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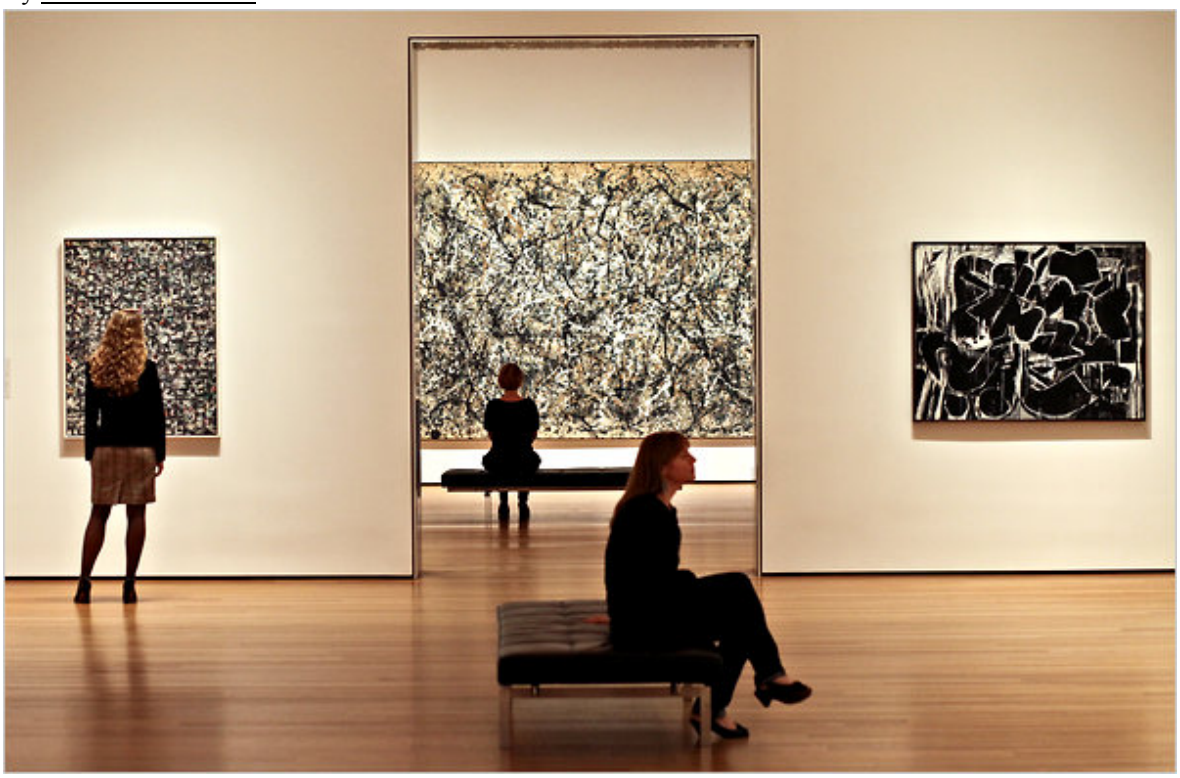
With a Jury of Their Peers
By ROBERTA SMITH



The Museum of Modern Art doesn't mess around with its vaunted permanent collection and core narrative. It may sometimes festoon the atrium or exterior with video projections or set live performers loose in the temporary-exhibition galleries.

It may even declare a brief time out from linearity and big names and let the curators toss around masterpieces like salad, as it did with the "Modern Starts" exhibitions at the turn of this century. And it may rather fatuously pat itself on its back for turning the museum into a "social space," as if art's osmotic, life-changing sociability weren't enough.

But when it comes to the past, the Modern stays the course as only the Modern can, which is magnificently, lavishly, intelligently, if also myopically. Its undeniably splendid landmark exhibition "Abstract Expressionist New York: The Big Picture" is a case in point.

This exhibition digs deep into the bedrock of the first American art style of international stature, formed by a hard-drinking, self-destructive band of mostly brothers who wrested a brave new style from European art, much of it set before them by — who else? — the Museum of Modern Art. The show brings all kinds of rich ore to the surface. And yet, and yet — it also sails into the future as if it were the past, and leaves you wondering if things might have been done a bit differently, with greater flexibility.

The exhibition is part generous show-and-tell and part velvet-gloved manifesto, which says, basically, this is the way we've always done it and always will. To accommodate the installation, the Modern has cleared its fourth-floor permanent-exhibition galleries and put Ann Temkin, chief curator of the department of painting and sculpture, in charge. Ms. Temkin has orchestrated a spacious, often brilliant installation of nearly 100 paintings and some 60 sculptures, drawings, prints and photographs, along with related ephemera, much of

which traces the museum's longstanding support of the style. Everything on view is from the Modern's collection; some of it hasn't been seen in decades.

It should be said that in mounting this show, Ms. Temkin had to work with the hand dealt her by generations of curatorial and trustee decisions and preferences. Especially blatant is the institutional bias against the great Willem de Kooning, represented here by a meager four paintings placed almost at random.

Even so, the show is more a generous retrenchment than an attempted revision. You could say that the nicely ambiguous title has been narrowly interpreted. This is not a survey of New York art in the Abstract Expressionist era; it generally features card-carrying, actively consorting Abstract Expressionists. It is not a bigger picture of the style than has previously been understood: it seems to be mostly about large canvases, spaciously installed in rhythms that, by show's end, start to feel a bit monotonous.

Still, in the face of the show's undeniable legerdemain, the logical first reaction is: what's not to like? Bandying about a few numbers and high points gives a sense of the scope. There is an especially immersive gallery devoted to eight radiantly colored canvases by Mark Rothko, and another nearly as intense, with seven by Barnett Newman, as well as generous pockets of paintings by Arshile Gorky, Adolph Gottlieb, Robert Motherwell, Franz Kline and Philip Guston, whose figurative 1969 "Edge of Town," near the show's exit, designates him as the only artist who got out alive. Attention is given to artists like Bradley Walker Tomlin, Grace Hartigan, Alfred Leslie and Richard Pousette-Dart, whose names may be new to many younger visitors.

Above all, there are 18 works by Jackson Pollock, starting with his snarling "She-Wolf," made in 1943 and acquired the next year. It is the first thing you'll see in the show's astounding opening gallery, where it announces the advent of the style, much the way Picasso's "Demoiselles d'Avignon" does Cubism — with grating, protean aggressiveness.

Hours can be spent in this gallery alone, the show's best by far for the way it mixes things up. Basically it sets six early Pollocks against eight early efforts by Guston, Pousette-Dart, Rothko, Hans Hofmann, Theodoros Stamos and William Baziotes. The gallery is a pitched battle about painting versus drawing, figure-ground versus all-over composition; stained versus impastoed surfaces; mythic versus biomorphic forms; and who dripped first. Pollock chews up the scenery at every turn, never repeating himself, barely painting the same way twice in his pursuit of all-overness.

The valuable curatorial wisdom here is that artists often look better — sharper, fuller — in the company of their peers than in the regal isolation of museum retrospectives. And the peers more than hold up here. Paintings by Pousette-Dart from 1940 and 1943 give "She-Wolf" a run for its money. Rothko's evanescent "Slow Swirl at the Edge of the Sea," with its delicate biomorphic forms twirling on seeping white, does a wonderful tango with the white-cake-icing impasto of Pollock's "Shimmering Substance."

Some things you will see for the first time or as if for the first time.

I never quite noticed the penile positioning of the blue blob in Baziotes's otherwise bright green "Dwarf," a semi-abstract gnome that the Modern acquired in 1947 and that makes a hilarious comment on male posturing, of which the Abstract Expressionist painters knew a thing or two. Nor has Pollock's tiny 1941 "Mask" ever struck me so forcefully as an all-in-one response to 1930s Picasso; it compresses Picasso's minotaur, screaming horses and blush-cheeked Marie-Thérèse into a single bristling head surrounded by basket-weave brushstrokes and starry orbs.

Later on, the staggered yellows, oranges and chartreuses of Rothko's ebullient "No. 1 (Untitled)" from 1948 confirm how magnificent transitional works can be. It looks back to the abbreviated landscapes of Milton

Avery, Rothko's mentor, and forward to the freer stains of Helen Frankenthaler while also plotting Rothko's own maturity.

Lee Krasner's 1951 painting "Number 3 (Untitled)" is a wonderfully refreshing sight, although it made me wish Ms. Temkin had not limited her sculptural selection to five works by David Smith and one smoldering black-on-black relief by Louise Nevelson. The Krasner's woody gray and rose verticals almost cry out for the company of some of Louise Bourgeois's totemic sculptures from the early 1950s, which may be the most innovatively abstract and expressionist of postwar American sculptures.

To see a Bourgeois sculpture requires visiting two smaller related exhibitions on the second and third floors that accompany Ms. Temkin's. Offering a change of pace with cheek-by-jowl installations of smaller works, they have been organized by Jodi Hauptmann, curator of drawings, and Sarah Suzuki, assistant curator of prints and illustrated books. "Ab Ex New York: Ideas Not Theories" delves into the goings-on at the legendary Eighth Street forum, the Club. "Ab Ex New York: Rock Paper Scissors" juxtaposes drawings, prints and objects by a dozen or so sculptors, including Bourgeois, Nevelson and also David Hare, Herbert Ferber, Isamu Noguchi and Richard Lippold. (For the record, the museum's official adoption of the contraction of Ab Ex for Abstract Expressionism is a little like the proverbial watching of the parents smoking marijuana, even in the age of texting.) There are some wonderful moments in these displays: engrossing works on paper galore; a quintet of wire sculptures by Lippold; the muscular wood and rope sculpture, "Totem for All Religions," by Frederick Kiesler; and a 1943 rug of biomorphic design by the painter John Ferren. Its imagery seems right in step with the early Baziotes and Rothko in the first gallery upstairs, as does a striking mosaic, also from 1943, by the painter Jeanne Reynal.

But despite a greater number of unfamiliar names and works, these shows still reinforce the sense of historical correctness that prevails in the big one upstairs. In the end Ms. Temkin's remarkable effort and its flanking shows display in different ways a reluctance to question the linear unspooling of art history according to designated styles that remains the Modern's core value and its Achilles' heel. (There have always been entrance requirements; the only difference is that those of the moment dictate a Conceptual-political pedigree.) You can see that Ms. Temkin had moments of leaning toward greater flexibility. The book accompanying the exhibition reproduces several impressive paintings by underexposed artists that would have made the proceedings feel more surprising and fuzzy around the edges. These include paintings by Romare Bearden, George McNeil, Milton Resnick and a work by Norman Lewis that is more interesting than either of the ones by him in the galleries. Perhaps there could also have been two, rather than one painting each, by Joan Mitchell or Ms. Frankenthaler, and one or two fewer works by Kline, Ad Reinhardt or Gottlieb.

