience is so much richer, combining analytical thoughts as well as sensory perceptions and emotions.

The specific frequency of much of the neural activity in the frontal areas - 40 hertz - is also significant. Slower frequency brain waves usually dominate in sleep, whereas 40 hertz waves are more characteristic of the waking state, suggesting secondary consciousness will only emerge if the relevant neurons are communicating at a fast enough rate. Hobson likens it to "turning up the volume" in the brain.

These experiments in lucid dreaming, few though they currently are, may have wide-reaching implications in clinical situations, particularly in the study of mental illness. "When you're a schizophrenic, you're in primary consciousness really," Voss claims. "What you're lacking is reflective awareness; you cannot distinguish between reality and your hallucinations." On this basis, Voss wonders whether it might be possible to stimulate the necessary regions in schizophrenic patients to help them achieve greater lucidity in their waking life. The work might even suggest ways for healthy people to enjoy lucid dreams. "Wouldn't it be nice if you could get somebody in REM sleep to become a lucid dreamer just by stimulating his brain?" says Voss. "No one's tried this before."

Luckily for me, I have been able to make my first foray into this strange state of consciousness without any artificial stimulation. I'm happy to report that on a sunny morning over the Easter weekend, I had my first lucid dream. It lasted all of a few seconds, and I was merely able to consciously twirl on the spot, but I woke up excited and happy. With the whole dream world now open to me, let's just hope this is only the start of my lucid life.

Lessons in lucidity

Lucid dreams may be an exciting state, in which you can control your dreams to live out even your most outré fantasies, but there are many other more serious reasons to try lucid dreaming. A pilot study by Victor Spoormaker at Utrecht University in the Netherlands, for example, recently found that lucid dreaming could help people overcome their nightmares (*Psychotherapy and Psychosomatics*, vol 75, p 389), though it would not be recommended for those with a history of mental illness.

Here are some top tips on how to achieve lucid dreaming:

Step 1: The reality test.

Ask yourself whether you are awake or dreaming throughout the day. Later on, in the land of nod, you might find yourself pondering this question. If you succeed, congratulations! You have opened the door to lucid dreams.

Step 2: Focus your thoughts.

People who focus single-mindedly on a task during the day, be it a computer game or playing a musical instrument, are more likely to experience lucid dreams, says Jayne Gackenbach at Grant MacEwan University in Edmonton, Canada.

Step 3: Plan your fantasy.

Almost as fun as the dreaming itself. Before you go to bed, think about what you want to dream lucidly about, in as much detail as possible.

Step 4: Total recall.

When you wake up, try to recall as many of your dreams as you can.

Step 5: Wake up and get motivated! ...And then go back to bed.

Probably best for lazy weekends. Set your alarm for an hour before you would usually wake up. When it goes off, try to remember your dreams. Then get out of bed, and only head back under the blankets an hour later, focusing on trying to have a lucid dream.

How dreams change as we age

Fetuses spend a lot of time in REM sleep, and infants up to the age of 1 spend four times as long in REM sleep as adults. But are they dreaming? "The fact that they twitch and have inhibited muscle tone and brain activation is a sure sign they're in REM sleep, but not that they're dreaming," says Allan Hobson at Harvard Medical School.

Even so, dreaming must at least begin in our first few years. "As soon as children are able to talk, they seem to report happenings that could only have been going on in their dream life," says Patrick McNamara at

Boston University. When children do start reporting their dreams, they almost always feature animals. "Nobody has any idea why," says McNamara.

Children who report the most dreams tend to have more developed mental imagery in their waking lives too, which may be linked to the development of the parietal lobes involved in visuospatial skills. Adolescence seems to be the peak of our dream life, and unfortunately, it tends to go downhill from there, with less REM sleep and therefore fewer dreams after the age of 20. Our dreams as adults are less pleasant, too, with more aggressive themes.

Dream mysteries

Why are some tasks impossible for our dream-selves?

You probably know the feeling: in the middle of your dream, you come across something vital revealed in the written word, only to find the sentences just slipping away before your eyes. But is this true for all complex tasks in dreams, or do our altered selves maintain some of our waking abilities? Robert Piller of Pomona College in Claremont, California, asked 27 lucid dreamers to try to perform a range of tasks in their dreams, like reading, writing and speaking a sentence, painting, drawing a cube and humming a tune. The linguistic tasks were all particularly difficult for the subjects, but somewhat surprisingly, the rest were more manageable. Piller thinks it's because the left cerebral hemisphere - the seat of language - is relatively inactive during REM sleep, whereas the right hemisphere, which takes care of more creative, visuospatial activities like painting and drawing, is still functioning (*Dreaming*, vol 19, p 273).

Why are we dead to the world when we sleep?

Our insulation from the environment during sleep is astonishing. In one extreme study in the 1960s, some sleeping subjects were completely unaware of their surroundings even when their eyes were taped open and objects were lit up in front of them. Neuroscientists believe that's due to "gates" of temporarily inactive neurons in the thalamus or certain regions of the cortex that prevent sensory information from propagating to the regions where it could be processed and consciously perceived.

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http://www.newscientist.com/article/mg20627640.900-want-to-find-your-mind-learn-to-direct-your-dreams.html

Anti-neutrino's odd behaviour points to new physics

- 13:33 16 June 2010 by **Anil Ananthaswamy**

Why have some of Fermilab's neutrinos gone missing? (Image: Fermilab)

Now you see it, now you don't: that's neutrinos for you. The astounding ability of these subatomic particles to morph from one type to another may have created another crack in our understanding of nature.

It may point the way to new physics that could tell us why the universe appears to be made only of matter and not antimatter too.

Physicists on the Main Injector Neutrino Oscillation Search (MINOS) experiment at Fermilab in Batavia, Illinois, were studying a phenomenon called neutrino oscillation when they found a discrepancy between neutrinos and anti-neutrinos that cannot be explained by standard model physics.

Neutrinos and their antimatter counterparts oscillate between three types: electron, tau and muon. In the MINOS experiment, muon neutrinos and muon anti-neutrinos are beamed at two detectors: a "near" detector at Fermilab itself, and a "far" detector inside a mine in Soudan, Minnesota. The particles have to pass through 700 kilometres of earth to get to the far detector.

Missing neutrinos

The particles are most likely changing into their tau counterparts. MINOS is not sensitive to taus, but infers them by measuring a deficit of muon neutrinos and anti-neutrinos.

According to our current understanding of neutrino physics, MINOS should see a similar deficit for neutrinos and anti-neutrinos, but on Monday the MINOS collaboration announced that this may not be what is happening.

When physicists measured a specific parameter related to neutrino oscillations, it was about 40 per cent greater for anti-neutrinos than for neutrinos. They say this is tentative evidence of a greater deficit in the anti-neutrino beam than in the neutrino beam.

Jenny Thomas of University College London, a spokeswoman for MINOS, stresses that the results are preliminary. "It could be an unlucky statistical fluctuation," she says. "Those things happen."

But if the effect proves solid, it could help us solve one of the biggest mysteries in physics: how an imbalance of matter and antimatter arose in the early universe.

The discrepancy could be due to a difference in the way neutrinos oscillate compared with anti-neutrinos. Or the anti-neutrinos may be interacting with the 700 kilometres of rock in a way that is not understood.

"If the effect is real, then there is some physics that is not expected," says Thomas. "Then there is something new that we don't understand, and that's fantastic."

Antonio Ereditato at the University of Bern, Switzerland, a spokesman for the OPERA neutrino experiment in Italy says: "This is once more proof that neutrino physics is a privileged tool to assess new physics." But he adds that statistically robust results are needed.

http://www.newscientist.com/article/dn19051-antineutrinos-odd-behaviour-points-to-new-physics.html

Aspirin and dental floss: Homespun high-energy physics

- 10:54 15 June 2010 by **Kate McAlpine**

Curing Fermilab's headache (Image: Peter Dazeley/Getty)

As the first physics results begin to emerge at the expensively engineered and hugely complex Large Hadron Collider, *New Scientist* looks at the everyday equipment that particle physicists couldn't live without – from aspirin to dental floss.

Aspirin tablets

Aspirin cures a different sort of headache for the engineers at Fermilab in Batavia, Illinois.

In Fermilab's particle accelerator, components called radio-frequency (RF) cavities generate an alternating electric field that pulls and then pushes bunches of charged particles as they pass through the accelerator. Leaks in the cooling system can drip water into the RF cavities, which could cause an electrical arc that would damage the accelerator hardware. But radiation stops technicians making repairs while the accelerator is running.

In the mid-1970s Fermilab engineers came up with an ingenious way of detecting leaks before they caused problems. They placed an aspirin tablet over a hole at the lowest point of the accelerator cavity, with part of an electrical switch holding it in place. When water dissolves the aspirin away, the switch is tripped and shuts off the high voltage in the RF cavity.

"It turned out that the aspirin tablets were the most reliable of methods tried," says John Reid of Fermilab.

Aspirin tablets are still used in the accelerator today, with a bottle of spares to hand. Although with the stress of the job, "I'm sure the crew chiefs occasionally wish there was something stronger available", adds Fermilab physicist Todd Johnson.

Fishing line

The nylon fibre that might be used to land a mackerel plays a vital role in the ALICE experiment, which fishes for quark-gluon plasma in the collisions of lead at the Large Hadron Collider near Geneva, Switzerland.

Some of the detectors in ALICE measure how long smashed particles take to travel from the collision point, one of two measurements that together reveal a particle's identity. These detectors form the outermost cylindrical layer of ALICE, with an area of about 150 square metres.

But the experiment's designers had a problem: what materials to use for these detectors? Scintillating plastics, which emit light when particles pass through them, would be accurate enough – but at this scale, the accompanying electronics would annihilate the budget.

Another proposed sensor was a layer of gas, one-tenth of a millimetre thick, enclosed in glass. Particles flying through the highly pressurised gas would produce a large electrical signal, requiring a special semiconductor glass to prevent a spark. This would ionise the gas so much that it reduces the sensitivity of the detector. "In fact, it was impossible to make this glass," says Crispin Williams of the ALICE experiment.

The technicians found that layering thin sheets of ordinary glass could do the job if the sheets were suspended on taut nylon fishing line so that a tiny, uniform space was created in between the sheets, filled by the gas. This cost about a tenth of the plastic scintillator design.

Aluminium foil

The kind you might pick up at the grocery store has a thin coating of oil to prevent food sticking to it, but the unoiled version is handy in nuclear and particle physics labs. In some experiments, it serves as a target – something for a beam of ordinary particles or nuclei to run into and generate exotic particles in the collision.

Wrapping scintillating plastic sensors in aluminium foil can increase their efficiency. The reflective covering helps keep light from escaping, maximising the amount of energy collected in a photomultiplier tubes, which change a light signal into an electrical one. "It is used in almost all of the experiments that I have worked on," says Howard Matis of Lawrence Berkeley National Laboratory in California.

Foil also comes in handy for wrapping up pieces of equipment that will be part of vacuum systems to keep out dust and other contaminants – not unlike wrapping up leftover food after a meal. But researcher Dan Bauer of the Cryogenic Dark Matter Search, which is located in an old mine in Soudan State Park, Minnesota, points out an essential difference: "We always use our leftovers even if they sit around for quite a while."

Plastic bottles

Particle detection from recycled plastic? A group of Japanese researchers recently tested the radiation-sensing capabilities of a lump of heat-proof plastic bottles and found that it signalled the presence of particles from neutrons to muons by emitting ultraviolet light.

They then hooked the plastic up to photomultipliers to test how accurately it sensed the energy of incoming particles. While it wasn't precise enough for cutting-edge particle research, the researchers believe it could be useful for other purposes.