One omission underscores this point: Janet Sobel, a self-taught artist who made and exhibited small drip paintings in New York in the mid-1940s while also working in a peasant-art-flavored figurative style. It is possible that Pollock saw these paintings, of which the Modern own three examples. But does it really matter? These works were a part of Abstract Expressionist New York. They picked up on ideas in the air. If they're good enough to be in the Modern's collection, they should be here. Alfred H. Barr Jr., the Modern's visionary founding director, drew a well-known outline of Modern art movements and famously likened the museum's collection to a torpedo moving through time. The implication was that the collection's involvement with the present is broad, but its back end is increasingly narrow, as superfluous, minor art falls away. But art is not so amenable to outlining, and art movements are really messy, edgeless things that should only become more so with age. Maybe it is time for a new, less militant metaphor. One possibility is a perpetually expanding umbrella, where everything — a historical moment, a museum's reach and our consciousness — only increases.

http://www.nytimes.com/2010/10/01/arts/design/01abex.html?_r=1&ref=design

Architecture Now Building New Names

By ROBIN POGREBIN

On June 24, Polshek Partnership — the prestigious 50-year-old architecture practice responsible for the Clinton presidential library, the Rose Center for Earth and Space at the American Museum of Natural History and the Santa Fe Opera House — disappeared.

Actually, the firm didn't go anywhere. Only the name went away. Its replacement? Ennead.

While the move has surprised many in the design world, it is consistent with a growing trend toward firm names that sound more like video games than architecture practices — H3, Obra, PARA-Project, Indie. "There is a movement away from the spelling out of the usual white male architect at the head of the firm," said Amale Andraos, who is a founder of Work Architecture Company with her husband, Dan Wood, in 2003.

Then there's the New Haven firm MOS. It started with the name !@#? in 2003 before quickly realizing it was unpronounceable and made a Web address impossible. So the partners changed to MOS, which incorporates the first letters of their last names — Michael Meredith and Hilary Sample — and which they liked because it evoked moss and the hip-hop artist Mos Def.

"Once you start an office, you realize it's not about one person," Mr. Meredith said. "What you become responsible for is building a culture rather than doing all the work. It's not really about you."

Emerging practitioners say the new nomenclature signifies a larger rejection of the idea of architect as singular creator and a retreat from the era of the "starchitect" fueled by the prerecession building boom. Anointing celebrity architects was arguably good for business, many practitioners say, but it did not represent the reality that it takes more than one person to design a building. The new names are a reaction against the image of the architect, embodied by Ayn Rand's character in "The Fountainhead," Howard Roark — the

visionary artist against the world. “With critical theory, the single hero Fountainhead leading the charge was really put into question,” Ms. Andraos of Work said. “There is a growing recognition that the principals lead the firm but it’s very much a collective enterprise.”

Others say they are just trying to breathe new life into architecture’s image. “We grew up in a time with so many of these brand-name architects,” said Brian Price, who started PARA-Project with Jonathan Lott in 2005. “There’s a kind of stodginess that’s associated with that — like accountant offices or lawyers — that we didn’t necessarily want to be a part of. We wanted to distance ourselves from a corporate identity that the name connotes.”

Florian Idenburg and Jing Liu tried to have it both ways by calling their Brooklyn firm Solid Objectives — Idenburg Liu.

In the case of the Firm Formerly Known as Polshek, the name change was meant to reflect that James Polshek, its 80-year-old founder, now maintains only a limited role in the practice. The remaining nine partners wanted to more accurately signify their collaborative process. Ennead (pronounced EN-ee-ad), denotes a group of nine deities in Egyptian mythology.

Mr. Polshek — whose firm started as James Stewart Polshek Architect, then became James Stewart Polshek and Associates, then James Stewart Polshek before settling on Polshek Partnership — said he encouraged the transition. “I wasn’t actually the auteur behind everything that came out of the office — how could I be?” he said.

In choosing the new name, the Ennead partners say they looked to models of other collectives, like the graphic design firm Pentagram and the Orpheus Chamber Orchestra, which has no conductor. “It’s very easy to imagine that architects are some solo genius laboring in the studio and that couldn’t be further from the truth of how buildings get made,” said Richard Olcott, one of the partners. “They are made by people working together.”

But some people in the profession see the move as a repudiation of Mr. Polshek’s legacy, and the squandering of a valuable brand. They also wonder what Ennead means and how to pronounce it. “It sounds like a fraternity or something,” said Barry Bergdoll, chief curator of architecture and design at the Museum of Modern Art. “Why did they want to drop Jim Polshek’s name? That seemed to me a kind of risky move. He’s a very respected architect with a very distinguished career and some very, very fine and important buildings.”

Historically, some architecture practices have managed to survive well beyond the demise or departure of their name partners: McKim, Mead & White, for example. People still think of Pei Cobb Freed & Partners as I. M. Pei’s firm, although Mr. Pei retired 20 years ago.

But for other traditionally named firms, the question of succession can be a difficult one, especially in today’s challenging economic marketplace. At Gwathmey Siegel & Associates Architects and Davis Brody Bond Aedas, name partners — Charles Gwathmey and J. Max Bond Jr. — died last year. Both firms are moving forward. Robert Siegel, 71, said: “It’s a game plan I talked about with Charlie when he became ill: ‘Do we continue on as a firm or do we stop?’ ” Mr. Siegel added that he would like to see the firm’s associates become equity partners over the next five years so he can become less primary. “It’s a work in progress,” he said.

In many cases firms have faded away with their stars, and there are few guideposts as to how to prepare for succession. “Every business person I talk to in the world — including the big moguls of industry — has the same conundrum,” the architect Frank Gehry said. “How do you pass on the baton to the next generation? I don’t know what the answer is.” (His firm is called Gehry Partners.)

There are earlier examples of celebrity architects who chose not to name their firms after themselves, like Thom Mayne (Morphosis) and Rem Koolhaas (OMA, or the Office for Metropolitan Architecture), though their firms are known because of them. The notion of a collective dates back to Walter Gropius and the Architects' Collaborative (TAC), which he founded in 1945 with seven younger architects in Cambridge, Mass. Other firms have made their names more neutral, like Hugh Hardy Architects, which became H3 in 2004, or Fox and Fowle, which morphed into FXFowle in 2005.

Mr. Polshek said he had been preparing for his transition out of the firm for years and had seen firsthand the downside of having one name personify a practice. For example, he said, potential clients were sometimes indignant if he wasn't present at project interviews. "They would say, 'Where's Mr. Polshek?' " he said. "You can say he's dead, but he's not. It happened several times. There are jobs we didn't get as a consequence."

But the choice of Ennead, with its emphasis on the number nine, raises a new issue — what to do if a partner leaves, or joins? Susan Rodriguez, one of the partners, says that the firm's name will resonate no matter how many people have an ownership stake. "There's a lot of magic to it — baseball, the nine-square grid," she said, referring to an exercise given to architecture students.

"There are some people who know what it is," Mr. Olcott added in defense of Ennead. "It's a crossword puzzle clue."

http://www.nytimes.com/2010/09/30/arts/design/30name.html?ref=design

Guggenheim to Create Architect-Designed 'Labs'

By CAROL VOGEL
Having an international presence — museums in New York, Venice, Bilbao, Berlin and, in the next few years, Abu Dhabi — has long distinguished the Solomon R. Guggenheim Foundation from the rest of the pack. So has the institution's high-profile architecture, from Frank Lloyd Wright's Fifth Avenue spiral to Frank Gehry's billowing titanium forms in Spain.

But recently the Guggenheim has been looking for ways to extend its global reach even further, without bricks and mortar. In June it began a video biennial in collaboration with YouTube that gives virtually anyone in the world with a video camera and a computer a shot at being included in a museum exhibition. And on Friday it will announce a six-year initiative, sponsored by BMW, in which temporary Guggenheim structures designed by architects will travel the world.

Over the next six years, three 5,000-square-foot BMW Guggenheim Labs will travel, in consecutive cycles, to three locations — one in the United States, one in Europe and one in Asia — spending three months in each place. At every stop, the Guggenheim's curators will invite leaders in the fields of architecture, art, science, design, technology and education to participate in discussions held in and around the structures about the complexities, realities and problems of urban living. Each lab will have a theme, and at the end of each cycle an exhibition at the Solomon R. Guggenheim Museum in New York will present the issues addressed during that lab's travels.

"It's all motivated by the same thing, to make what is on the walls here more compelling," said Richard Armstrong, director of the Solomon R. Guggenheim Foundation. He added that he hoped that program would help the Guggenheim attract new audiences, including in New York, and "engage with architects without collecting more buildings."

Two assistant curators at the Guggenheim — David van der Leer and Maria Nicanor — are in charge of the project; they have already selected Atelier Bow-Wow, the Tokyo-based architects, to design the first lab. It will be installed somewhere in the United States (probably New York City, though museum officials would not confirm that) late next summer. Yoshiharu Tsukamoto, a partner at Atelier Bow-Wow, had little to say about the planned structure in a telephone interview, beyond that it will be collapsible and "will probably be made of some metallic material."
The theme of the first lab will be "Confronting Comfort: The City and You." "We did interviews on the street asking people what it is they love most about the city and what they hate most, and the answer was the same: the people," Mr. van der Leer said.

BMW has associated itself with name-brand art and architecture for years, commissioning artists including Alexander Calder and Jeff Koons to creating "Art Cars" and hiring the London architect Zaha Hadid to design a factory in Germany. Thomas Girst, who is responsible for the company's cultural communications, said it was making "a significant contribution" toward the initiative, although he declined to say exactly how large the investment is.

http://www.nytimes.com/2010/09/30/arts/design/30guggenheim.html?ref=design

What Walls Say in 'Wall Street'

By RUTH LA FERLA

"THIS painting here, I bought it 10 years ago for $60,000. I could sell it today for $600,000. The illusion has become real, and the more real it becomes, the more desperately they want it."

The speaker, Gordon Gekko, is imparting his slippery wisdom to Bud Fox, his ambivalent young protégé. The subject, "Paysage," an outsize Miró canvas, decorates Gekko's office in "Wall Street," the big-screen morality tale that features Michael Douglas as a corporate raider who amasses artworks — Picasso, Nevelson, Dubuffet — like so many Cracker Jack prizes.

In "Wall Street: Money Never Sleeps," a contemporary bookend to Oliver Stone's splashy '80s film, Gekko is still buying and selling illusions. A wizened Satan in winged lapels, he invests in pieces intended to say as much about who he is as do his Savile Row suits.

Which is, of course, the point. "People are so not aware of what they're being fed when they see art in a film," said Fanny Pereire, whose job it was to select the works that hang on the office walls and in the private digs of the "Wall Street" protagonists. They are, she said, "as important as the costumes — they tell part of the story," delineating character in bold strokes and, as significantly, tapping into the cultural climate. Displayed flamboyantly or lurking in the shadows, those works (or their reproductions) are as essential in establishing the movie's tone as are the repeated references in the dialogue to "morals hazards," "bubbles" and "C.D.O.'s."