"The PET bottle scintillators should prove useful for environmental radiation monitoring with portable scintillator devices," says Hidehito Nakamura of the National Institute of Radiological Sciences in Tokyo, Japan. He also suggested it could be used to keep tabs on radiation in nuclear power plants.

Scintillators made from recycled plastic have proved accurate enough for DIY particle detectors designed at Laurence Berkeley National Laboratory. These detectors can be made by high-school teachers and used by students to study cosmic rays.

Matis, who developed these detectors at Berkeley, agrees with Nakamura that accuracy could be improved by reducing the white hue of the plastic.

"That means that there is absorption of light which reduces the efficiency," says Matis. More attention to the cooling process after it is melted down into a lump, or trying different types of PET bottles, could result in a more accurate recycled particle sensor.

Best of the rest

The Cryogenic Dark Matter Search detector in Minnesota must be kept less than a degree above absolute zero, so is insulated with a series of progressively colder layers towards its core. To avoid any contact between the layers, which could cause unwanted warming, stray wires are tied down with **dental floss**.

Gelatine-like **konnyaku noodles** come in handy for researchers at the high-energy accelerator research organisation KEK in Tsukuba, Japan. Their sticky properties mean they can be used as a test seal for the vacuum needed to make muon detectors.

In their lab for future technologies, Fermilab physicists are working on a new kind of electron source that is spurred by a pulsing laser to emit electrons in pulses. The diameter of that pulse is controlled by an iris, which needs to be opened and closed by someone a safe distance from the radiation. It turns out that servomotors intended to control the wing flaps and rudders on **model airplanes** perform the task and withstand radiation well.

Fermilab physicists also use **stockpots** filled with mineral oil to insulate high-voltage cable joints, where power from a single supply splits to several cables.

Finally, physicists on the CDF experiment at Fermilab in the 1980s found that a **coffin** worked as a suitable "dark box" to test their scintillators.

http://www.newscientist.com/article/dn19043-aspirin-and-dental-floss-homespun-highenergy-physics.html

The Real Science Gap

It's not insufficient schooling or a shortage of scientists. It's a lack of job opportunities. Americans need the reasonable hope that spending their youth preparing to do science will provide a satisfactory career.

By Beryl Lieff Benderly

Business leaders have cried "scientist shortage," but scores of thousands of young Ph.D.s are laboring in U.S. university labs as low-paid, temporary workers, ostensibly training for permanent faculty positions that will never exist. (Illustration by Red Nose Studios)

For many decades, and especially since the United States attained undisputed pre-eminence in science during World War II, a parade of cutting-edge technologies has accounted for much of America's economic growth. Countless good jobs now ride on whether the Next Big Thing — and the several things after that — will be developed in America and not, as many fear, in China, India, the European Union, Japan, Korea or another of the powers now producing large numbers of scientists and engineers.

Brilliant advances and the industries they foster come from brilliant minds, and for generations the United States has produced or welcomed from abroad the bulk of the world's best scientists, engineers, inventors and innovators. But now, troubling indicators suggest that — unlike the days when the nation's best students flocked to the challenges of the space race, the war on cancer, the tech boom, and other frontiers of innovation — careers in science, engineering and technology hold less attraction for the most talented young Americans. With competitors rapidly increasing their own supplies of technically trained personnel and major American companies outsourcing some of their research work to lower-wage countries, an emerging threat to U.S. dominance becomes increasingly clear.

Congress and successive administrations have responded with steps they have been told will solve the problem. But some of the solutions they have adopted and hope to continue — in particular, large increases in funding for research and graduate training — will, experts in the scientific labor market believe, have the opposite effect, ultimately discouraging high-achieving Americans from committing their working lives to scientific innovation. The solutions that will attract the nation's brightest young people back to science, these experts argue, are not even on the table.

The current approach — trying to improve the students or schools — will not produce the desired result, the experts predict, because the forces driving bright young Americans away from technical careers arise elsewhere, in the very structure of the U.S. research establishment. For generations, that establishment served as the world's nimblest and most productive source of great science and outstanding young scientists. Because of long-ignored internal contradictions, however, the American research enterprise has become so severely dysfunctional that it actively prevents the great majority of the young Americans aspiring to do research from realizing their dreams.

To remain competitive against rising rivals, the nation must reconstruct this system so it once again guides the best of America's large supply of young scientific ability into research and innovation. This process, experts contend, begins with identifying the real reason that scientifically gifted young Americans are increasingly unable and unwilling to pursue scientific careers. It is not, as many believe, that the nation is producing too few scientists, but, paradoxically, just the opposite.

"There is no scientist shortage," declares Harvard economics professor Richard Freeman, a pre-eminent authority on the scientific work force. Michael Teitelbaum of the Alfred P. Sloan Foundation, a leading demographer who is also a national authority on science training, cites the "profound irony" of crying shortage — as have many business leaders, including Microsoft founder Bill Gates — while scores of thousands of young Ph.D.s labor in the nation's university labs as low-paid, temporary workers, ostensibly training for permanent faculty positions that will never exist.

Back when today's senior-most professors were young, Ph.D.s routinely became tenure-track assistant professors, complete with labs of their own, in their late 20s. But today, in many fields, faculty openings routinely draw hundreds of qualified applicants. The tiny fraction who do manage to land their first faculty post are generally in their late 30s or early 40s by the time they get their research careers under way. Today's large surplus of scientists began in the life sciences but is now apparent in fields as diverse as astronomy, meteorology and high-energy physics. These surpluses, Teitelbaum notes, hardly constitute "market indicators signaling shortages."

The shortage theorists and the glut proponents, however, do agree on two things: First, something serious is wrong with America's scientific labor supply. A prime symptom noted by all: a growing aversion of America's top students — especially the native-born white males who once formed the backbone of the nation's research and technical community — to enter scientific careers. Increasingly, foreign-born technical and scientific personnel on temporary visas staff America's university labs and high-tech industries.

The second point of agreement is that, unless the underlying problem is fixed, it will seriously impair the nation's ability to recruit top-flight homegrown talent — both for domestic innovation and for the high-level, classified, technical work vital for national security.

But disagreement rages about causes and cures. Is the influx of foreigners a cause of high-achieving Americans' reluctance to become scientists, as the labor force experts assert, or an effect, as the industry interests insist? Once all the political rhetoric and verbiage of blue-ribbon panels is cleared away, the data clearly support those arguing for the existence of a glut of aspiring scientists.

America's schools, it turns out, consistently produce large numbers of world-class science and math students, according to studies by Harold Salzman of the Heldrich Center for Workforce Development at Rutgers University and his co-author, B. Lindsay Lowell, director of policy studies for the Institute for the Study of

International Migration at Georgetown University. But the incentives that once reliably delivered many of those high scorers into scientific and technical careers have gone seriously awry.

If the nation truly wants its ablest students to become scientists, Salzman says, it must undertake reforms — but not of the schools. Instead, it must reconstruct a career structure that will once again provide young Americans the reasonable hope that spending their youth preparing to do science will provide a satisfactory career.

"It's not an education story, it's a labor market story," Salzman says.

"No one designed the present system. It just happened," says Maxine Singer, a former president of the Carnegie Institution of Washington (now the Carnegie Institution for Science) and a researcher who, in the late 1950s, became an independent investigator heading her own lab at the National Institutes of Health at the age of 27. Indeed, the current system of funding scientific research arose, essentially by accident, from a set of choices made shortly after World War II.

Before the war, America's research enterprise had been small and sparsely funded. The struggle against Germany and Japan, however, showed Americans that science could be a mighty force for solving problems. The nation had witnessed the atomic bomb, developed in secret by a government program called the Manhattan Project, abruptly force Japanese surrender. Such wartime innovations as radar and penicillin also conspicuously saved American lives.

In November 1944, months before the war ended, President Franklin Roosevelt wrote to Vannevar Bush, a Ph.D. engineer who was instrumental in organizing the Manhattan Project and who directed the top secret Office of Scientific Research and Development, which coordinated the wartime research effort. "What," Roosevelt asked, "can the government do now and in the future to aid research activities by public and private organizations?"

Bush answered with a July 1945 report to Roosevelt's successor, President Harry Truman, titled *Science, The Endless Frontier*. In it, Bush outlined the basic structures of civilian research that remain to this day. Central to his scheme was a proposed National Research Foundation to organize and oversee funding across all fields of civilian science. In 1950, after several attempts, Congress created the National Science Foundation. As the war ended, furthermore, the National Institutes of Health, then a small agency, began its transformation into the world's largest funder of civilian research, with an annual budget exceeding $30 billion.

Bush's report listed "Five Fundamentals" that he believed must guide government support of civilian research. Congress has never fulfilled the first, which called for stable, predictable funding for science. It did, however, enact the other four: Research funds are awarded and administered by nonpartisan experts; civilian research is funded primarily "through contracts or grants to organizations outside the federal government"; the universities receiving grants control "policy, personnel, and the method and scope of the research"; and while the funding agencies retain "independence and freedom" in regard to the research carried on in institutions receiving public funds, they are responsible to the president and Congress."

Government-funded civilian research thus became largely the province of research universities, and that research is the major activity and income source on many campuses. In 2008, more than 700 universities and research institutes, and more than 50,000 grant-winning professors (called principal investigators or PIs), absorbed $16 billion in grants from NIH alone. The recent stimulus package devoted $10 billion to short-term NIH research grants to universities and colleges.

Bush's report also enunciated a federal responsibility for training scientists, initially to make up "the deficit of science and technology students who, but for the war, would have received … degrees." But, in a piece of advice that went unheeded, he advocated designing plans "to attract into science only that proportion of youthful talent appropriate to the needs of science. …"

The system devised after the war has proven efficient, economical and flexible, with principal investigators proposing and carrying out research projects and universities administering them and taking a portion of each grant as overhead. Government has come to depend on the universities for results and the universities on the government for a portion of their income. And the system didn't just advance science; it also supported education by employing graduate students in government-funded research, with the implicit assumption that after earning their degrees, doctorate-level scientists would generally become faculty members themselves, ultimately winning their own grants to support their own labs and graduate students.

All went well for a number of years because postwar American higher education expanded exponentially after the war, creating many new faculty jobs. First, the GI Bill flooded the campuses with millions of veterans-turned-students. Then, as the great veteran wave was ebbing, Sputnik launched a vast increase in funding for college-level science and math study. Colleges were also expanding their faculties and facilities to prepare for the enormous baby boom generation.

But the system had a basic flaw that was revealed only gradually, as the expansion of academe slowed in the early 1970s: The system's central feature — the "self-replicating" professor who produces a steady stream of new Ph.D.s as a byproduct of grant research — had no control over the job prospects for those graduates.

Before the mid-1970s, U.S. science and engineering graduates could look forward not only to intellectual challenge and the excitement of doing important and admired work, but to security and, ultimately, an upper-middle-class income. Aspiring scientists could climb a clearly defined ladder from graduate school to stable and reasonably lucrative careers. Able students could finish a doctorate in four or five years, generally supported by a fellowship or assistantship.

A handful of the most talented new Ph.D.s might then spend a year or two as postdoctoral fellows, generally following a particularly promising line of inquiry in the lab of a prominent professor. Marked as rising talents, they would proceed to especially prestigious assistant professorships. Postdocs, as such researchers are still called, would work on projects of their own devising under the guidance of some of their field's leading figures; it was considered not quite proper for professors to involve such fellows in their own research. More commonly, however, new Ph.D.s would move directly from grad school into permanent posts, whether on a university's tenure track, as a researcher in a government scientific agency, or in the research laboratory of a large corporation.

Today, only a handful of young scientists — the few lucky or gifted enough to win famous fellowships or score outstanding publications that identify them early on as "stars" — can look forward to such a future. For the great majority, becoming a scientist now entails a penurious decade or more of graduate school and postdoc positions before joining the multitude vainly vying for the few available faculty-level openings. Earning a doctorate now consumes an average of about seven years. In many fields, up to five more years as a postdoc now constitute, in the words of Trevor Penning, who formerly headed postdoctoral programs at the University of Pennsylvania, the "terminal de facto credential" required for faculty-level posts.

And today's postdocs rarely pursue their own ideas or work with the greats of their field. Nearly every faculty member with a research grant — and that is just about every tenure-track or tenured member of a science

department at any of several hundred universities — now uses postdocs to do the bench work for the project. Paid out of the grant, these highly skilled employees might earn $40,000 a year for 60 or more hours a week in the lab. A lucky few will eventually land faculty posts, but even most of those won't get traditional permanent spots with the potential of tenure protection. The majority of today's new faculty hires are "soft money" jobs with titles like "research assistant professor" and an employment term lasting only as long as the specific grant that supports it.

Many young Americans bright enough to do the math therefore conclude that instead of gambling 12 years on the small chance of becoming an assistant professor, they can invest that time in becoming a neurosurgeon, or a quarter of it in becoming a lawyer or a sixth in earning an MBA. And many who do earn doctorates in math-based subjects opt to use their skills devising mathematical models on Wall Street, rather than solving scientific puzzles in university labs, hoping a professorship opens up.

For scientifically trained young people from abroad, though — especially those from low-wage countries like China and India — the calculus of opportunity is different. For them, postdoc work in the U.S. is an almost unbeatable opportunity. Besides the experience and prestige of working in the world's leading scientific power, a postdoc research position is likely to pay many times more than a job at home would. Beyond that, many foreign postdocs erroneously believe that the temporary H-1B visa that admits them to the U.S. will eventually lead to permanent residency. These drastically different opportunity structures explain why more than half of what the National Science Board has estimated as 93,000 postdocs in the U.S. are now foreigners on short-term visas.

To be sure, this predicament — the reality that a once-desirable career path for the best U.S. scientific talent has become a route to penury, frustration and disappointment — is not the dominant cultural narrative. For decades, America has been worried that it will fall behind in the technology race because of a looming shortage of scientific researchers. "Pronouncements of shortages in American science and engineering have a long history," the Sloan Foundation's Teitelbaum writes. "They date at least to the late 1950s, around the time the [USSR] launched Sputnik." Stunned that its nuclear-armed archenemy had apparently grabbed the lead in missile technology and space flight, America leapt to the false conclusion that its science was inadequate. Federal money swiftly poured into science and engineering scholarships and so successfully attracted students that, by the early 1970s, the market for young scientists and engineers was flooded.

Shortage predictions surfaced again in the 1980s, when a policy office in the National Science Foundation produced a flawed demographic analysis predicting a shortfall of technical talent. Testifying before Congress about that study in 1995, NSF Director Neal Lane stated that "there was really no basis to predict a shortage." Nonetheless, the dot-com boom of the 1990s brought another round of dire forecasts that were advanced by an industry group, the Information Technology Association of America, but harshly criticized on methodological grounds by the U.S. General Accounting Office.

The shortage scenario's most recent incarnation is *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, a highly influential report published by the National Academies in 2005. Touted by *New York Times* columnist Thomas Friedman, *Gathering Storm* immediately attracted media attention far beyond what the usual wonkish Academies offering receives. Written in response to a congressional request for proposals to bolster the nation's competitiveness against the rising scientific prowess of India and, especially, China, *Storm* claimed U.S. science education was not keeping pace with the nation's needs; the report became the basis of the America COMPETES Act of 2007 (technically the America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Act of 2007). This law seeks to increase the nation's competitiveness by increasing investment in research and

raising the number of students at all levels studying science. (Congress was debating a reauthorization of the law as this article went to press.)

The Academies published another report on the science labor force in 2005, *Bridges to Independence: Fostering the Independence of New Researchers in Biological Research*, but it went essentially uncovered outside the science press. *Bridges* examined the ominous "crisis of expectation" among the thousands of frustrated young scientists unable to move into suitable career employment. The report was motivated by an alarming fact: The average age of scientists winning their first independent NIH grants — a major career milestone that once tended to come in a researcher's late 20s or early 30s — had risen to 42, well past the period widely considered a researcher's most creative. "Current career structures and opportunities," *Bridges* noted, "… adversely affect the future of the biomedical research workforce as well as the success, productivity and research directions of individuals who do pursue such careers."

But in the national arena, *Storm*'s outsized influence drowned out *Bridges*' message. *Storm* pushes for more Americans earning undergraduate and graduate degrees in what it calls the science and math "areas of national need," without ever specifying which specific fields those areas may encompass. *Storm* also states that "the number of people with doctorates in the sciences, mathematics and engineering awarded by U.S. institutions each year has not kept pace with the increasing importance of science and technology to a nation's prosperity." But the report provides no metric to judge that importance or the numbers of scientists or engineers needed to serve prosperity.

Storm does acknowledge "much debate in recent years about whether the United States is facing a looming shortage of scientists and engineers … [but] there is not a crisis at the moment. …" Still, *Storm* urges upgrading K-12 science and math instruction because "the domestic and world economies depend more and more on science and engineering. But our primary and secondary schools do not seem able to produce enough students with the interest, motivation, knowledge and skills they will need to compete and prosper in such a world."

This claim, however, is "largely inconsistent with the facts," Teitelbaum declared in 2007 congressional testimony about *Storm* and another similar report. In reality, he said, "students emerging from the oft-criticized K-12 system appear to be studying science and math subjects more, and performing better in them, over time. … Nor are U.S. secondary school students lagging far behind comparable students in economically-competitive countries, as is oft-asserted."

In fact, three times as many Americans earn degrees in science and engineering each year as can find work in those fields, *Science & Engineering Indicators 2008*, a publication of the National Science Board, reports. The number of science and engineering Ph.D.s awarded annually in the U.S. rose by nearly 60 percent in the last two decades, from about 19,000 to 30,000, the report says. The number of people under 35 in the U.S. holding doctorates in biomedical sciences, *Indicators* notes, rose by 59.4 percent — from about 12,000 to about 19,000 — between 1993 and 2001, but the number of under-35s holding the tenure-track positions rose by just 6.7 percent, remaining under 2,000.

Storm does make one criticism of American education that hits the mark: American students on average make mediocre showings in international comparisons. Closer analysis, however, reveals no threat to the supply of potential scientists, who come not from the average but the top scorers. In this regard, "the U.S. is not at any particular disadvantage compared to most nations, and the supply of [science and engineering] graduates is large and ranks among the best internationally," write Salzman and Lowell in a rejoinder to *Gathering Storm* pointedly titled *Into the Eye of the Storm: Assessing the Evidence on Science and Engineering Education*,

Quality and Workforce Demand. "The notion that the United States trails the world in educational performance misrepresents the actual test results and reaches conclusions that are quite unfounded," they continue.

On the widely cited Trends in International Math and Science Study test, for example, the national rankings of fourth- and eighth-grade students fail to take account of the size of the differences separating the scores of various countries. "The U.S.'s 5th place in 2003 is statistically identical to 4th and 3rd places," Salzman and Lowell note. Although "the U.S. has not taken first place in math or science," it is "one of the few countries that does consistently perform above the international average." In addition, internal analysis reveals that American TIMSS scores have been improving over time, a feat duplicated by only two other countries.

Much attention has also centered on the apparently poor showing of American 12th-graders in math and science testing. But, Lowell and Salzman note, the TIMSS "high school" exam did not test students of a particular age or grade, but rather those in their final year of secondary school — 12th grade in the U.S., but up to three or more years later in some other countries. "The U.S. has not performed 'poorly' in a statistical sense," University of Pennsylvania education professor Erling Boe and co-author Sujie Shin write in an analysis in the *Phi Delta Kappan* education journal. The math and science results, they conclude, don't separate the U.S. from other developed countries, but Western countries from Japan, Korea and Hong Kong. "The U.S. is quite comparable to other Western nations," none of which matches the East Asians, they write.

Very significantly, American students are by far the most diverse of any industrialized country, with a "substantial gap in the U.S. between the achievement scores of white students and those of black students … and Hispanic students," according to Boe and Shin. White Americans on average substantially outscored Europeans in math and science and came in second to the Japanese, but American black and Hispanic students on average significantly trailed all other groups. Raising America's average scores therefore doesn't require repairing an educational system that performs poorly overall, but boosting the performance of the students at the bottom, overwhelmingly from low-income and minority families.

And Americans' interest in math and science doesn't flag in college. "The proportion of all bachelor's degrees awarded in [science and engineering] has been relatively stable over time, as has the proportion of freshmen in [those majors]," Lowell and Salzman found. A new study, however, reveals an increasing share of the very best of those students opting not to pursue science careers after graduation. In regard to science- and math-based careers, Salzman says, "Everything shows that wages and working conditions and career prospects have … gotten worse."

American universities still focus intensely on the academic research career as the highest and best ambition for science students. Opportunities do, of course, exist beyond the campus. For generations, most chemists have worked in industry. Biotech, computer technology and other emerging industries create other scientific jobs. For a variety of reasons, however, many Ph.D.s find the transition from academe to private business hard to accomplish. And at the university, "alternative careers" — that is, becoming anything other than a professor — generally get the lip service worthy of distant second choices.

This traditional value system does not persist only because of professorial cluelessness. In his recent book, *Lives in Science*, University of Georgia sociologist Joseph Hermanowicz documents the key role that this mythology plays in recruiting students for graduate programs. "Professors rely upon these people to carry out their work," he says, "and one way in which to get that accomplished is by training people in the ideals of science, which include these notions of success."

Back when today's senior scientists were starting their careers, this mythology formed part of an implicit bargain, labor force economist Paula Stephan of Georgia State University has pointed out. Academic science functioned as an apprenticeship system, with graduate students and postdocs accepting meager pay and long hours, knowing that their teachers took personal responsibility for launching their careers. Indeed, the success of senior scientists' students was an important measure of their professional standing, notes Vincent Mangematin of Grenoble Ecole de Management in France, an expert on scientific career trajectories.

Starting about three decades ago, however, this long-standing agreement began to unravel. In a number of fields, placing students in desirable faculty jobs became more and more difficult, and several years of postdoctoral "training" gradually became the norm for nearly everyone rather than, as formerly, a mark of special distinction. It was, in fact, a form of disguised unemployment. "Simply put, there are not enough tenure-track academic positions for the available pool of … researchers," the *Bridges* report says.

Whereas new Ph.D.s had formerly spent a year or so applying for perhaps three or four faculty openings before accepting a job, they now spent multiple years sending out scores of applications, often without success. Graduate students and postdoctoral "trainees" were less and less the protégés of mentors morally responsible for their futures, Mangematin points out. They morphed instead into highly skilled, highly motivated and invitingly inexpensive labor, doing the bench work needed for professors to keep their grants. Winning those grants gradually came to outweigh placing their students in good jobs as a major mark of professional stature.

The obstacles facing today's young scientists therefore don't constitute temporary aberrations but rather are structural features of a system that evolved over a period of 60 years and now meets the needs of major interest groups within the existing structure of law and regulation. Essentially, this system provides a continuing supply of exceptionally skilled labor at artificially low prices, permitting the federal government to finance research at low cost. Based on federal statutes, regulations and appropriations, the system can be fundamentally altered only by congressional action.

The groups that benefit from the science labor glut include senior professors, who receive the great bulk of federal grant funding, and the research universities that employ them (and the graduate students and postdocs) while receiving overhead payments from the grants. Change that could substantially relieve the plight of young scientists seems especially difficult to effect. The groups supporting the current situation are well organized, with strong and effective lobbies and are seen, both by themselves and by society at large, as representing major social goods: The established researchers and their scholarly associations claim to speak for "science," and thus for technological progress and the hope of cures for dread diseases. The universities represent education and opportunity.