Guiding a visitor though the Sonnabend Gallery in Chelsea, which lent artworks for the film, Ms. Pereire pointed out that the sumptuous trappings of "Money Never Sleeps" reflect the subtle shift in values born on the eve of financial collapse.

"There was a time," Ms. Pereire said, "when some people felt that at every dinner party, they had to have something different hanging on their wall." Unwanted pieces were relegated to storage. Today such acquisitions are more likely to stay put, destined to survive both market fluctuations and the vagaries of style. Less breathlessly hip than the works on display in the original "Wall Street," they are often just as grand.

"In the '80s there was a blind, aggressive sense of acquisition," said Edward Pressman, a producer on both films. People were buying without bounds, their artworks very showy." In 2008, when the action in the sequel takes place, "the money is exponentially larger in scale," Mr. Pressman said. "The people of this universe have grown kind of used to their fortunes. They are more confident." Flush with a sense of entitlement, "they have discovered new ways of showing it," he said. Their investments are, accordingly, "more historically significant and probably much more valuable."

The cyclone-like wire sculpture that dominates Gekko's London office, without blocking his epic view of the Thames, is a case in point. That piece, by Antony Gormley, considered a successor in stature to Henry Moore, suggests "transparency," Ms. Pereire said. It hints that the character has been chastened but not beaten by his eight-year prison stint, that he has gained a clarity that lets him maneuver ever more nimbly between the boardrooms of London and New York.

That's a lot to hang on a single work. But using art to explore such emotional and cultural nuances is Ms. Pereire's job — and something of a mission. A New Yorker, she cultivated a lynx eye for cultural relevance by visiting private collections and fairs and developing relationships with the art world's power brokers. "I understand who buys what and why," she said. The film's heroes and heavies, she added, are a "composite of people I know."

Her choices have also been colored by the director's private obsessions. "Oliver is a collector, very particular in every detail," she said of Mr. Stone, who has owned works by Julian Schnabel and Jean-Michel Basquiat, and invests in contemporary Chinese art.

Like the director, Ms. Pereire, who has been a consultant on films like "Michael Clayton" and "Revolutionary Road," likes to share her expertise with the cast. At the outset of filming, "I get the scripts like everyone else," she said. "I make books for the actors, complete with the works and bios of the artists."

SHE hopes to impart the sense of art as a metaphor. "Even if they are not conscious of it, that's what the characters are buying," she said. A Clifford Ross photograph of churning waves hangs in the home of Bretton James, played by Josh Brolin. It suggests "the force of turmoil," she said. Richard Prince's "Untitled (Cowboy)" (1999), stands in, none too subtly, for "James's role as the big honcho, the financial cowboy. He has the house to show for it and the art that goes with it."

Central to James's collection — and to Mr. Stone's efforts to invest his characters with mythic dimensions — is a Goya depiction of "Saturn Devouring His Son," which looms like an impending tempest in his den, hinting darkly that to stand in his way is to risk being consumed.

Training a lens on that work is an obvious way of pointing up James's exalted position, lending a gravitas to his character and, not less, to the film. As Mr. Pressman, the producer, likes to joke, "It's the only Goya not in the Prado."

http://www.nytimes.com/2010/09/30/fashion/30wall.html?ref=design

When Life Gets in the Way of Art

By RANDY KENNEDY

The photographs of Ernest C. Withers — of the Little Rock integration battle, of the Emmett Till murder trial, of the aftermath of the assassination of the Rev. Dr. Martin Luther King Jr. — are among the most powerful records of the civil rights movement. They have lived on in dozens of books and museum collections.

But would these images be seen differently if the captions noted that Mr. Withers was known in some circles not by his name but by an Orwellian cipher, ME 338-R — the code used by the F.B.I. to identify him in the reports he filed for many years as a paid informer?

The revelation that he spied on the very leaders who gave him unequaled access to the movement's inner workings, published this month by The Commercial Appeal in Memphis after a two-year investigation, has shocked many friends and admirers of Withers. He died in 2007 after a long, distinguished career that also included taking important images of Negro League baseball and of the pioneers of the blues.

But beyond issues of personal betrayal, the news raised much more difficult and fundamental questions — ones central to photography and documentary work but to the history of art and popular culture as well — about artistic intent, about the assumptions and expectations of the viewing public and about the relationship between artists and their work.

There has been no shortage of reminders recently about the rockiness of this terrain. In July, word came that the painter Larry Rivers — no paragon of virtue, but generally seen as a kind of genial playboy of the New York School — had pressured his two adolescent daughters into appearing in films and videos in which the girls were naked or topless, interviewed by their father about their developing breasts.

This news cast a shadow over perceptions of his work, but should it, any more than Picasso's deep misogyny or Caravaggio's murderous temper has over theirs? Any more than T. S. Eliot's anti-Semitism or Rimbaud's probable connection to the African slave trade has over their poetry?

Or in an example with closer parallels to Withers, should we think "On the Waterfront" a lesser movie, or even see it in a different light, because it was directed and written by two men, Elia Kazan and Budd Schulberg, who named names before the House Un-American Activities Committee?

On a comic, or maybe tragicomic, level the issue of deception and critical reception was also raised recently by "I'm Still Here," the movie held out by its director, Casey Affleck, as a documentary of the unsightly celebrity disintegration of the actor Joaquin Phoenix, who is seen snorting drugs, abusing underlings and doing other things most people suspect all celebrities do.

Prompted in part by its disappointing debut at the box office, both Mr. Affleck and Mr. Phoenix confessed last week that it was all an act, an attempt to explore celebrity and media and the mutually abusive relationship the two have long had, with the public as their codependent child.

As a documentary — one in which uncertainty about its veracity or at least discomfort about its supposed honesty was meant to supply most of the energy and seemed to be, in fact, the motivating idea — the movie received generally horrible reviews.

Now that the switch has been flipped, and Mr. Phoenix's crackup will be viewed as pure performance, the movie could become less interesting because it is less real. Or, perhaps, more interesting, because the destructive lengths both men went to in service of their critique has now been revealed.

The movie actually performed better in its second week of release, after the confession, than it did in its first. Part of that was undoubtedly due to the publicity, but maybe authorial intent, as scrambled as an egg in this case, doesn't count for much after all, as it shouldn't count in judging Withers's work.

Mr. Affleck, appropriately, enlisted the words of Picasso in his defense: "Art is the lie that tells the truth."

In one sense, there is no question in Withers's photography that he was telling the truth and that the way he told it helped propel the movement he was documenting. As a lifelong Tennessean whose great-great-grandfather had been lynched and who was beaten by the police while covering the funeral of Medgar Evers, he had experienced the oppression of the South as fully as many of its black residents. And his best-known pictures — one of a crowd of black strikers in 1968 all bearing boldfaced signs proclaiming "I Am a Man" — were powerful indictments of that oppression.
But now there are lots of questions: how could he make such pictures while at the same time selling information he knew might hurt or at least hinder those fighting to end the oppression? Were there pictures he could have taken or published but didn't because of it? Perhaps he kept the two lives somehow separate, a much more difficult idea to accept when thinking about the work of socially engaged artists.

"I think that we hope they'll be the pure expression of that inner voice that most of us have that wants to better the world," said Deborah Willis, chairwoman of the department of photography and imaging at New York University and an expert on the history of African-American photography. "But life is complex."

Ms. Willis, who knew Withers for more than two decades and considered him a mentor, said that even if the many open questions about his involvement with the F.B.I. are answered to his detriment, "the photographs, I believe, will prevail; it doesn't change the images."

Brett Abbott, the curator of an exhibition now on view at the J. Paul Getty Museum in Los Angeles, "Engaged Observers: Documentary Photography Since the Sixties," said the revelations might prompt some scholars to sift back through the entire body of Withers's work to re-evaluate it in light of his work as an informer.

But he cautioned that even when dealing with art whose intentions appear to be relatively straightforward — as some documentary photography and film can, seeking to right a wrong, further a cause, stop a war — it is always "treading on dangerous ground" to try to locate the value of the work in the life of the artist or in his sense of morality.

"The 'I Am a Man' image is one of the enduring images of the civil rights movement," he said. "And when you're dealing with icons, it may not matter all that much what the biographical context of the person making that image was. Pictures like that take on a life of their own."

Withers, whose work will soon be enshrined in a museum named after him on Beale Street in Memphis, is no longer around to speak for himself. But many other photographers and activists whose work helped define the civil rights movement are, and several have spoken up in his defense. Bruce Davidson, who documented the struggles in the South for four years, beginning with the Freedom Rides in 1961, said in an interview that even photographers who think they understand their motivations often end up having to separate them from their work.

"I once took a picture in 1962 of a very poor black girl in Shelby County, Tennessee, holding a big white doll," said Mr. Davidson, who is white. "And I didn't publish it for many years even though it was a powerful image and something I thought told the story. I didn't put the doll there. I didn't even say to the little girl, 'Can you hold it a little higher?' It was a true moment, but I didn't know if people would believe it because it almost seemed too good to be true. And then a lot of years passed until it almost seemed like something someone else had taken. And that's when I finally put it out, because then the time was right."

http://www.nytimes.com/2010/09/26/weekinreview/26kennedy.html?ref=design

Abstract Meditations

By CAROL VOGEL

A 15-foot-long abstract etching was hanging on a wall in Julie Mehretu's sun-filled Chelsea studio last week. A combination of delicate markings reminiscent of Chinese calligraphy, scribbles that vaguely resemble Cy Twombly canvases and bolder architectural shapes, it is to be the centerpiece of "Notations After the Ring," an exhibition at the Metropolitan Opera's Gallery Met, the four-year-old lobby exhibition space.

The show is opening on Tuesday, the day after the premiere of "Das Rheingold," the first installment of the director Robert Lepage's new production of the "Ring" cycle. A solo exhibition will accompany each of the four operas in the cycle.

What hung in the studio was a proof of the final etching, minus a grid that divides the finished composition into 12 equal parts, a gesture that the artist said was intended as a kind of pacing not unlike a musical composition. Called "Auguries," the work grew out of the visual language she explored in a suite of six paintings that make up "Grey Area," a show on view at the Guggenheim Museum in New York through Oct. 6.

"I had just finished those big paintings," Ms. Mehretu said, "and after a project like that I usually do a group of drawings or prints."

So when she was approached by Dodie Kazanjian, the Gallery Met's director, to create work pegged to "Das Rheingold," Ms. Mehretu said, the challenge intrigued her because "when I'm working I am usually listening to music, and I have always been interested in the juxtaposition of looking at images and listening."