Young scientists, meanwhile, are not only impecunious and unorganized for political action, but generally don't even view themselves as an interest group apart from the larger scientific community — despite having interests that are at odds in major ways with those of their professors and universities. The National Postdoctoral Association, which ostensibly speaks for postdocs, is a creature of the American Association for the Advancement of Science, a major representative of organized academic scientists. Postdoc unions exist on a handful of campuses, but they focus on local workplace conditions rather than national issues like the structure of careers.

By the early 1970s, periodic surveys of the biomedical labor force by the National Academy of Sciences were noticing more and more new Ph.D.s accepting temporary postdoctoral appointments instead of proceeding to

permanent jobs. Before long, the Academy's reports were calling this demoralizing trend disguised unemployment, and the pool continued to grow relentlessly for the next 30 years.

During the 1990s dot-com boom, as the market for information technology workers began to tighten and salaries to rise, information industry interests agitated in Congress for admitting more high-skilled foreign workers. According to Teitelbaum, lobbyists for the tech industry struck a deal with those of the research universities: If the universities would support a higher visa cap for industry, industry would support an unlimited supply of H-1B visas for nonprofit organizations, essentially giving universities the right to bring in as many foreign postdocs as they wished.

Since then, tens of thousands of Ph.D.s, primarily from China, have arrived to staff American university laboratories, and the information industry has padded its ranks with temporary workers who come largely from India. The transformation of postdocs from valued protégés to cost-effective labor force was complete.

Harvard economist George Borjas has documented that an influx of Ph.D.s from abroad reduces incomes of all comparable doctorates. Although some people argue that advanced education assures good career prospects, "the supply-demand textbook model is correct after all," Borjas says. It turns out to work as powerfully on molecular biologists and computer programmers as on gardeners and baby sitters.

The director of postdoctoral affairs at one stellar university, who requested anonymity to avoid career repercussions, puts it more acidly. The main difference between postdocs and migrant agricultural laborers, he jokes, is that the Ph.D.s don't pick fruit.

According to a recent post on the blog of a well-informed physicist, eight people have already accepted postdoc positions at Princeton in the field of particle physics for the coming year. That is one particle physicist shy of the total number in that field hired nationally as faculty members this year.

So what can be done to rescue the American scientific labor market from self-destruction?

Obviously, the "pyramid paradigm can't continue forever," says Susan Gerbi, chair of molecular biology at Brown University and one of the relatively small number of scientists who have expressed serious concern about the situation. Like any Ponzi scheme, she fears, this one will collapse when it runs out of suckers — a stage that appears to be approaching. "We need to have solutions for some new steady-state model" that will limit the production of new scientists and offer them better career prospects, she adds. At this point, however, the policy options become slim. There has been relatively little attention given to possible solutions for the scientist glut — in no small part because the scientific establishment has been busy promoting the idea that the U.S. has a shortage of science students.

Any change in the science labor market would, of course, require dismantling the current system and erecting something that would value young scientists for their future potential as researchers and not just for their present ability to keep universities' grant mills humming. This would mean paying them more and exploiting them less. It would also mean limiting their numbers by both producing and importing fewer scientists, so incomes could rise to something commensurate with the investment in time and talent and the high-level skills of a Ph.D.

Assorted critics of the present system have suggested various models. Generally these involve staffing labs with permanent career employees, from technicians to Ph.D. senior scientists, on a long-term basis rather than

depending on low-paid transients. Some institutions have used variants of this model. They include the Howard Hughes Medical Institution's Janelia Farm in Ashburn, Va., and the legendary, now essentially defunct, Bell Laboratories, which belonged to the monopoly telephone company and produced seven Nobel Prizes.

Scientists-in-training also need effective means of preparing themselves for the careers that exist outside the academy. This will require universities to provide resources and time during graduate school and postdoc years for learning unrelated to an ever-narrowing focus on a single research question.

But dismantling the current system would require overcoming the powerful vested interests that now benefit from the inequities and exploitation of young scientists. Well before that could happen, there would have to be an honest recognition of today's labor market realities, the forces that caused these distortions and the damage they are doing.

Whether the nation can overcome the interests of those who benefit from America's current policy of doing science on the cheap is not at all clear. Due to recession-related financial difficulties, Yale University recently announced small reductions in the number of graduate students it would admit. Science departments objected, according to the student newspaper. The *Yale Daily News* reported: "Professors in the Computer Science Department are conducting federally funded research projects — research that must be conducted with the help of graduate students, computer science chair Avi Silberschatz said. If these projects are not delivered, he said, it may be difficult to win future grants."

But unless the nation stops, as one Johns Hopkins professor put it, "burning its intellectual capital" by heedlessly using talented young people as cheap labor, the possibility of drawing the best of them back into careers as scientists will become increasingly remote. A nation that depends on innovation for its prosperity, that has unsurpassed universities and research centers, and that has long prided itself on the ingenuity and inventiveness of its technical elite, must devise ways of making solid careers in science once again both captivating and attainable. There's no shortage of American talent. What's in critically short supply are the ideas and determination to use that talent wisely.

http://www.miller-mccune.com/science/the-real-science-gap-16191/

A Poor Nation, With a Health Plan

By DONALD G. McNEIL Jr.

MAYANGE, Rwanda — The maternity ward in the Mayange district health center is nothing fancy.

It has no running water, and the delivery room is little more than a pair of padded benches with stirrups. But the blue paint on the walls is fairly fresh, and the labor room beds have mosquito nets.

Inside, three generations of the Yankulije family are relaxing on one bed: Rachel, 53, her daughter Chantal Mujawimana, 22, and Chantal's baby boy, too recently arrived in this world to have a name yet.

The little prince is the first in his line to be delivered in a clinic rather than on the floor of a mud hut. But he is not the first with health insurance. Both his mother and grandmother have it, which is why he was born here.

Rwanda has had national health insurance for 11 years now; 92 percent of the nation is covered, and the premiums are $2 a year.

Sunny Ntayomba, an editorial writer for The New Times, a newspaper based in the capital, Kigali, is aware of the paradox: his nation, one of the world's poorest, insures more of its citizens than the world's richest does.

He met an American college student passing through last year, and found it "absurd, ridiculous, that I have health insurance and she didn't," he said, adding: "And if she got sick, her parents might go bankrupt. The saddest thing was the way she shrugged her shoulders and just hoped not to fall sick."

For $2 a year, of course, Rwanda's coverage is no fancier than the Mayange maternity ward.

But it covers the basics. The most common causes of death — diarrhea, pneumonia, malaria, malnutrition, infected cuts — are treated.

Local health centers usually have all the medicines on the World Health Organization's list of essential drugs (nearly all are generic copies of name-brand drugs) and have laboratories that can do routine blood and urine analyses, along with tuberculosis and malaria tests.

Ms. Mujawimana gave birth with a nurse present, vastly increasing the chances that she and her baby would survive. Had there been complications, they could have gone by ambulance to a district hospital with a doctor.

"In the old days, we came here only when the mother had problems," her mother said. "Now the village health worker orders you not to deliver at home."

Since the insurance, known as health mutuals, rolled out, average life expectancy has risen to 52 from 48, despite a continuing AIDS epidemic, according to Dr. Agnes Binagwaho, permanent secretary of Rwanda's Ministry of Health. Deaths in childbirth and from malaria are down sharply, she added.

Of course, many things that are routine in the United States, like M.R.I. scans and dialysis, are generally unavailable. Cancer, strokes and heart attacks are often death sentences. The whole country, with a population of 9.7 million, has one neurosurgeon and three cardiologists. (By contrast, New York City has 8 million people; at a national softball tournament for neurosurgeons in Central Park 10 days ago, local hospitals fielded five teams.)

(In another contrast with the United States, obesity and its medical complications are almost a nonissue. Visitors to Rwanda are quickly struck by how thin everyone on the street is. And it is not necessarily from malnutrition; even the president, Paul Kagame, a teetotaling ascetic, is spectral.)

General surgery is done, but waits can be weeks long. A few lucky patients needing advanced surgery may be treated free by teams of visiting doctors from the United States, Cuba, Australia and elsewhere, but those doctors are not always around. Occasionally, the Health Ministry will pay for a patient to go to Kenya, South Africa or even India for treatment.

Still, even with rationing this strict, how can any nation offer so much for $2 a year?

The answer is: It can't. Not without outside help.

Partners in Health, the Boston-based health charity, which runs two rural hospitals and a network of smaller clinics in Rwanda, said its own costs ran $28 per person per year in areas it serves. It estimated that the government's no-frills care costs $10 to $20.

According to a study recently published in Tropical Medicine & International Health, total health expenditures in Rwanda come to about $307 million a year, and about 53 percent of that comes from foreign donors, the largest of which is the United States. One big donor is the Global Fund to Fight AIDS, Tuberculosis and Malaria, which is experimenting with ways to support whole health systems instead of just treating the three diseases in its name. It pays the premiums for 800,000 Rwandans officially rated as "poorest of the poor."

In a nation of poor farmers, who is officially poorest is decided by village councils. They weigh assets like land, goats, bicycles and radios and determine whether a hut has a costly tin roof or just straw.

“People know their neighbors here,” said Felicien Rwagasore, a patient coordinator at the Mayange clinic. “They do not make mistakes.”

Making every Rwandan pay something is part of President Kagame’s ambitious plan to push his people toward more self-reliance and, with luck, eventually into prosperity. The country has been called “Africa’s Singapore.” It has clean streets and little crime, and each month everyone does one day of community service, like planting trees. Private enterprise is championed, and Mr. Kagame has been relentless about punishing corrupt officials. In the name of suppressing remarks that might revive the hatreds that spawned the 1994 genocide, his critics say, he suppresses normal political dissent, too.

A more practical obstacle to creating a health insurance system, however, is that most of the world’s poor, including Rwanda’s, resist what they see as the unthinkable idea of paying in advance for something they may never get.

“If people pay the $2 and then don’t get sick all year, they sometimes want their money back,” said Anja Fischer, an adviser to the Health Ministry from GTZ, the German government’s semi-independent aid agency.

Also, the co-pays can be overwhelming. Even $5 for a Caesarean section can be too much for people as close to the edge as the Yankulijes, who live by growing beans and sweet potatoes and wear American castoffs (Mrs. Yankulije’s T-shirt read “Wolverines Football”).

Many live by barter and cannot scrape together even $2 in coins, said Dr. Damas Dukundane, who works in a poor rural area. Since the government accepts only cash, he said, his patients sometimes go to traditional healers, who could be dangerous quacks but will take goats or chickens.

As a result of all these factors, Rwanda is a patchwork of small clinics, some richer or better-run than others. Mayange’s, for example, gets donations and guidance from the Access Project founded by Josh N. Ruxin, a Columbia professor of public health who now lives in Kigali.

For example, the computer that prints the insurance cards has a Webcam on it. Previously, Professor Ruxin said, for insurance costing $2, villagers had to bring in photographs that had cost them $1 or more.

A clearer example of how the system overburdens the poor, he said, was the fact that the wealthiest Rwandans pay the same $2 that the rural poor do.

Dr. Binagwaho, the Health Ministry official, agreed.

“It’s totally insane that my mother pays the same as the woman who cleans her house,” she said. “That law is being changed.”