The Wagner epic also reminded her of Berlin, where she has been living on and off since a residency at the American Academy there in 2007 and where she has enjoyed going to the opera.

Ms. Kazanjian said she had thought Ms. Mehretu would be the right artist to pair with the first "Ring" opera because "Julie's work is symphonic and continuous in the same way as Wagner's is." She added that Ms. Mehretu's "layered compositions — sometimes as many as four, five or more layers laid on top of one another — give the work great complexity and depth."

In addition to the abstract etching, the show will include nine black-and-white drawings — graphite on paper — that are abstract in composition. "There are always lessons I learn from paintings and images I want to pull out from them and take further," Ms. Mehretu said.

She has also been working on a large painting based on the facade of the 19th-century Bayreuth opera house in Germany, which was designed to Wagner's specifications expressly for his operas. The canvas, which is layered as a kind of visual kaleidoscope, depicts the building as though it were in motion, folding in and out of itself. "It records many of the architectural changes that happened and ones that didn't," Ms. Mehretu said.

Operagoers will be able to see that painting not in the show but at the top of the majestic staircase on the Met's grand tier level.

CHRISTIE'S TO SELL

Shorenstein Collection

The San Francisco real estate mogul Walter H. Shorenstein and his wife, Phyllis, were of a generation whose tastes veered toward pretty Impressionist paintings. Mr. Shorenstein, who died in June at 95, was well known as a Democratic Party fund-raiser, and his wife, who died in 1994, was a passionate advocate of Asian art, not only as a collector but also as a founder of the city's Asian Art Museum, which opened in Golden Gate Park in 1966.

Starting in November, their family will be selling more than 170 paintings and decorative objects from the couple's estate at Christie's in New York and Hong Kong. The collection is expected to bring more than $24 million.

"The combination of Impressionist paintings and Asian art is an unusual one," said Conor Jordan, head of Christie's Impressionist and modern art department in New York, who explained that the couple bought most of their paintings from blue-chip galleries in New York and Paris.

Among the best of them is Caillebotte's "Seine à Argenteuil," a sun-drenched scene of racing boats on the Seine from 1882. Estimated at $5 million to $7 million, it will go on the block Nov. 3 in Christie's Impressionist and modern art auction. So will a portrait of three of Pissarro's children in the family garden, a canvas that he painted in 1892 and that is expected to fetch $3 million to $4 million. There is also an early landscape by Seurat from 1882 that is expected to bring $1.8 million to $2.5 million and will be sold alongside four drawings and one painting from another seller. While Mr. Jordan would not say where they are coming from, experts familiar with the works say they belong to the Paris collector André Bromberg.

"Seraut died when he was only 31," Mr. Jordan said. "So when good things by the artist come up, they are eagerly pursued."

TEAM FOR CARNEGIE SHOW

Lynn Zelevansky, the new director of the Carnegie Museum of Art in Pittsburgh, has decided that three heads are better than one. In planning the 56th Carnegie International, its survey of contemporary art, which takes place every few years, she has put together a team of three to organize it: Daniel Baumann, an independent curator in Basel, Switzerland; Dan Byers, an associate curator at the Carnegie; and Tina Kukielski, a former senior curatorial assistant at the Whitney Museum of American Art who will go to the Carnegie as a temporary associate curator and stay for the run of the exhibition.

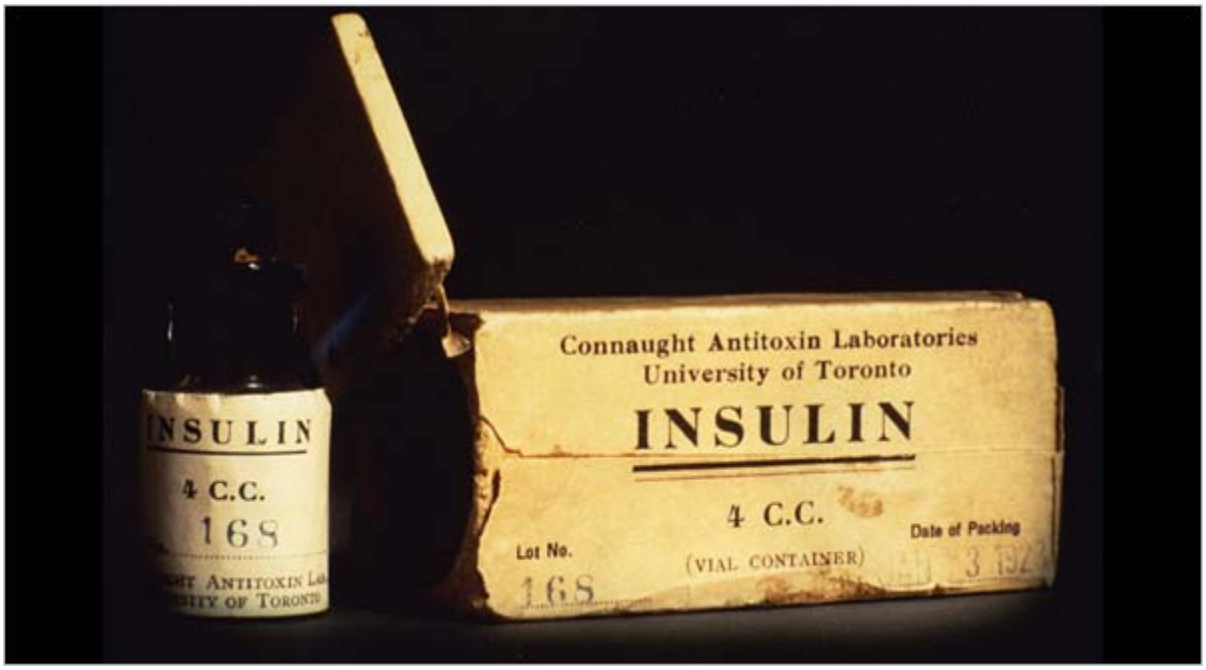
"I was reacting against the idea of a single voice," Ms. Zelevansky said. "A collaborative approach seems more appropriate, yet I wanted to have someone from the museum to anchor it."

The show, which is to open in 2013, has been moved to October from May, and the space between this Carnegie International and the last one will be five years instead of four. "Because I was new, I wanted to have a little extra breathing room," said Ms. Zelevansky, who started at the Carnegie last year.

Although it is too early to announce the artists or other details of the show, she did say that she hoped to use other spaces around the city so that there would still be room at the museum to show off its own collections.

http://www.nytimes.com/2010/09/24/arts/design/24vogel.html?ref=design

Rediscovering the First Miracle Drug
By ABIGAIL ZUGER, M.D.



Every few months some miracle drug or other is rolled out with bells and confetti, but only once or twice in a generation does the real thing come along.

These are the blockbuster medications that can virtually raise the dead, and while the debuts of some, like the AIDS drugs, are still fresh in memory, the birth of the first one is almost forgotten. It was injectable insulin, long sought by researchers all over the world and finally isolated in 1921 by a team of squabbling Canadians. With insulin, dying children laughed and played again, as parents wept and doctors spoke of biblical resurrections.

Visitors to a new exhibition opening Tuesday at the New-York Historical Society will find a story made particularly vivid by dramatic visuals, for insulin's miracle was more than a matter of better blood tests. As in Ezekiel's vision of the dry bones, it actually put flesh on living skeletons.

But the miracle went only so far: insulin was not a cure. In 1921, New York City's death rate from diabetes was estimated to be the highest in the country, and today the health department lists diabetes among the city's top five killers. Now though, it is adults who die, not children. What insulin did was turn a brief, deadly illness into a long, chronic struggle, and both the exhibit and the book, "Breakthrough," by Thea Cooper and Arthur Ainsberg, on which it is based highlight the complicated questions that inevitably follow medical miracles: Who will get the drug first? Who will pay for it? Who will make enough for everyone? And, of course, who will reward its developers as they feel they deserve?

In the first decades of the 20th century, half a dozen different research groups were hot on the trail of insulin, a hormone manufactured in the pancreas but difficult to separate out from the digestive enzymes also made there.

Without insulin the body is unable to use glucose, its primary fuel. Most diabetic children lack insulin completely, while adults with so-called Type 2 diabetes often associated with obesity are resistant to the

hormone's action. Either way, sugar and starch in the diabetic's diet turn into poison, clogging the bloodstream with unusable glucose: the glucose is eliminated in sweet-tasting urine as the body's cells literally starve in the midst of plenty. Insulin-deficient patients are both thirsty and ravenous, but the more they eat, the faster they waste away.

Before insulin was available, doctors understood enough of this sequence to cobble together a stopgap treatment: diabetics were put on salad- and egg-based diets devoid of sugar and starch, with only the minimum number of calories needed to survive. Already thin, these patients became skeletal, but the excess glucose disappeared from their blood and urine, and they survived far longer than untreated contemporaries.

Dr. Elliott Joslin, whose Boston clinic was and remains a renowned diabetes center, recalled that before insulin one of his dieting patients was "just about the weight of her bones and a human soul."

The other great authority on diet therapy was New York's Dr. Frederick Allen, now long forgotten, who founded a residential hospital for diabetics, first on East 51st Street in Manhattan, and then in rural New Jersey.

It was to Dr. Allen that the eminent American jurist and Supreme Court justice Charles Evans Hughes turned when his daughter Elizabeth was diagnosed with diabetes in 1919, at age 11.

Elizabeth Hughes was a cheerful, pretty little girl, five feet tall, with straight brown hair and a consuming interest in birds. On Dr. Allen's diet her weight fell to 65 pounds, then 52 pounds, and then, after an episode of diarrhea that almost killed her in the spring of 1922, 45 pounds. By then she had survived three years, far longer than expected. And then her mother heard the news: insulin had finally been isolated in Canada.

The unlikely hero was Frederick Banting, an awkward Ontario farmboy who graduated from medical school without distinction, was wounded in World War I, then more or less forced himself into a laboratory at the University of Toronto with an idea of how to get at the elusive substance. Over the miserably hot summer of 1921 Dr. Banting and his assistant Charles Best experimented on diabetic dogs, with only limited success until finally dog No. 92, a yellow collie, jumped off the table after an injection and began to wag her tail.

Meanwhile, Dr. Banting's mentor and lab director, Dr. John J. R. Macleod, was summering in Scotland.

Dr. Banting never forgave Dr. Macleod for arriving back in the autumn, rested and refreshed, and taking over. His bitter hostility lasted years, long after the Nobel Prize ceremony in 1923 which Dr. Banting refused to attend, for although he shared the physiology prize with Dr. Macleod, he would not share a podium.

Meanwhile, mothers all over the globe were writing him heart-wrenching letters: "My dear Dr. Banting: I am very anxious to know more of your discovery," wrote one, going on to describe her daughter's case: "She is pitifully depleted and reduced."