Still, Dr. Binagwaho said, Rwanda can offer the United States one lesson about health insurance: “Solidarity — you cannot feel happy as a society if you don’t organize yourself so that people won’t die of poverty.”

http://www.nytimes.com/2010/06/15/health/policy/15rwanda.html?nl=health&emc=healthupdateema2

Sperm whale faeces 'helps oceans absorb CO2'

Page last updated at 21:33 GMT, Tuesday, 15 June 2010 22:33 UK

By Richard Black
Environment correspondent, BBC News

Sperm whales may put a gentle (and unwitting) brake on climate change

Sperm whale faeces may help oceans absorb carbon dioxide from the air, scientists say.

Australian researchers calculate that Southern Ocean sperm whales release about 50 tonnes of iron every year.

This stimulates the growth of tiny marine plants - phytoplankton - which absorb CO2 during photosynthesis.

The process results in the absorption of about 400,000 tonnes of carbon - more than twice as much as the whales release by breathing, the study says.

The researchers note in the Royal Society journal Proceedings B that the process also provides more food for the whales, estimated to number about 12,000.

Phytoplankton are the basis of the marine food web in this part of the world, and the growth of these tiny plants is limited by the amount of nutrients available, including iron.

Faecal attraction

Over the last decade or so, many groups of scientists have experimented with putting iron into the oceans deliberately as a "fix" for climate change.

Not all of these experiments have proved successful; the biggest, the German Lohafex expedition, put six tonnes of iron into the Southern Ocean in 2008, but saw no sustained increase in carbon uptake.

Although 400,000 tonnes of carbon is less than one-ten-thousandth of the annual emissions from burning fossil fuels, the researchers note that the global total could be more substantial.

There are estimated to be several hundred thousand sperm whales in the oceans, though they are notoriously difficult to count; and lack of iron limits phytoplankton growth in many regions besides the Southern Ocean.

So it could be that whale faeces are fertilising plants in several parts of the world.

Crucial to the idea is that sperm whales are not eating and defecating in the same place - if they were, they could just be absorbing and releasing the same amounts of iron.

Instead, they eat their diet - mainly squid - in the deep ocean, and defecate in the upper waters where phytoplankton can grow, having access to sunlight.

Releasing the iron here is ultimately good for the whales as well, say the researchers - led by Trish Lavery from Flinders University in Adelaide.

Phytoplankton are eaten by tiny marine animals - zooplankton - which in turn are consumed by larger creatures that the whales might then eat.

The scientists suggest a similar mechanism could underpin the "krill paradox" - the finding that the abundance of krill in Antarctic waters apparently diminished during the era when baleen whales that eat krill were being hunted to the tune of tens of thousands per year.

http://news.bbc.co.uk/2/hi/science_and_environment/10323987.stm

US experiment hints at 'multiple God particles'

Page last updated at 23:17 GMT, Monday, 14 June 2010 00:17 UK

By Paul Rincon
Science reporter, BBC News

The idea comes from results gathered by the DZero experiment

There may be multiple versions of the elusive "God particle" - or Higgs boson - according to a new study.

Finding the Higgs is the primary aim of the £6bn ($10bn) Large Hadron Collider (LHC) experiment near Geneva.

But recent results from the LHC's US rival suggest physicists could be hunting five particles, not one.

The data may point to new laws of physics beyond the current accepted theory - known as the Standard Model.

The Higgs boson's nickname comes from its importance to the Standard Model; it is the sub-atomic particle which explains why all other particles have mass.

However, despite decades trying, no-one, so far, has detected it.

The idea of multiple Higgs bosons is supported by results gathered by the DZero experiment at the Tevatron particle accelerator, operated by Fermilab in Illinois, US.

The Standard Model fits just about every test we've thrown at it. To fit in a new effect in one particular place is not easy

Dr Adam Martin Fermilab

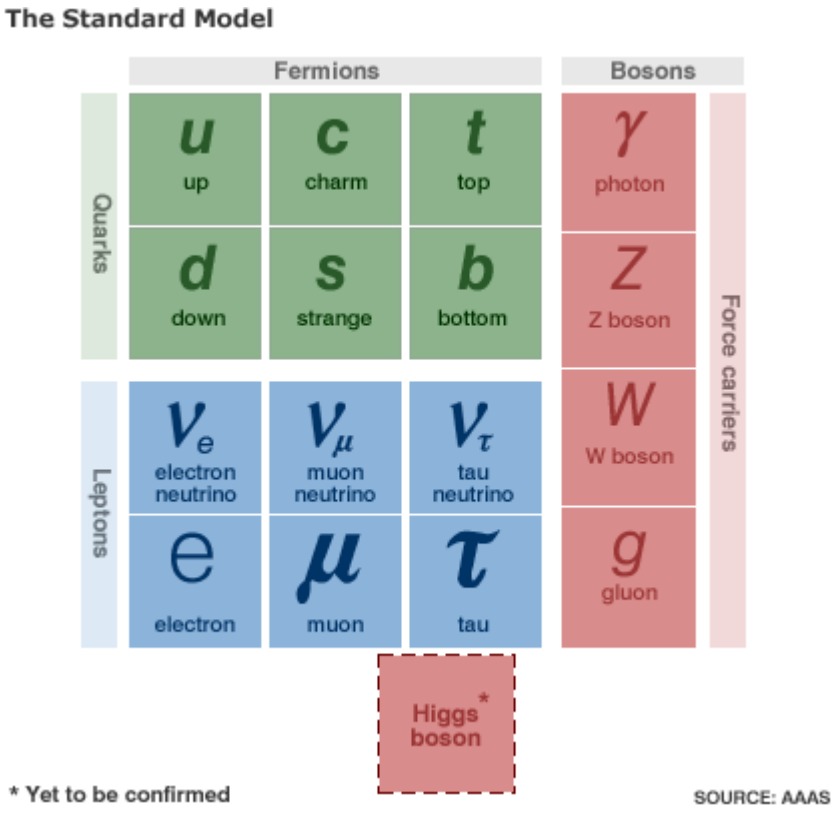
DZero is designed to shed light on why the world around us is composed of normal matter and not its shadowy opposite: anti-matter.

Researchers working on the experiment observed collisions of protons and anti-protons in the Tevatron.

The collisions produced pairs of matter particles slightly more often than they yielded anti-matter particles.

Physicists had already seen such differences - known as "CP violation", but these effects were small compared to those seen by the DZero experiment.

The DZero results showed much more significant "asymmetry" of matter and anti-matter - beyond what could be explained by the Standard Model.



Bogdan Dobrescu, Adam Martin and Patrick J Fox from Fermilab say this large asymmetry effect can be accounted for by the existence of multiple Higgs bosons.

They say the data points to five Higgs bosons with similar masses but different electric charges.

Three would have a neutral charge and one each would have a negative and positive electric charge. This is known as the two-Higgs doublet model.

Dr Martin told BBC News that the two-Higgs doublet could explain the results seen by the DZero team while keeping much of the Standard Model intact.

"In models with an extra Higgs doublet, it's easy to have large new physics effects like this DZero result," he explained.

"What's difficult is to have those large effects without damaging anything else that we have already measured."

Dr Martin explained that there were other possible interpretations for the DZero result.

But he added: "The Standard Model fits just about every test we've thrown at it. To fit in a new effect in one particular place is not easy."

Developed in the 1970s, the Standard Model incorporated all that was then known about the interactions of sub-atomic particles.

Stepping stone

But today, many physicists regard it as incomplete, a mere stepping stone to something else.

The Standard Model cannot explain the best known of the so-called four fundamental forces: gravity; and it describes only ordinary matter, not the dark matter which makes up some 25% of the Universe.

The Standard Model only has one Higgs "doublet". Although we tend to think of the Higgs boson as one particle, it actually comes in a package of four, explained Dr Martin.

"In the Standard Model, you only see one of them because the other three are absorbed into [other parts of the scheme] such as the W and the Z bosons. There's only one left," he told BBC News.

"So if you want to add another Higgs doublet - you actually have to add four more particles."

The two-Higgs doublet model also ties in with a theory in particle physics known as supersymmetry.

Supersymmetry represents an extension to the Standard Model, in which each particle in the scheme has a more massive "shadow" partner particle.

But so far, physicists have lacked experimental evidence for the existence of these more massive particles.

Evidence for the Higgs and for supersymmetry could be uncovered by the LHC, the world's most powerful "atom smasher" which is housed 100m under the French-Swiss border.

The researchers have published the latest study on the pre-print server arXiv.org; the results were reported by Symmetry magazine. The three researchers are based at Fermilab but are not DZero team members.

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http://news.bbc.co.uk/2/hi/science_and_environment/10313875.stm

Lung cancer risk 'cut by B vitamin'

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By Michelle Roberts
Health reporter, BBC News

Lung cancer is the second most common cancer in the UK after breast

People with plenty of a B-vitamin in their blood appear to be at a reduced risk of lung cancer, even if they smoke, a European study suggests.

High levels of Vitamin B6 and the amino acid methionine cut the risk by half, a study of 400,000 people suggested.

These occur naturally in nuts, fish and meat or can be taken as supplements.

But experts told the Journal of the American Medical Association that stopping smoking remained the best way of reducing lung cancer risk.

And, as yet, it is too early to say that taking vitamins would provide any extra protection, they say.

Higher vitamin levels could simply reflect healthier lifestyles.

More studies are needed before scientists can be confident that increasing levels of B-vitamins in the diet can reduce the risk of lung cancer, and also to understand why this might be, says the World Cancer Research Fund (WCRF) which was involved in the research.

Healthy diet

Dr Panagiota Mitrou, of the WCRF, said: "These findings are really exciting as they are important for understanding the process of lung cancer and could have implications for prevention.

"But while this is an important study, it is vital that we get the message across to smokers that increasing intake of B-vitamins is not - and never will be - a substitute for stopping smoking."

Vitamin B levels might be higher in people who eat a healthy diet, and this in itself can help reduce the risk of cancer

Dr Joanna Owens Cancer Research UK

However, it could mean that ex-smokers and people who have never smoked can do something positive to reduce their risk of lung cancer, she said.

The study looked at nearly 400,000 people from 10 European countries over eight years.

They included people who had never smoked, current smokers and ex-smokers.

Regardless of their smoking status, the people with higher circulating levels of both Vitamin B6 and methionine in their blood appeared to be protected against lung cancer.

Far fewer of them developed lung tumours over the course of the study compared with those with the lowest levels of the essential nutrients - 129 people versus 408 respectively, out of a total of 899 cancer cases overall.

Dr Paul Brennan, lead researcher of the study from the International Agency for Research on Cancer, said: "If further research does confirm our findings then the next step would be to identify the optimum B-vitamin levels for reducing future cancer risk."

Dr Joanna Owens, of Cancer Research UK, said: "Although this study suggests a link between vitamin B levels in the blood and reduced risk of lung cancer, this doesn't prove that vitamin B can directly protect against the disease.

"Vitamin B levels might be higher in people who eat a healthy diet, and this in itself can help reduce the risk of cancer.

"The most important way to prevent lung cancer is to stop smoking. No amount of vitamins can counteract the risks posed by smoking."

http://news.bbc.co.uk/2/hi/health/10318410.stm

'Much more water' found in lunar rocks

Page last updated at 21:17 GMT, Monday, 14 June 2010 22:17 UK

By Katia Moskvitch
Science reporter, BBC News

Some of the water on the Moon may have been delivered by comets

The Moon might be much wetter than previously thought, a group of scientists has said.

A US-led team analysed the mineral apatite in lunar rocks picked up by the Apollo space missions and in a lunar meteorite found in North Africa.

The scientists found that there was at least 100 times more water in the Moon's minerals than they had previously believed.

The new study has been published in the journal PNAS.

This group is one of several different teams of researchers hunting for evidence of water on the Moon - and clues to how it got there.

Lead author Francis McCubbin from the Carnegie Institution for Science in Washington DC told BBC News that the water content on the Moon ranges from 64 parts per billion to five parts per million.

"It would be about 2.5 times the volume of the Great Lakes," he said.

"Or another way of looking at it - if you took all of the water that was locked up inside the rocks of the Moon and put them on the surface, it would make a metre-thick layer covering the Moon."

The scientist explained that the Moon most probably formed after a Mars-sized space body collided with the young Earth, some 4.5 billion years ago.

The high-energy impact produced molten debris, which eventually cooled to form our planet's only natural satellite.

Back then, he said, there was a magma ocean on the Moon. Magma contained water, which eventually erupted via "fire fountains" on to the lunar surface.

Most of this water evaporated during the volcanic activity - but some of it stayed, said Dr McCubbin.

"I like to use the analogy of someone who's trying to make non-alcoholic beer. There's always going to be some alcohol left," he explained.

Quest for water

After the US Apollo space missions of the late 1960s and early 1970s returned to Earth with numerous samples of lunar rocks, scientists spent years examining them in search of water.

So maybe there was a lot of cometary debris going by and as these 'dirty icebergs' hit the Moon, they provided a lot of water input

Lawrence Taylor University of Tennessee in Knoxville

At first, they declared that the Moon was dry - but this theory was challenged in 2008, when a US team used the method of secondary ion mass spectrometry (SIMS) and found evidence of water in lunar volcanic glasses - pebble-like rocks that ended up on the Moon's surface after the volcanic outpouring.

It was a breakthrough discovery, even though the quantity of water was only of the order of 46 parts per million.

Nevertheless, the scientists said that their research shed light on the origins of lunar water, asserting that it was "native" to the Moon.

Earlier in 2010, a radar experiment aboard India's Chandrayaan-1 lunar spacecraft found thick deposits of water-ice near the Moon's north pole.

In the recent study, Dr McCubbin and his colleagues used SIMS to look at the Apollo samples once more - but this time, they analysed the only water-bearing mineral of the rocks - apatite.

This mineral happens to be a major component of tooth enamel and bones and, as Dr McCubbin explained, "has a better chance of retaining water than volcanic glass".

The team specifically studied hydroxyl (OH) - a chemical compound in apatite that contains one atom of oxygen and one atom of hydrogen.

The researchers combined their measurements with models that analyse how the material crystallised as the Moon cooled.

The team found that the Moon's interior contains at least 100 times more water than was previously believed, stored in lunar minerals.

Other researchers have called the results important for future studies.

"It is gratifying to see this proof of the OH contents in lunar apatite," commented lunar scientist Bradley Jolliff from Washington University in St. Louis, Missouri.

"The concentrations are very low and, accordingly, they have been until recently nearly impossible to detect. We can now finally begin to consider the implications—and the origin - of water in the interior of the Moon."

Other theories

Dr Lawrence Taylor from the University of Tennessee in Knoxville, US has been involved in a separate, but similar research.

He told BBC News that besides finding water in the apatite, he and Jim Greenwood from Wesleyan University in Connecticut have come up with an additional theory about the origins of lunar water.

"We're thinking now that there might have been a cometary input as well," said Dr Taylor.

He explained that there were a lot of comets flying around at the time of the Moon's formation, "hitting the little, nascent, early Moon some 4.5 billion years ago".

Some scientists call comets "dirty icebergs" as they mostly contain ice, as well as other rocky material, soil and gases.

"So maybe there was a lot of cometary debris going by and as these 'dirty icebergs' hit the Moon, they provided a lot of water input," Dr Taylor said.

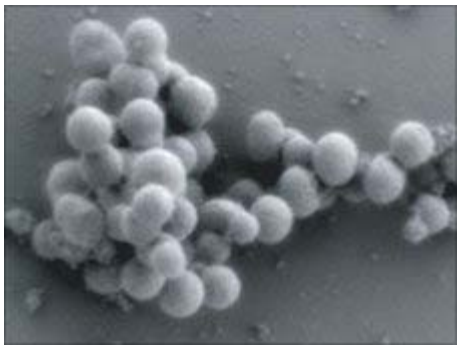
"Back then, the outer portion of the Moon was molten, it was all a lunar magma ocean, so the comets were incorporated into the chemistry of the [Earth's satellite]".

http://news.bbc.co.uk/2/hi/science_and_environment/10313173.stm

Artificial life 'needs regulation' - public survey says

Page last updated at 00:04 GMT, Monday, 14 June 2010 01:04 UK

By Pallab Ghosh
Science correspondent, BBC News



The public dialogue on synthetic biology began late in 2009

The public wants a say in how research in to the manufacture of synthetic life is conducted, according to a report.

The Synthetic Biology Public Dialogue was commissioned by the two UK research councils responsible for funding what has been dubbed "synthetic biology".

It sets out to advise the funders of this research how best to proceed.

The report revealed that people are comfortable with the the idea of creating life, but only if it is properly regulated.

It also found that people wanted an assurance that the research could bring tangible benefits.

The research councils, the Biotechnology and Biological Sciences Research Council (BBSRC) and the Engineering and Physical Sciences Research Council (EPSRC), embarked on their public dialogue in late 2009.

Having the word 'synthetic' next to the word 'biology' does provoke a reaction in people that can be negative

Professor Paul Freemont UK centre for Synthetic Biology

The resulting report concluded that people wanted scientists who worked with the bits and pieces of life to do so with humility and respect for the material they were working with.

It also showed that people wanted to have a say in how the research was conducted and how grants were awarded. There should be consideration of social values as well as scientific merit, they said.

Professor Paul Freemont, co-director of the UK centre for Synthetic Biology at Imperial College London, said his gut reaction to this idea was that it could be "very difficult".

But he said that as he thought more about it, he decided it was a "good idea".

"We want the science to flourish," he said, "but we also want it to be acccepted. We want the public to engage with it, understand it and also to influence it".

Such direct input by the public has never been tested in scientific research, but the report's author Dr Brian Johnson argues that there has never before been anything as potentially world-changing as synthetic biology.

"We are dealing here with the emergence of a very new culture which is taking biology to where it's always wanted to go," he said.

"We have spent the past thousand years learning how organisms work and interact. What synthetic biology is attempting to do is to not just take organisms apart but to put them together in a new way.

"So this is a real quantum leap in science which people have described as the second industrial revolution".

Believe the hype?

Following the recent announcement of the manufacture of "Synthia", which was described as the world's synthetic lifeform, many eminent scientists said that some people were "hyping up" the potential of the research.

Some have said that Synthia, created by the US scientist Craig Venter, should not be called a synthetic lifeform at all for technical reasons. And, according to Professor Freemont, a name change would make life easier for those working in the field.

"Having the word 'synthetic' next to the word 'biology' does provoke a reaction in people that can be negative," he said.

But Roland Jackson, chief executive of the British Science Association thinks that a name change for the field would be a mistake.

"Craig Venter did artificially create that cell," he said. "The concept of the synthetic and the natural are difficult oppostions for the public and scientists need to be aware of that.

"But I don't think they should be over-sensitive to it. They should say what they mean and mean what they say and I think the public respects an honest and open approach to this.

http://news.bbc.co.uk/2/hi/science_and_environment/10297561.stm

Windscreen water infection risk

Page last updated at 23:46 GMT, Sunday, 13 June 2010 00:46 UK

By Emma Wilkinson
Health reporter, BBC News

The HPA's Dr Isabel Oliver explains the risk from windscreen washer water

Windscreen wiper water may be the cause of 20% of cases of Legionnaires' Disease in England and Wales, the Health Protection Agency says.

Stagnant, warm water is a breeding ground for the Legionella bacterium, which when inhaled causes pneumonia.

Yet adding screenwash kills the bacteria and could save lives, the Agency advised.

The finding came after researchers spotted that professional drivers are five times more likely to be infected.

Legionnaires' disease is fairly rare. Most cases are sporadic and a source of the infection is not found.

The number of cases vary from year to year, but in 2009 there were 345 in England and Wales - although some infections were caught overseas.

It mainly affects the over 50s and is generally more common in men.

Early symptoms feel similar to flu with muscle aches, tiredness, headaches, dry cough and fever. It is fatal in around 10-15% of patients.

Driving

To work out why people who spend a long time driving were at higher risk of infection, the research team in the south-west branch of the HPA carried out a questionnaire of people infected.

They found that those most at risk were those who drove or travelled in a van, those who drove through industrial areas, and those who spent a lot of time in the car or who often had the car window open.

This is a bug which lives in the environment and will take advantage of warm water systems that are not cleaned out

Professor Hugh Pennington

In all they found that the biggest risk was associated with not adding screenwash to windscreen wiper water, the European Journal of Epidemiology reports.

In a pilot study carried out by the HPA, traces of Legionella were found in one in five cars that did not have screenwash, but in no cars that did.

Dr Isabel Oliver, regional director of the HPA South West, said more research was needed but people may want to check they have screenwash in their cars as they usually contain agents which would stop the growth of bacteria.

"It does not spread from person to person but is present in water environments and is breathed in when it gets into the air in fine particles or mist."

Professor Hugh Pennington, an expert in bacteriology, said the advice to add screenwash was very sound - especially as it would also lead to a cleaner windscreen.

"This is a bug which lives in the environment and will take advantage of warm water systems that are not cleaned out.

"Legionnaires' is rare but it kills people and it's an extremely unpleasant disease.

"If you can prevent it with something this simple then it's a no brainer really."

http://news.bbc.co.uk/2/hi/health/10293519.stm

Geopolitical Cycles

By ROBERT SULLIVAN

THE LOST CYCLIST

The Epic Tale of an American Adventurer and His Mysterious Disappearance

By David V. Herlihy

326 pp. Houghton Mifflin Harcourt. $26

O to be young and biking in America at the close of the 19th century and have nothing to worry about, except perhaps the roads (which were an issue only if they were *good*: on the big-wheeled "boneshaker" bikes, as one cycling reporter put it, "the element of safety is rather distasteful to a good many riders who prefer to run some risk, as it gives zest to the sport")! O to ride when cyclists were called wheelmen, Bicycling World covered bike races as if they were moon launches and spectators cheered on men in short-legged pants and caps that — *wait!* — looked a lot like what that guy on the G train in Brooklyn was wearing the other day! O to ride between bicycling meccas like Pittsburgh and Buffalo, at a time when America was embracing travel and just setting out, like bicyclists, into the wide world!

Those were the days when Frank Lenz, a 24-year-old wheelman, departed New York in 1892 to round the globe — a trip grippingly detailed in David Herlihy's "Lost Cyclist: The Epic Tale of an American Adventurer and His Mysterious Disappearance." Whether you consider Lenz's disappearance mysterious or not will have to do with your attitude toward biking in deserts, but suffice it to say Lenz's trip ends when he goes where everyone told him not to go — eastern Turkey, in the midst of a Turkish and Kurdish campaign that would kill some 10,000 Armenian civilians. "The Lost Cyclist" is not a book for anyone who wants a panoramic view of the socioeconomic landscape in the borderlands of Europe and Asia where Lenz, a correspondent for The Outing Magazine, was last seen. It is a view from the helmet cam in the days before helmet cams and at times can feel, a bit irritatingly, like riding a geopolitically stationary bike. At the start of a chain of atrocities that eventually culminated in the Armenian genocide, The Evening News Reviewof East Liverpool, Ohio, sounds like The Onion as it looks just past its own nose, to blare: "Frank Lenz Is Lost."

Then again, what's fascinating about this thoroughly researched story is the cluelessness, recklessness and luckiness — to a point, anyway — of American travelers in general and Americans in the overinflated world of early American biking in particular. Lenz was to be the first person to circle the world solo on routes that

required the most actual bike mileage, as opposed to routes that included more boats or trains. Herlihy concentrates on the attempt to rescue Lenz, an impossible task taken on by William Sachtleben, an Illinois bicyclist who had just finished his own record-setting around-the-world ride.