That was from Elizabeth Hughes's mother, Antoinette. Charles Evans Hughes had by that time temporarily left the Supreme Court, and was serving as secretary of state in President Warren G. Harding's administration. Dr. Banting, unimpressed, replied no, sorry, no insulin available — for, in fact, the team was having difficulty making enough for more than a handful of patients.

And then a few weeks later, Dr. Banting changed his mind.

Presumably higher powers had intervened, or perhaps Justice Hughes himself — a rigid, unsmiling man whom Theodore Roosevelt had nicknamed "the bearded iceberg" — had pulled strings. Either way, Elizabeth traveled posthaste to Toronto and the lifesaving injections.

It was the end of her journey, but only the beginning for many children without her connections, who had to wait while the Canadians fought bitterly with each other over how to fairly distribute their tiny amounts of the lifesaving substance.

Dr. Banting wound up giving one of his colleagues a black eye before it was all over, and Eli J. Lilly and Company, the Indianapolis pharmaceutical firm, won the right to mass-produce insulin. It was the first partnership negotiated among academia, individual physicians and the pharmaceutical industry.

When the first combinations of AIDS drugs proved to save lives in just the same seemingly miraculous way, Dr. Kent Sepkowitz, an infectious disease expert at Memorial Sloan-Kettering Cancer Center in New York, was moved to look up the old literature on the discovery of insulin and found many parallels between the two eras. "In some sense, the breakthrough is the easy part," he said. "Then the real work begins."

For both insulin and the AIDS drugs the big challenge was "getting it from here to there," Dr. Sepkowitz said. The expense and logistics of large-scale insulin manufacture were initially daunting. But soon trainloads of frozen cattle and pig pancreas from the giant Chicago slaughterhouses began to arrive at Lilly's plant. By 1932 the drug's price had fallen by 90 percent.

Meanwhile, the notion of allowing patients to test their own urine for glucose and calculate their own insulin doses was outlandish to most doctors. Diabetes was the first illness which forced them to cede some medical authority to the patient, said Jean Ashton, one of the exhibit's curators. With insulin, diabetics suddenly acquired both the right and the responsibility to maintain their own health.

Some of the children who were early recipients of insulin became diabetes advocates, speaking out for patients' rights well into their old age. But not Elizabeth Hughes: she ran in the other direction, far from the headlines that briefly made her the most famous diabetic child in the United States. Although she received an estimated 42,000 insulin shots before she died in 1981 at the age of 74, she systematically destroyed most of the material documenting her illness, expunged all references to diabetes from her father's papers, and occasionally even denied she had been ill as a child.

Ms. Cooper, a writer, and Mr. Ainsberg, a Wall Street executive and amateur historian, show no compunction in making her the focus of their story anyway, creating dialogue for her, and even imagining a few pivotal scenes of which there is no historical record. But Elizabeth forms only a small part of the exhibit, and a viewer suspects this is exactly what she would have preferred. The few dozen of her letters that survive from her six-month stay in Toronto, as she exuberantly regained health and strength, emphasize how desperately she wanted to stop being a patient forever.

It was a great day when she injected herself with insulin for the first time: "I can do it perfectly beautifully," she wrote to her mother. "Now I feel so absolutely independent."

The exhibition "Breakthrough: The Dramatic Story of the Discovery of Insulin" opens on Tuesday at the New-York Historical Society, 2 West 77th Street, New York, and continues through Jan. 31, 2011.

http://www.nytimes.com/2010/10/05/health/05insulin.html?nl=health&emc=healthupdateema2

Neurofeedback Gains Popularity and Lab Attention

By KATHERINE ELLISON

You sit in a chair, facing a computer screen, while a clinician sticks electrodes to your scalp with a viscous goop that takes days to wash out of your hair. Wires from the sensors connect to a computer programmed to respond to your brain's activity.

Try to relax and focus. If your brain behaves as desired, you'll be encouraged with soothing sounds and visual treats, like images of exploding stars or a flowering field. If not, you'll get silence, a darkening screen and wilting flora.

This is neurofeedback, a kind of biofeedback for the brain, which practitioners say can address a host of neurological ills — among them attention deficit hyperactivity disorder, autism, depression and anxiety — by allowing patients to alter their own brain waves through practice and repetition.

The procedure is controversial, expensive and time-consuming. An average course of treatment, with at least 30 sessions, can cost $3,000 or more, and few health insurers will pay for it. Still, it appears to be growing in popularity.

Cynthia Kerson, executive director of the International Society for Neurofeedback and Research, an advocacy group for practitioners, estimates that 7,500 mental health professionals in the United States now offer neurofeedback and that more than 100,000 Americans have tried it over the past decade.

The treatment is also gaining attention from mainstream researchers, including some former skeptics. The National Institute of Mental Health recently sponsored its first study of neurofeedback for A.D.H.D.: a randomized, controlled trial of 36 subjects.

The results are to be announced Oct. 26 at the annual meeting of the American Academy of Child and Adolescent Psychiatry. In an interview in the summer, the study's director, Dr. L. Eugene Arnold, an emeritus

professor of psychiatry at Ohio State, noted that there had been "quite a bit of improvement" in many of the children's behavior, as reported by parents and teachers.

Dr. Arnold said that if the results bore out that neurofeedback was making the difference, he would seek financing for a broader study, with as many as 100 subjects.

John Kounios, a professor of psychology at Drexel University, published a small study in 2007 suggesting that the treatment speeded cognitive processing in elderly people. "There's no question that neurofeedback works, that people can change brain activity," he said. "The big questions we still haven't answered are precisely how it works and how it can be harnessed to treat disorders."

Russell A. Barkley, a professor of psychiatry at the Medical University of South Carolina and a leading authority on attention problems, has long dismissed claims that neurofeedback can help. But Dr. Barkley says he was persuaded to take another look after Dutch scientists published an analysis of recent international studies finding significant reductions in impulsiveness and inattention.

Still, Dr. Barkley cautioned that he had yet to see credible evidence confirming claims that such benefits can be long lasting, much less permanent.

And another mainstream expert is much more disapproving. William E. Pelham Jr., director of the Center for Children and Families at Florida International University, called neurofeedback "crackpot charlatanism." He warned that exaggerated claims for it might lead parents to favor it over proven options like behavioral therapy and medication.

Neurofeedback was developed in the 1960s and '70s, with American researchers leading the way. In 1968, M. Barry Sterman, a neuroscientist at the University of California, Los Angeles, reported that the training helped cats resist epileptic seizures. Dr. Sterman and others later claimed to have achieved similar benefits with humans.

The findings prompted a boomlet of interest in which clinicians of varying degrees of respectability jumped into the field, making many unsupported claims about seeming miracle cures and tainting the treatment's reputation among academic experts. Meanwhile, researchers in Germany and the Netherlands continued to explore neurofeedback's potential benefits.

A major attraction of the technique is the hope that it can help patients avoid drugs, which often have side effects. Instead, patients practice routines that seem more like exercising a muscle.

Brain cells communicate with one another, in part, through a constant storm of electrical impulses. Their patterns show up on an electroencephalogram, or EEG, as brain waves with different frequencies.

Neurofeedback practitioners say people have problems when their brain wave frequencies aren't suited for the task at hand, or when parts of the brain aren't communicating adequately with other parts. These issues, they say, can be represented on a "brain map," the initial EEG readings that serve as a guide for treatment. Subsequently, a clinician will help a patient learn to slow down or speed up those brain waves, through a process known as operant conditioning. The brain begins by generating fairly random patterns, while the computer software responds with encouragement whenever the activity meets the target.

Dr. Norman Doidge, a psychiatrist at the Center for Psychoanalytic Training and Research at Columbia and the author of "The Brain That Changes Itself" (Viking, 2007), said he considered neurofeedback "a powerful stabilizer of the brain." Practitioners make even more enthusiastic claims. Robert Coben, a neuropsychologist

in Massapequa Park, N.Y., said he had treated more than 1,000 autistic children over the past seven years and had conducted a clinical study, finding striking reductions in symptoms, as reported by parents.

Maureen and Terrence Magagnos of Lynbrook, N.Y., took their 7-year-old son, Peter, to Dr. Coben after he was given a diagnosis of pervasive developmental disorder in first grade. “He had classic symptoms of autism,” said Mr. Magagnos. “His speech was terrible, he made very little eye contact and he screamed for attention — literally screamed.”

Their exceptionally generous insurance covered neurofeedback, so they decided to give it a try, with sessions twice a week for the next five years.

At the start of the treatment, Dr. Coben said, he discovered that Peter had been suffering tiny, asymptomatic seizures. He says neurofeedback helped stabilize the child’s brain activity, eliminating the seizures. And within three months, said Mr. Magagnos, a retired police officer, Peter’s teachers were calling to report remarkable improvements.

“Today I’d say he has ‘autism light,’ ” he added. “He still has some symptoms, but he is much more manageable.”

Whether such results can be achieved with other children is a matter of debate. Still, as practitioners lobby for broader acceptance, including insurance recognition, a sure sign of neurofeedback’s increasing popularity is the number of companies selling supposedly mind-altering systems to use at home.

With names like SmartBrain Technologies and the Learning Curve Inc., they offer equipment purported, respectively, to “pump the neurons” and “make lasting changes in attention, memory, mood, control, pain, sleep and more.”

The Food and Drug Administration regulates all biofeedback equipment as medical devices. The only approved use, however, is for “relaxation.” Peter Freer, a former grade-school teacher who is chief executive of a North Carolina firm called Unique Logic and Technology, says that since he began his business in 1994, he has sold several thousand of his “Play Attention” systems, advertised to improve a child’s focus, behavior, academic performance and social behavior.

The equipment, which costs $1,800, is advertised as “a sophisticated advancement of neurofeedback.” Mr. Freer says his clients include more than 600 school districts. (He adds that his system, as distinct from “clinical” neurofeedback, aims not to change brain waves but rather to put the user in an “attentive state” that makes it easier to learn skills.) Neurofeedback in general is a largely unregulated, with practitioners often devising their own protocols about where on the scalp to place electrodes. Results vary widely, and researchers caution that it is extremely important to choose one’s practitioner with care.

When it comes to to the actual devices, Dr. Kerson, at the International Society for Neurofeedback and Research, cautioned that they should never be used without experienced supervision.

“Oftentimes what people do is find a way to get one of these machines on eBay and use it at home,” she said, adding that unskilled use could interfere with medications or prompt an anxiety attack or a seizure. “Neurofeedback is a powerful therapy,” she said, “and should be treated that way.”

http://www.nytimes.com/2010/10/05/health/05neurofeedback.html?ref=health

Awareness: Killer of 200,000 Americans, Hardly Noticed

By RONI CARYN RABIN

Sepsis causes more than 200,000 deaths in the United States each year, yet Americans know little about it: most people questioned online for a new study said they had never heard the term.

The illness develops when the immune system's response to an infection spins out of control, causing severe injury to other organs in the body. Early symptoms may include chills, confusion, abnormal body temperature, rapid heart rate, low blood pressure and rash; a quick diagnosis is critical to preventing deaths.

The new study, of 1,000 Americans 18 and older questioned in late August and early September, found that 3 out of 5 were not familiar with the term. Among older adults, who are at higher risk, the percentage was even higher.

The study, commissioned by the Feinstein Institute for Medical Research, part of the North Shore-Long Island Jewish Health System, was carried out by APCO Insight, an international research firm, and released last week.

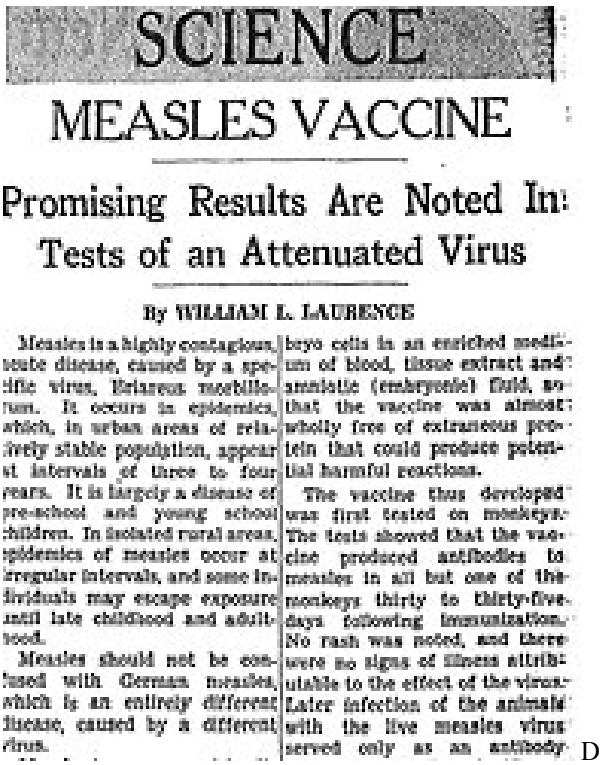
Raising awareness is critical to reducing the number of sepsis deaths, said Dr. Kevin J. Tracey, the institute's president. People should be able to identify the very early signs of the illness, just as they have learned to be vigilant for symptoms of a heart attack.

"If someone has an infection on the arm or leg, and then develops a fever, or starts to feel sick all over," he said, "someone should say, 'I'm concerned about sepsis.' "

http://www.nytimes.com/2010/10/05/health/research/05awareness.html?ref=research

Measles Vaccine, 1960

By NICHOLAS BAKALAR



SCIENCE

MEASLES VACCINE

Promising Results Are Noted In Tests of an Attenuated Virus

By WILLIAM L. LAURENCE

Measles is a highly contagious, acute disease, caused by a specific virus, Briarcus morbillorum. It occurs in epidemics, which, in urban areas of relatively stable population, appear at intervals of three to four years. It is largely a disease of pre-school and young school children. In isolated rural areas, epidemics of measles occur at irregular intervals, and some individuals may escape exposure until late childhood and adulthood.

Measles should not be confused with German measles, which is an entirely different disease, caused by a different virus.

beyo cells in an enriched medium of blood, tissue extract and amniotic (embryonic) fluid, so that the vaccine was almost wholly free of extraneous protein that could produce potential harmful reactions.

The vaccine thus developed was first tested on monkeys. The tests showed that the vaccine produced antibodies to measles in all but one of the monkeys thirty to thirty-five days following immunization. No rash was noted, and there were no signs of illness attributable to the effect of the virus. Later infection of the animals with the live measles virus served only as an antibody

D

The first scientific description of measles dates from the ninth century, and the disease was first mentioned in The New-York Daily Times on Oct. 14, 1851, when the newspaper was not yet one month old.

A front-page “Weekly Report of Deaths” that day noted that the disease had killed two people in Brooklyn. Other front-page news on Oct. 14: A man tied his foot to a hot-air balloon and dangled above the streets of Paris. (Parisians, apparently easier to impress than they are today, were “tickled with each repetition of the spectacle.”)

The first measles preventive mentioned in The Times, on Feb. 10, 1924, was an account of the advice of one Dr. William H. Park, who had concluded that if one member of a family contracted the disease, it could be prevented in the rest “by injecting into the veins a few drops of blood taken from any other convalescent person within six days after recovery.”

The Times reported no evidence that the procedure worked, but on May 14, 1944, in a “Science in Review” roundup, Waldemar Kaempffert wrote that researchers had found a “new weapon against measles,” gamma globulin, a blood protein that contains antibodies and is still used today in the treatment of some diseases. A small study “at a girls’ college in the East,” the report said, demonstrated that injections of the substance could prevent the disease.

Gamma globulin became widely used, but it was only partly effective. On Nov. 29, 1958, The Times reported that there were 410 measles deaths the previous year, nearly twice the number caused by polio. “The Salk polio vaccine was largely responsible,” the Associated Press dispatch said. “There is no measles vaccine.”

But there would be one soon. On Oct. 4, 1960, The Times reported that a vaccine developed by Dr. John F. Enders of Harvard and colleagues, using the measles virus itself, was being tested in New York City. With what today would appear as serene indifference, the reporter wrote that it was being given to 1,500 "retarded children" at the Willowbrook School on Staten Island, in addition to 4,000 children in Nigeria, where the disease was epidemic.

By Sept. 17, 1961, The Times was ready to announce that the vaccine had "proved itself 100 per cent effective" in preventing measles and hailed Dr. Enders's "triumph" as "one of the great achievements of medicine."

In a letter to the editor on Oct. 1, Dr. Enders refused to accept credit for himself, acknowledging six other scientists and adding, with becoming modesty, "To me it seems most desirable that the collaborative character of these investigations should be understood, not solely for personal reasons but because much of all modern medical research is conducted in this way." **NICHOLAS BAKALAR**

http://www.nytimes.com/2010/10/05/health/05first.html?ref=research

U.S. Military Orders Less Dependence on Fossil Fuels

By ELISABETH ROSENTHAL

With insurgents increasingly attacking the American fuel supply convoys that lumber across the Khyber Pass into Afghanistan, the military is pushing aggressively to develop, test and deploy renewable energy to decrease its need to transport fossil fuels.

Last week, a Marine company from California arrived in the rugged outback of Helmand Province bearing novel equipment: portable solar panels that fold up into boxes; energy-conserving lights; solar tent shields that provide shade and electricity; solar chargers for computers and communications equipment.

The 150 Marines of Company I, Third Battalion, Fifth Marines, will be the first to take renewable technology into a battle zone, where the new equipment will replace diesel and kerosene-based fuels that would ordinarily generate power to run their encampment.

Even as Congress has struggled unsuccessfully to pass an energy bill and many states have put renewable energy on hold because of the recession, the military this year has pushed rapidly forward. After a decade of waging wars in remote corners of the globe where fuel is not readily available, senior commanders have come to see overdependence on fossil fuel as a big liability, and renewable technologies — which have become more reliable and less expensive over the past few years — as providing a potential answer. These new types of renewable energy now account for only a small percentage of the power used by the armed forces, but military leaders plan to rapidly expand their use over the next decade.

In Iraq and Afghanistan, the huge truck convoys that haul fuel to bases have been sitting ducks for enemy fighters — in the latest attack, oil tankers carrying fuel for NATO troops in Afghanistan were set on fire in Rawalpindi, Pakistan, early Monday. In Iraq and Afghanistan, one Army study found, for every 24 fuel

convoys that set out, one soldier or civilian engaged in fuel transport was killed. In the past three months, six Marines have been wounded guarding fuel runs in Afghanistan.

"There are a lot of profound reasons for doing this, but for us at the core it's practical," said Ray Mabus, the Navy secretary and a former ambassador to Saudi Arabia, who has said he wants 50 percent of the power for the Navy and Marines to come from renewable energy sources by 2020. That figure includes energy for bases as well as fuel for cars and ships.

"Fossil fuel is the No. 1 thing we import to Afghanistan," Mr. Mabus said, "and guarding that fuel is keeping the troops from doing what they were sent there to do, to fight or engage local people."

He and other experts also said that greater reliance on renewable energy improved national security, because fossil fuels often came from unstable regions and scarce supplies were a potential source of international conflict.

Fossil fuel accounts for 30 to 80 percent of the load in convoys into Afghanistan, bringing costs as well as risk. While the military buys gas for just over $1 a gallon, getting that gallon to some forward operating bases costs $400.

"We had a couple of tenuous supply lines across Pakistan that are costing us a heck of a lot, and they're very dangerous," said Gen. James T. Conway, the commandant of the Marine Corps.

Col. Robert Charette Jr., director of the Marine Corps Expeditionary Energy Office, said he was "cautiously optimistic" that Company I's equipment would prove reliable and durable enough for military use, and that other Marine companies would be adopting renewable technology in the coming months, although there would probably always be a need to import fuel for some purposes.

While setting national energy policy requires Congressional debates, military leaders can simply order the adoption of renewable energy. And the military has the buying power to create products and markets. That, in turn, may make renewable energy more practical and affordable for everyday uses, experts say.

Last year, the Navy introduced its first hybrid vessel, a Wasp class amphibious assault ship called the U.S.S. Makin Island, which at speeds under 10 knots runs on electricity rather than on fossil fuel, a shift resulting in greater efficiency that saved 900,000 gallons of fuel on its maiden voyage from Mississippi to San Diego, compared with a conventional ship its size, the Navy said.

The Air Force will have its entire fleet certified to fly on biofuels by 2011 and has already flown test flights using a 50-50 mix of plant-based biofuel and jet fuel; the Navy took its first delivery of fuel made from algae this summer. Biofuels can in theory be produced wherever the raw materials, like plants, are available, and could ultimately be made near battlefields.

Concerns about the military's dependence on fossil fuels in far-flung battlefields began in 2006 in Iraq, where Richard Zilmer, then a major general and the top American commander in western Iraq, sent an urgent cable to Washington suggesting that renewable technology could prevent loss of life. That request catalyzed new research, but the pressure for immediate results magnified as the military shifted its focus to Afghanistan, a country with little available native fossil fuel and scarce electricity outside cities.

Fuel destined for American troops in landlocked Afghanistan is shipped to Karachi, Pakistan, where it is loaded on convoys of 50 to 70 vehicles for transport to central bases. Smaller convoys branch out to the

forward lines. The Marines' new goal is to make the more peripheral sites sustain themselves with the kind of renewable technology carried by Company I, since solar electricity can be generated right on the battlefield.