For both men, the trips were about their careers. “Lenz would rather be a famous cycle tourist than a miserable bookkeeper, toiling his life away in the bowels of a dingy factory,” writes Herlihy, the author of “Bicycle,” an excellent history. (Herlihy often writes from inside the heads of the cyclists, who, it should be noted, fall a lot and don’t wear helmets.) Even the biker who set the round-the-world record before Sachtleben describes his adventure in almost negative terms — a trip that saves Americans “the trouble of wandering all over the earth themselves.”

Herlihy emphasizes the gonzo details: Lenz fording deadly Burmese rivers, or Sachtleben’s cohort pantomiming a chicken to acquire eggs. Often, one wants to strangle the Americans, even after they meet an especially obnoxious German biker, who accuses them of riding merely to promote themselves and their “cushion tires.” At least the German has the courtesy to pick up a few foreign phrases: “What good all the petty languages of Egypt, Palestine, Turkey and Asia will do for him I don’t see,” Sachtleben says. “These countries play such an insignificant part in the world’s affairs that I am even in doubt sometimes whether it pays to travel through them.”

If there’s a bicycle-built-for-three feeling to “The Lost Cyclist,” it’s because Herlihy is mostly along for the ride, hesitating to weigh in on the Americans’ racist jerkiness, at home and abroad. In China, Lenz declares that “the Chinese hate all whites” and that “the cry of ‘foreign devil’ greets me everywhere.” Eventually, feelings are mutual. “Twice I have used my revolver to frighten off Chinese who stoned me,” he reports. Lenz follows the German telegraph line, seeking safety with European line operators. Nine hundred miles from Constantinople, he has had it: “I am tired, very tired, of being a ‘stranger.’ ” In the passes between Tabriz and Erzurum, he disappears.

At the buried moral center of “The Lost Cyclist” is Sachtleben. He knew that Outing’s offer to undertake the rescue would “renew his reputation as a world wanderer and roving reporter par excellence,” and that he “might even delve into the Armenian massacres and make himself an even more valuable commodity on the lecture circuit.” After he witnesses another killing, Outing withdraws its backing. But Sachtleben won’t budge and eventually pushes for charges against Lenz’s killers. Herlihy, however, seems annoyed by Sachtleben’s muddled attempts to exonerate some Armenians who had been falsely accused, suggesting he should have “concentrated on finding Lenz’s grave rather than on meting out justice in Turkey.”

When he finally does come home, Sachtleben has a chance to lecture on bicycling but wants to talk just about the massacres. When he steps off the boat, a reporter can’t believe how much the 30-year-old has aged. As Sachtleben says at the end of this sad tale of bike-roics, “Now I feel like an old man; all my boyishness is gone.”

Robert Sullivan’s most recent book is “The Thoreau You Don’t Know.”

http://www.nytimes.com/2010/06/20/books/review/Sullivan-t.html?nl=books&emc=booksupdateema3

'War and Peace': The Fact-Check

By MARK MAZOWER

RUSSIA AGAINST NAPOLEON

The True Story of the Campaigns of "War and Peace."

By Dominic Lieven

Illustrated. 618 pp. Viking. $35.95

Dominic Lieven, a professor of history at the London School of Economics, is a distinguished scholar of the czarist empire, and in this superb book he has written his masterpiece. The story he tells — Russia's gargantuan struggle with Napoleon — will be known to most people through Tolstoy's "War and Peace," and it takes a brave man to challenge the great novelist. But that indeed is Lieven's goal, and for the most persuasive of reasons. He believes that Tolstoy's account is badly misleading (Lieven has a historian's natural concern for the facts) and perhaps more important has skewed our view of Russia and contributed to our tendency to misunderstand and belittle its role in international affairs.

In the first place, Tolstoy depicted a war in which individuals had little control over the course of events; military expertise is seen as a peculiarly German character trait, and the Russians instead depend on fate, snow and the vastness of their land to save themselves. Second, the novel essentially ends in late 1812, before the Russian Army has begun the quite extraordinary advance across Europe that led to its defeating Napoleon and entering Paris in triumph just over a year later.

Lieven's account in "Russia Against Napoleon" could not be more different. He concentrates on the men who led the Russian Army to victory — the young Czar Alexander and his close advisers — and shows that they won because they got more things right than Napoleon did. They understood him better than he did them, and while Napoleon may have been a battlefield genius, Alexander showed greater diplomatic skill in bringing together the coalition that eventually defeated him. That was no easy matter, given the fear of the French that prevailed in the German lands, and the fear of Russian predominance as well.

The reason the Russians were able to persuade the Prussians and above all the hesitant Austrians to join them is that they had already shown that Napoleon could be defeated. This they had done through management of their long and deliberate retreat in 1812, which had drawn the French deep into Russia, far from their supply lines, and exposed them to constant attacks on their flanks. It was a strategy that had required a lot more than good luck and heavy snow. It had needed complex administration in the provisioning of food and, above all, horses (Lieven is very good on how the availability of horses could win or lose a war). It needed a ferociously efficient, cruel but widely tolerated conscription system.

Most invisibly but significantly, it required trust among sovereign, elite and people. It was this confidence and belief — call it the legitimacy of the autocratic system — that explains how Alexander could be fairly confident his regime would survive even after abandoning his capital. Lieven makes the instructive comparison with what happened in Paris when the Russian Army marched into the French capital: within hours the rats were fleeing Napoleon's ship, his closest relatives had slipped away and Prince Talleyrand was negotiating the succession.

Lieven takes us into the heart of the Russian military. Himself the descendant of imperial officers, he offers us something close to a rose-tinted picture of that caste, and a notably heroic picture of Alexander himself, the man who "more than any other individual," he tells us, "was responsible for Napoleon's overthrow." Lieven's pride is evident when he reminds us that the czar's Guards were "the finest-looking troops in Europe."

But this pious act of memory brings with it a deep understanding of the men and the system that made the Russian imperial army so effective. There is a certain amount of Tolstoyan partying and drinking, courtly intrigue and battlefield maneuvering here, but there is also much more serious attention to the Russian ability to appraise the finely balanced strategic alternatives that loomed up almost every minute from the time the decision was taken to prepare for invasion.

Stand and fight, or conduct that hardest of maneuvers — the sustained and orderly retreat? Hold Moscow, or risk the monarchy and leave it to its fate? Entrap the French Army and try to destroy it in the Russian wastes, or allow it to retreat in its turn? — the favored policy, on the eminently sensible grounds that if French power were eradicated, Russia would face new enemies in its place. Above all, stop at the borders of the empire in 1813 and negotiate a new peace with the chastened French — which much of the Russian military elite wanted — or spur the exhausted troops on to a feat unknown in the annals of European warfare, making them march as far across Europe as it took to topple Napoleon? This was Alexander's policy, ambitious and cogent, and one he pursued in the face of counterarguments for many months until he was proved right.

If this was a war between modernity, as represented by the revolutionary French armies, and empire, it was empire that won. And this is Lieven's deeper point: to remind us of empire's vitality and single-mindedness, of the rational efficiency of th*e ancien régime w*hen faced with its would-be destroyer. Empire could throw together armies as fast as a revolutionary regime could, if not faster, and Russian equipment and provisioning were a match for the French. The French, of course, communicated with one another in their own language, but this made it easy for the Russians to read captured letters; Russian generals, on the other hand, could

communicate in a variety of languages — including, in one case, Latvian, which virtually guaranteed complete confidentiality. Moreover, Alexander worked easily and well with the numerous Frenchmen who fled Napoleon's regime and wanted to help in his downfall. As a result, his intelligence operation was far superior to that of his enemy.

Exhaustion was the toughest enemy of all in this struggle of epic marches. Prussia's best commander, the elderly Blücher, was under such strain that at one point he started hallucinating about giving birth to an elephant. But the imperial military machine could cope even with this, and with victory in the air Blücher himself recovered sufficiently to be carried on toward Paris in full view of his troops, wearing a lady's green silk hat to shade his eyes.

Lieven wants us to remember a time when a Russian army entered a Western European capital and was hailed as a liberator. It is a salutary image today when our abiding memory of the last great war systematically plays down the Russian contribution — both military and political. Hollywood glamorizes the Anglo-American Normandy landings but is silent about the far vaster Operation Bagration — the most lethal offensive in history — that pummeled the Germans in the summer of 1944 and saw Russian troops charge across Europe in a fashion reminiscent of their forebears. This book reminds the reader that Russia's deep and intimate involvement in European security has taken many forms. In doing so it shows how a magisterial lesson about the past can hold a message for the future as well.

Mark Mazower is a professor of history at Columbia University.

http://www.nytimes.com/2010/06/20/books/review/Mazower-t.html?ref=books

Dangerous Zeal

By STEVEN HELLER

THE RISE AND FALL OF SENATOR JOE MCCARTHY

By James Cross Giblin

Illustrated. 294 pp. Clarion Books/Houghton Mifflin Harcourt. $22. (Ages 12 and up)

Young people have doubtless heard the trash talk about President Obama's being "un-American," but they probably have no idea that similar charges against ordinary citizens nearly brought the government to a standstill during the height of the Red scare in the 1950s. Exposure of real spies after World War II and fears of Stalin's Russia had created a tense mood in Washington. So when a junior Republican senator from Wisconsin, Joseph R. McCarthy, began accusing the State Department of harboring "card-carrying members of the Communist Party," for a time he tapped into a popular cause. But as chairman of the Senate's Permanent Subcommittee on Investigations, McCarthy would pursue his anti-Communist crusade with a zeal that would ensnare and wrong many innocent people.

"Fifth column" Communism doesn't much concern modern-day Americans worried about national security, yet in this post-9/11 era, policies that threaten to unfairly single out private citizens are equally divisive. So while James Cross Giblin's latest, carefully researched biography, "The Rise and Fall of Senator Joe McCarthy," may not always make for exciting reading (and is marred by lackluster design), it is nonetheless timely and significant.

Giblin shows how McCarthy stirred up political controversy out of an apparently insatiable hunger for power. His background was modest: he grew up as one of seven children on a farm in the town of Grand Chute, Wis. He raised chickens, then managed a grocery store before deciding to go to high school at the age of 20, where he completed the four-year program in nine months. He then largely put himself through college and law school, where he found his political ambition.

Given the limitations of most high school history curriculums, Giblin is ambitious here in charting McCarthy's rise. He includes information that may be news to some adults — tracing the roots of McCarthy's deceptive political tactics to his earliest battles for public office, for instance. During McCarthy's first campaign, for district attorney of Shawano, Wis., he accused the widely respected incumbent of violating local law by continuing his private practice. Although the charge was technically correct, McCarthy — only 27 at the time — deliberately skewed the facts: the D.A. did practice, but not much, and he "made almost no money from it." Joe (as the author calls him throughout the book) lost the election, but his ploy earned him a surprise second-place showing and a host of new followers.

Giblin also provides a detailed account of McCarthy's service in World War II. McCarthy, who after his defeat in the district attorney's race went on to be elected a circuit-court judge, left the bench in 1942 to join the Marines. He served in the Pacific as an intelligence officer for a dive-bomber squadron, yet he embellished his few missions and used the experience to develop his personal aura. "He cajoled the squadron's photographers into taking dramatic pictures of him in his flight uniform," Giblin writes, and used the pictures during his early campaigns for Senate.

McCarthy won election to the Senate in 1946, but his brash and often reckless behavior made him enemies — though this, too, worked to his benefit. In 1950, as a kind of punishment, he was sent to backwater towns to represent the Republican Party at celebrations of Lincoln's birthday. Seeing this as a chance to grab attention, McCarthy gave a speech to a women's Republican club in Wheeling, W.Va., that changed his life and the tenor of the anti-Communism debate. During the speech, McCarthy held up a piece of paper and declared it "a list of names" of employees at the State Department who were known "members of the Communist Party and members of a spy ring" (according to Giblin, the sheet of paper was merely a page from his speech). This was not a new charge, but the national press jumped on it.