There are similar tactical advantages to using renewable fuel for planes and building hybrid ships. "Every time you cut a ship away from the need to visit an oiler — a fuel supply ship — you create an advantage," said Mr. Mabus, noting that the Navy had pioneered previous energy transformations in the United States, from sail power to coal power in the 19th century, as well as from coal to oil and oil to nuclear power in the 20th century.

The cost calculation is also favorable. The renewable technology that will power Company I costs about $50,000 to $70,000; a single diesel generator costs several thousand dollars. But when it costs hundreds of dollars to get each gallon of traditional fuel to base camps in Afghanistan, the investment is quickly defrayed.

Because the military has moved into renewable energy so rapidly, much of the technology currently being used is commercially available or has been adapted for the battlefield from readily available civilian models.

This spring, the military invited commercial manufacturers to demonstrate products that might be useful on the battlefield. A small number were selected for further testing. The goal was to see, for example, if cooling systems could handle the 120 degree temperatures often seen in current war zones or if embedded solar panels would make tents more visible to enemy radar.

This summer, renewable technologies proved capable of powering computers, residences and most equipment for more than a week at a test base in the Mojave Desert — though not enough to operate the most sophisticated surveillance systems.

Much more is in the testing stages: one experimental cooling system uses a pipe burrowed into the cool earth eight feet underground that vents into tents; a solar fan on the tent roof evacuates the hot air and draws cool air from underground. The Marines are exploring solar-powered water purification systems and looking into the possibility of building a small-scale, truck-based biofuel plant that could transform local crops — like illegal poppies — into fuel.

"If the Navy comes knocking, they will build it," Mr. Mabus said. "The price will come down and the infrastructure will be created."

http://www.nytimes.com/2010/10/05/science/earth/05fossil.html?ref=science

Aiming to Learn as We Do, a Machine Teaches Itself

By STEVE LOHR

Give a computer a task that can be crisply defined — win at chess, predict the weather — and the machine bests humans nearly every time. Yet when problems are nuanced or ambiguous, or require combining varied sources of information, computers are no match for human intelligence.

Few challenges in computing loom larger than unraveling semantics, understanding the meaning of language. One reason is that the meaning of words and phrases hinges not only on their context, but also on background knowledge that humans learn over years, day after day.

Since the start of the year, a team of researchers at Carnegie Mellon University — supported by grants from the Defense Advanced Research Projects Agency and Google, and tapping into a research supercomputing cluster provided by Yahoo — has been fine-tuning a computer system that is trying to master semantics by learning more like a human. Its beating hardware heart is a sleek, silver-gray computer — calculating 24 hours a day, seven days a week — that resides in a basement computer center at the university, in Pittsburgh. The computer was primed by the researchers with some basic knowledge in various categories and set loose on the Web with a mission to teach itself.

“For all the advances in computer science, we still don’t have a computer that can learn as humans do, cumulatively, over the long term,” said the team’s leader, Tom M. Mitchell, a computer scientist and chairman of the machine learning department.

The Never-Ending Language Learning system, or NELL, has made an impressive showing so far. NELL scans hundreds of millions of Web pages for text patterns that it uses to learn facts, 390,000 to date, with an estimated accuracy of 87 percent. These facts are grouped into semantic categories — cities, companies, sports teams, actors, universities, plants and 274 others. The category facts are things like “San Francisco is a city” and “sunflower is a plant.”

NELL also learns facts that are relations between members of two categories. For example, Peyton Manning is a football player (category). The Indianapolis Colts is a football team (category). By scanning text patterns, NELL can infer with a high probability that Peyton Manning plays for the Indianapolis Colts — even if it has never read that Mr. Manning plays for the Colts. "Plays for" is a relation, and there are 280 kinds of relations. The number of categories and relations has more than doubled since earlier this year, and will steadily expand.

The learned facts are continuously added to NELL's growing database, which the researchers call a "knowledge base." A larger pool of facts, Dr. Mitchell says, will help refine NELL's learning algorithms so that it finds facts on the Web more accurately and more efficiently over time.

NELL is one project in a widening field of research and investment aimed at enabling computers to better understand the meaning of language. Many of these efforts tap the Web as a rich trove of text to assemble structured ontologies — formal descriptions of concepts and relationships — to help computers mimic human understanding. The ideal has been discussed for years, and more than a decade ago Sir Tim Berners-Lee, who invented the underlying software for the World Wide Web, sketched his vision of a "semantic Web."

Today, ever-faster computers, an explosion of Web data and improved software techniques are opening the door to rapid progress. Scientists at universities, government labs, Google, Microsoft, I.B.M. and elsewhere are pursuing breakthroughs, along somewhat different paths.

For example, I.B.M.'s "question answering" machine, Watson, shows remarkable semantic understanding in fields like history, literature and sports as it plays the quiz show "Jeopardy!" Google Squared, a research project at the Internet search giant, demonstrates ample grasp of semantic categories as it finds and presents information from around the Web on search topics like "U.S. presidents" and "cheeses."

Still, artificial intelligence experts agree that the Carnegie Mellon approach is innovative. Many semantic learning systems, they note, are more passive learners, largely hand-crafted by human programmers, while NELL is highly automated. "What's exciting and significant about it is the continuous learning, as if NELL is exercising curiosity on its own, with little human help," said Oren Etzioni, a computer scientist at the University of Washington, who leads a project called TextRunner, which reads the Web to extract facts.

Computers that understand language, experts say, promise a big payoff someday. The potential applications range from smarter search (supplying natural-language answers to search queries, not just links to Web pages) to virtual personal assistants that can reply to questions in specific disciplines or activities like health, education, travel and shopping.

"The technology is really maturing, and will increasingly be used to gain understanding," said Alfred Spector, vice president of research for Google. "We're on the verge now in this semantic world."

With NELL, the researchers built a base of knowledge, seeding each kind of category or relation with 10 to 15 examples that are true. In the category for emotions, for example: "Anger is an emotion." "Bliss is an emotion." And about a dozen more.

Then NELL gets to work. Its tools include programs that extract and classify text phrases from the Web, programs that look for patterns and correlations, and programs that learn rules. For example, when the computer system reads the phrase "Pikes Peak," it studies the structure — two words, each beginning with a capital letter, and the last word is Peak. That structure alone might make it probable that Pikes Peak is a mountain. But NELL also reads in several ways. It will mine for text phrases that surround Pikes Peak and similar noun phrases repeatedly. For example, "I climbed XXX."

NELL, Dr. Mitchell explains, is designed to be able to grapple with words in different contexts, by deploying a hierarchy of rules to resolve ambiguity. This kind of nuanced judgment tends to flummox computers. “But as it turns out, a system like this works much better if you force it to learn many things, hundreds at once,” he said.

For example, the text-phrase structure “I climbed XXX” very often occurs with a mountain. But when NELL reads, “I climbed stairs,” it has previously learned with great certainty that “stairs” belongs to the category “building part.” “It self-corrects when it has more information, as it learns more,” Dr. Mitchell explained.

NELL, he says, is just getting under way, and its growing knowledge base of facts and relations is intended as a foundation for improving machine intelligence. Dr. Mitchell offers an example of the kind of knowledge NELL cannot manage today, but may someday. Take two similar sentences, he said. “The girl caught the butterfly with the spots.” And, “The girl caught the butterfly with the net.”

A human reader, he noted, inherently understands that girls hold nets, and girls are not usually spotted. So, in the first sentence, “spots” is associated with “butterfly,” and in the second, “net” with “girl.”

“That’s obvious to a person, but it’s not obvious to a computer,” Dr. Mitchell said. “So much of human language is background knowledge, knowledge accumulated over time. That’s where NELL is headed, and the challenge is how to get that knowledge.”

A helping hand from humans, occasionally, will be part of the answer. For the first six months, NELL ran unassisted. But the research team noticed that while it did well with most categories and relations, its accuracy on about one-fourth of them trailed well behind. Starting in June, the researchers began scanning each category and relation for about five minutes every two weeks. When they find blatant errors, they label and correct them, putting NELL’s learning engine back on track.

When Dr. Mitchell scanned the “baked goods” category recently, he noticed a clear pattern. NELL was at first quite accurate, easily identifying all kinds of pies, breads, cakes and cookies as baked goods. But things went awry after NELL’s noun-phrase classifier decided “Internet cookies” was a baked good. (Its database related to baked goods or the Internet apparently lacked the knowledge to correct the mistake.)

NELL had read the sentence “I deleted my Internet cookies.” So when it read “I deleted my files,” it decided “files” was probably a baked good, too. “It started this whole avalanche of mistakes,” Dr. Mitchell said. He corrected the Internet cookies error and restarted NELL’s bakery education.

His ideal, Dr. Mitchell said, was a computer system that could learn continuously with no need for human assistance. “We’re not there yet,” he said. “But you and I don’t learn in isolation either.”

http://www.nytimes.com/2010/10/05/science/05compute.html?ref=science

STEM Education Has Little to Do With Flowers

By NATALIE ANGIER

If you want to talk about bolstering science and math education in this country, I'll gladly break out my virtual pompoms and go rah. Who wouldn't? Our nation's economy, global allure and future tense all depend on the strength of its scientific spine.

But mention the odious and increasingly pervasive term "STEM education," and instead of cheerleading gear, I reach for my ... pistil. In my disgruntlement, I am not alone.

For readers who heretofore have been spared exposure to this little concatenation of capital letters, or who have, quite understandably, misconstrued its meaning, STEM stands for Science, Technology, Engineering and Mathematics, supposedly the major food groups of a comprehensive science education.

Aficionados pronounce STEM exactly as you'd imagine — like the plant part, like the cell type, like what you do to a tide and I wish I could do to this trend, but it's probably too late. Go to any convention, Congressional hearing or science foundation bagel chat on the ever ominous theme of "Science in the Classroom, and why can't our students be more like Singapore's when they take international tests anyway?" and you'll hear little about how to teach trigonometry or afford all those Popsicle sticks needed for the eighth-grade bridge-building competition, but you'll be pelted by references to STEM.

A new report from the President's Council of Advisors on Science and Technology offers many worthy ideas for improving science education, like creating a "master corps" of the nation's finest science teachers who would in turn train others; but the STEM word keeps thudding up its pages like so many gristle nubs in a turkey burger. It's greasy-peasy: collapse down education, and you've got a buzz phrase to rival phys ed.

As even those who use the term admit, it is deeply, serio-comically flawed. For starters, it is opaque and confusing. "Everybody who knows what it means knows what it means, and everybody else doesn't," said Eric Lander, co-chairman of the president's advisory council and head of the Broad Institute of the Massachusetts Institute of Technology and Harvard University. When he first heard the term, he figured it was a too-cute reference to botany. "I thought, stem education? What about flower education?" he said.

These days, given the public's fixation on embryonic stem cells — progenitor cells that give rise to all the different tissues of the body — the potential for confusion is even worse. "People hear about STEM education, and they think some harm has come to an embryo in the process," Dr. Lander said.