Thus McCarthy's anti-Communist offensive began in earnest, as he used his Senate subcommittee position (with Roy Cohn, chief counsel, by his side) to investigate virtually anyone he chose. McCarthy's career ended only when courageous journalists like Edward R. Murrow exposed his tactics on national television; those reports, and the senator's own bullying performance during the Army-McCarthy hearings of 1954, finally alienated the public, and the Senate voted to condemn him.

"The Rise and Fall of Senator Joe McCarthy" draws attention to a particular brand of home-grown demagoguery, the kind that wraps itself in Americanism. If I were a high school teacher concentrating on the postwar era, I would devote a good part of my course to discussing this book for the cautionary tale it tells.

Steven Heller writes the Visuals column for the Book Review.

http://www.nytimes.com/2010/06/20/books/review/Heller3-t.html?ref=booksA Musical Battle Flag, Waved by All Sides

By ANTHONY TOMMASINI

THE NINTH

Beethoven and the World in 1824

By Harvey Sachs

Illustrated. 225 pages. Random House. $26.

For generations Beethoven's Ninth Symphony, with its choral finale espousing universal brotherhood, has been the work of choice to solemnize a peace treaty, open a new concert hall or foster communal bonding. Leonard Bernstein conducted the Ninth at an outdoor concert in Berlin to celebrate the fall of the Berlin Wall. Then again it was conducted profoundly by the great Wilhelm Furtwängler in Nazi Germany, leading orchestras and choruses purged of Jews.

In short, as Harvey Sachs writes in his insightful new book, "The Ninth: Beethoven and the World in 1824," Beethoven's last symphony has been "used as a battle flag by liberals and conservatives, by democrats and autocrats, by Nazis, Communists and anarchists."

Yet, as Mr. Sachs makes clear here, Beethoven's Ninth, whatever ideas and ideals we charge or clutter it with, is also an ingenious composition by a towering master in his transcendent late period, a path-breaking work that defined its cultural era. Mr. Sachs, a historian and critic who is the author of valuable biographies of Toscanini and Rubinstein, convincingly relates the symphony to contemporaneous works by champions of Romanticism in other fields, including Byron, Pushkin, Delacroix, Stendhal and Heine.

"The Ninth" is, coincidentally, Mr. Sachs's ninth book, if you include two he co-wrote. Though relatively slender, this book caused Mr. Sachs more trouble than any other, he writes, because it forced him to think more than ever "about what music means to me and what role so-called high culture played, plays and ought to play in civilization." In putting the symphony in its historical context and analyzing it in detail, Mr. Sachs ranges far, sometimes very far, losing focus in the process, as when he ventures to explain the origins of polyphony in the Middle Ages.

He begins strongly, though, with a vivid depiction of the circumstances surrounding the premiere of the symphony at the Kärntnertor Theater in Vienna on May 7, 1824. He quotes firsthand accounts of Beethoven's disheveled appearance and chaotic home life in an apartment with dirty linen in heaps, grime everywhere and broken coffee cups on tables amid stacks of manuscript paper.

While preparing the premiere of his symphonic hymn to mankind, which sets Schiller's "Ode to Joy" in its finale, Beethoven was abusive to devoted assistants like Anton Schindler, an early biographer. Beethoven,

who essentially sponsored the concert, stood to make or lose a great deal of money. When expenses grew out of control, he blamed poor Schindler, even comparing him to a sewer. “Stopped-up sluices often overflow quite suddenly,” Beethoven wrote in a letter to the ever-patient Schindler. Mr. Sachs is excellent at evoking the musical climate of Vienna in the 1820s. From today’s vantage point, Vienna of old might seem a haven of high culture. The “hard truth,” Mr. Sachs writes, “is that terms such as ‘crossover,’ ‘kitsch’ and ‘dumbing down’ could as easily have been applied to the cultural life of Vienna in Beethoven and Schubert’s day as to that of major cities throughout the Western world in our own.”

The Ninth had its premiere on an ambitious program that included an overture (“The Consecration of the House”) and three sections from the “Missa Solemnis,” Beethoven’s late-period sacred work. This symphony, the longest yet written and the first to include an elaborate choral finale, presented unprecedented technical challenges. The piece was performed by an assembled roster of professional and amateur players and choristers, apparently after just two full rehearsals. It is impossible to imagine that the performance came close to even subpar accounts today.

There was a tumultuous ovation, since Beethoven was a living legend and the sheer impact of this monumental symphony must have been astonishing. One anonymous critic proclaimed that Beethoven, a “son of the gods,” had “brought the holy, life-giving flame directly from heaven.”

More typical, though, was the reaction of a critic who lamented that the finale was overlong and hard to follow, attributing the problem to Beethoven having been robbed of his hearing by cruel fate. I like the blunt assessment of another critic who, noting the difficulty of the vocal parts, wrote, “The singers did what they could.” Mr. Sachs astutely points out that this piece proclaiming all men brothers, an unabashed call for freedom, appeared in the middle of a decade characterized by dynastic repression and ultraconservative nationalism.

Later on, in what is basically a 15-page caveat, he concedes that it is questionable to speculate on the meaning of a musical work. To make his point he throws in some of the more outrageous ideological readings of the piece, like that of the musicologist Susan McClary, who, he writes, “denounced the first movement as an example of ‘horrifyingly violent’ masculine rage.”

Then, caveat ended, he presents his own 30-page detailed, personal description of the work. As someone who describes music in nontechnical terms for a living, I admire Mr. Sachs’s perceptive, often vivid account. I am not sure to whom it is pitched, though, since you can’t follow his descriptions without knowing the music intimately.

The question of the message of the Ninth is unavoidable. I strongly resist those who try to pin specific messages on, say, the late Beethoven piano sonatas. But as Mr. Sachs points out, even in the “non-text-based segments of the symphony’s finale Beethoven all but screams the word ‘MEANING!’ at us.”

Beethoven always said music was a higher calling than philosophy. Yet by this late stage of his life, he had long been cut off from natural social intercourse because of his deafness, isolation and orneriness. His pieces were not expressions of his life; they were his life, Mr. Sachs argues. Reading this book, you feel for the composer, trying to bond with others through an astonishing symphony.

http://www.nytimes.com/2010/06/18/books/18book.html?ref=books

Should Oiled Birds Be Cleaned?
by Nell Greenfieldboyce
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Charlie Riedel/AP

An oiled white ibis lands on an island in Barataria Bay off the coast of Louisiana June 8.

Brian Sharp, an ornithologist who has a private consulting firm in Oregon, says that on the news lately, he has heard wildlife experts in Louisiana talk about their efforts to clean up wild birds that have gotten covered in oil.

"And they're saying, 'Yes, we can save these birds,' and, 'Yeah, we can take care of them,' " Sharp says.

But he seriously doubts it.

Sharp says he believes many of the cleaned birds will simply not survive after being released back to the wild. That's because in the wake of the Exxon Valdez accident, he looked at several species of seabirds affected by oil to see how long they lived after being washed and banded with ID tags.

Based on tags that were later found, Sharp says the majority of rehabilitated birds didn't last long after being released — just days, or weeks.

Birds Impacted By The Spill

Michael Seymour, an ornithologist with the Louisiana Department of Wildlife & Fisheries, talks from Grand Isle beach in Louisiana about some of the bird species affected by the BP oil spill. "Literally every day, we're checking every colony out here to see what the progress of the oil is," he says. Seymour hopes that habitat damage won't be permanent, but says it's difficult to judge how long effects will linger.

Brown pelicans: Only last year did the brown pelican come off the endangered species list, and now it faces trouble once again. "The majority of the birds that we're seeing that are oil-impacted are brown pelicans," Seymour says. Brown pelicans, which are the state bird of Louisiana, fly over the water looking for prey and

plunge headfirst to catch fish. Both diving for fish and swimming through oily waters can cause problems for these birds, says Seymour.

Laughing gulls: Laughing gulls during mating season have a striking red bill and a black head with eyes rimmed in white, according to the National Audubon Society. But all you see of this laughing gull is a layer of black oily muck. Laughing gulls tend to hunt by picking up things off the surface of the water, which is where they can run into problems, Seymour says.

Egrets and herons: These birds feed along the shorelines, beaches and tidal areas. Some herons and egrets are exposed to oil as they wade and hunt food. It sticks to their bellies, legs, chest -- even their neck and head -- as they dunk their faces into the water to grab fish or small crustaceans. Seymour says he's particularly worried about reddish egrets. "Their numbers are declining, and we don't have a whole lot of colonies of them left in the state," he says. "And certainly our colonies aren't very big that we do have."

--Whitney Blair Wyckoff

"When they're released, they're still incapacitated," he says. "They're still sick."

The birds hadn't been just covered in oil — they'd ingested it as they tried to preen. Sharp says he does understand how agonizing it is to see the suffering of oiled birds, and he thinks that if people want to try to clean them, that's their choice.

"Just so that they don't deceive themselves and the public that they're really having great, grand results and saving lots and lots, a high proportion of the birds," Sharp says. "Because it's just the opposite."

Other scientists have come to a similar conclusion. One biologist in Germany recently has been widely quoted as saying that oiled birds should be left alone or euthanized.

Rehabilitation

That bothers Michael Fry, a toxicologist who works at the American Bird Conservancy. Some research doesn't support such a grim view, he says.

"The success at rehabilitation goes all over the map, from like 3 percent of the birds that are brought in, to over 90 percent of the birds that are brought in," Fry says.

Many factors can influence the outcome of a rehabilitation effort, Fry says — everything from the type of oil to the species of bird.

"Loons and grebes, for instance, are very delicate birds when it comes to oil spills," he says. "Gulls are tough birds. Penguins are very tough birds."

He notes that studies of African penguins cleaned after oil spills show that most survive and go on to breed.

Plus, Fry says, studies done years ago may not reflect the success rates that rescuers could have today because modern rehabilitation techniques cause birds less stress, and birds are carefully monitored to make sure they are ready to be released.

"The responders are getting much better at assessing the health of the birds," Fry says.

Little Data

But some scientists say it's not clear how much difference that makes for the birds' survival.

"They are getting better care in captivity," says Dan Anderson, a biologist at the University of California, Davis, who has studied the effect of oil on birds.

Still, he says, "I'd like to see a report, you know, with statistics and everything on how well these newer techniques are working."

About 20 years ago, he and Fry collaborated on a study that used radio tracking to follow brown pelicans in California that had gotten caught in oil spills, and then cleaned up and released.

"There was one bird that made it for 19 years," Anderson says. "But most of the birds didn't even make it through the first six months."

And the survivors didn't seem to breed, at least during two years of tracking. Anderson says he thinks scientists should try to find out if brown pelicans in this latest spill fare any better.

"The question is still under debate, and legitimately so," he says. "Some follow-up work on this oil spill needs to be done."

Workers who clean oiled birds also want to see more research on how the animals do once they are released.

Mark Russell, a project manager with the International Bird Rescue Research Center, says that the Gulf spill seems like "a golden opportunity to find more information out."

But Russell says that in the absence of clear answers, the birds' suffering still demands action.

"Until we know, we have a moral obligation to stay the course and care for these animals," he says, "and we owe it to each individual animal."

Sometimes, Russell says, euthanasia may be the right choice if it looks like there's no chance a bird could return to the wild. But if recovery seems possible, he thinks a bird should get that chance.

http://www.npr.org/templates/story/story.php?storyId=127749940&sc=nl&cc=sh-20100619