The term also sounds didactic and jargony, which is why Sally Ride, the former astronaut who now travels the country promoting the glories of science education to girls and other interested parties, said she consciously avoids it.

"With my NASA heritage, I'm perfectly capable of speaking entirely in acronyms, including the verbs," she said. "But this is not very helpful when talking to the public."

Dr. Ride's instincts are well grounded. According to survey results released last month by the nonprofit group Entertainment Industries Council, when some 5,000 participants were asked whether they understood the term "STEM education," 86 percent said no. "They said it made them think of stem cells, branches, leaves and broccoli stems," said Brian Dyak, the group's president. "I have no clue on that last one." Clearly, he added, "we have a branding issue here."

But is it a brand worth pitching? Some critics argue that the term is unnecessary and potentially self-defeating. What's wrong with a simple science education, or if need be, science and math education? What's with all the discipline call-outs that demanded the invention of an acronym?

"A program officer from a foundation recently asked me, 'Is the work you're doing STEM education or science education?' " said Elizabeth Stage, the director of the Lawrence Hall of Science at the University of California, Berkeley. "I drew him a Venn diagram, showing him what's central about science and how that overlaps with technology, engineering and math."

Dr. Stage, a mathematician by training, thinks it's a "false distinction" to "silo out" the different disciplines, and would much prefer to focus on what the fields have in common, like problem-solving, arguing from evidence and reconciling conflicting views. "That's what we should have in the bulls'-eye of our target," she said.

The decision to include engineering and technology in the education "messaging" dates roughly to the 1990s, when the National Science Foundation and other government agencies began trying to draw up national standards for science education, specifying what students in kindergarten through 12th grade should know by the end of every school year.

"I remember it being made explicit that science encompassed more than straight-up science, and you started hearing requests to include mention of math, technology and engineering," Dr. Stage said.

Pragmatism and economics are also part of the equation. As government has turned ever more avidly to industry to help pay for expensive improvements in the science classroom, the need to emphasize the link between a well-rounded science education and tomorrow's techie work force has grown accordingly. "A lot of corporations are now talking to each other about what they're doing in STEM education," said Dr. Stage, and those corporations include engineering and computer heavyweights like Exxon Mobil, Intel and Hewlett-Packard.

Dr. Lander argues that that there is a basic rightness to the itemizing spirit behind STEM. "Science is discovering the laws of the natural world, and mathematics isn't that, it's logical, deductive truth, and its experiments don't have error bars," he said. "And when you get to technology and engineering, it's the constructed world, and that's different than the discovered one." He'd like a better term than the current one,

but said he's tried "all four factorial permutations" of the letters, and the alternatives are either unpronounceable or already claimed by a baseball team. Dr. Ride points out that an earlier version of the official acronym was, in fact, SMET, "and thankfully we've moved away from that," she said.

Yet others don't frame the word "science" so narrowly, as the province of the given rather than of the forged. Science has always encompassed the applied and the basic, and the impulses to explore and to invent have always been linked. Galileo built a telescope and then trained it on the sky. Advances in technology illuminate realms beyond our born senses, and those insights in turn yield better scientific toys. Engineers use math and physics and the scientific mind-set in everything they design; and those who don't, please let us know, so we can fly someone else's airplane and not cross your bridge when we come to it. Whatever happened to the need for interdisciplinary thinking? Why promote a brand that codifies atomization?

Besides, acronyms encourage rampant me-tooism. Mr. Dyak said that some have lobbied for the addition of medicine to the scholastic program, complete with a second M. "It's called STEM squared," he said. Even the arts are hankering for an orthographic position, he added.

STEAM education: great books, labs and motherboards, and free rug cleaning, too.

http://www.nytimes.com/2010/10/05/science/05angier.html?ref=science

For Those Near, the Miserable Hum of Clean Energy

By TOM ZELLER Jr.

VINALHAVEN, Me. — Like nearly all of the residents on this island in Penobscot Bay, Art Lindgren and his wife, Cheryl, celebrated the arrival of three giant wind turbines late last year. That was before they were turned on.

"In the first 10 minutes, our jaws dropped to the ground," Mr. Lindgren said. "Nobody in the area could believe it. They were so loud."

Now, the Lindgrens, along with a dozen or so neighbors living less than a mile from the $15 million wind facility here, say the industrial whoosh-and-whoop of the 123-foot blades is making life in this otherwise tranquil corner of the island unbearable.

They are among a small but growing number of families and homeowners across the country who say they have learned the hard way that wind power — a clean alternative to electricity from fossil fuels — is not without emissions of its own.

Lawsuits and complaints about turbine noise, vibrations and subsequent lost property value have cropped up in Illinois, Texas, Pennsylvania, Wisconsin and Massachusetts, among other states. In one case in DeKalb County, Ill., at least 38 families have sued to have 100 turbines removed from a wind farm there. A judge rejected a motion to dismiss the case in June.

Like the Lindgrens, many of the people complaining the loudest are reluctant converts to the antiwind movement.

"The quality of life that we came here for was quiet," Mrs. Lindgren said. "You don't live in a place where you have to take an hour-and-15-minute ferry ride to live next to an industrial park. And that's where we are right now."

The wind industry has long been dogged by a vocal minority bearing all manner of complaints about turbines, from routine claims that they ruin the look of pastoral landscapes to more elaborate allegations that they have direct physiological impacts like rapid heart beat, nausea and blurred vision caused by the machines' ultra-low-frequency sound and vibrations.

For the most extreme claims, there is little independent backing.

Last year, the American Wind Energy Association, a trade group, along with its Canadian counterpart, assembled a panel of doctors and acoustical professionals to examine the potential health impacts of wind turbine noise. In a paper published in December, the panel concluded that "there is no evidence that the audible or sub-audible sounds emitted by wind turbines have any direct adverse physiological effects."

A separate study financed by the Energy Department concluded late last year that, in aggregate, property values were unaffected by nearby wind turbines.

Numerous studies also suggest that not everyone will be bothered by turbine noise, and that much depends on the context into which the noise is introduced. A previously quiet setting like Vinalhaven is more likely to produce irritated neighbors than, say, a mixed-use suburban setting where ambient noise is already the norm.

Of the 250 new wind farms that have come online in the United States over the last two years, about dozen or so have generated significant noise complaints, according to Jim Cummings, the founder of the Acoustic Ecology Institute, an online clearinghouse for information on sound-related environmental issues.

In the Vinalhaven case, an audio consultant hired by the Maine Department of Environmental Protection determined last month that the 4.5-megawatt facility was, at least on one evening in mid-July when Mr. Lindgren collected sound data, in excess of the state's nighttime sound limits. The developer of the project, Fox Island Wind, has contested that finding, and negotiations with state regulators are continuing.

In the moonlit woods behind a neighbor's property on a recent evening, Mr. Lindgren, a retired software engineer, clenched a small flashlight between his teeth and wrestled with a tangle of cables and audio recording equipment he uses to collect sound samples for filing complaints.

At times, the rustle of leaves was all that could be heard. But when the surface wind settled, a throbbing, vaguely jetlike sound cut through the nighttime air. "Right there," Mr. Lindgren declared. "That would probably be out of compliance."

Maine, along with many other states, puts a general limit on nighttime noise at 45 decibels — roughly equivalent to the sound of a humming refrigerator. A normal conversation is in the range of 50 to 60 decibels.

In almost all cases, it is not mechanical noise arising from the central gear box or nacelle of a turbine that residents react to, but rather the sound of the blades, which in modern turbines are mammoth steel appendages well over 100 feet long, as they slice through the air.

Turbine noise can be controlled by reducing the rotational speed of the blades. But the turbines on Vinalhaven already operate that way after 7 p.m., and George Baker, the chief executive of Fox Island Wind — a for-profit arm of the island's electricity co-operative — said that turning the turbines down came at an economic cost.

"The more we do that, the higher goes the price of electricity on the island," he said.

A common refrain among homeowners grappling with sound issues, however, is that they were not accurately informed about the noise ahead of time. “They told us we wouldn’t hear it, or that it would be masked by the sound of the wind blowing through the trees,” said Sally Wylie, a former schoolteacher down the road from the Lindgrens. “I feel duped.”

Similar conflicts are arising in Canada, Britain and other countries . An appeals court in Rennes, France, recently ordered an eight-turbine wind farm to shut down between 10 p.m. and 7 a.m. so residents could get some sleep.

Richard R. James, an acoustic expert hired by residents of Vinalhaven to help them quantify the noise problem, said there was a simpler solution: do not put the turbines so close to where people live.

“It would seem to be time for the wind utility developers to rethink their plans for duplicating these errors and to focus on locating wind turbines in areas where there is a large buffer zone of about a mile and one-quarter between the turbines and people’s homes,” said Mr. James, the principal consultant with E-Coustic Solutions, based in Michigan.

Vinalhaven’s wind farm enjoys support among most residents, from ardent supporters of all clean energy to those who simply say the turbines have reduced their power bills. Deckhands running the ferry sport turbine pins on their hats, and bumper stickers seen on the island declare “Spin, Baby, Spin.”

“The majority of us like them,” said Jeannie Conway, who works at the island’s ferry office.

But that is cold comfort for Mrs. Lindgren and her neighbors, who say their corner of the island will never be the same.

“I remember the sound of silence so palpable, so merciless in its depths, that you could almost feel your heart stop in sympathy,” she said. “Now we are prisoners of sonic effluence. I grieve for the past.”

http://www.nytimes.com/2010/10/06/business/energy-environment/06noise.html?ref=science

Neanderthals' Big Loss in Battle of the Elements
By SINDYA N. BHANOO

Homo sapiens may not have pushed Neanderthals to extinction, as some scientists have hypothesized; it may have been the weather that did them in.

Volcanic eruptions thousands of years ago devastated Neanderthals in Western Asia and in Europe, anthropologists report in Current Anthropology.

Naomi Cleghorn, an anthropologist at the University of Texas at Arlington, and colleagues studied a Neanderthal site in the Caucasus Mountains of southwestern Russia. They were able to identify volcanic ash from two separate eruptions that occurred in the area between 45,000 and 40,000 years ago.

Recently, a separate study found that there was another large volcanic eruption in Italy 40,000 years ago, in an area also occupied at the time by Neanderthals. At the time, our own species was primarily in Africa and southern Europe, areas less affected by the eruptions. Neanderthals were concentrated in Asia and Europe.

"Early modern humans, if any of them were on the affected landscape, had a replenishment population elsewhere," she said.

About 2,000 years after the volcanic events (though the exact dates are unclear), humans appear to have moved into parts of Europe previously occupied by Neanderthals, the anthropologists say. "We would like

people to look more carefully at other Neanderthal sites and to look more carefully for events like this," Dr. Cleghorn said.

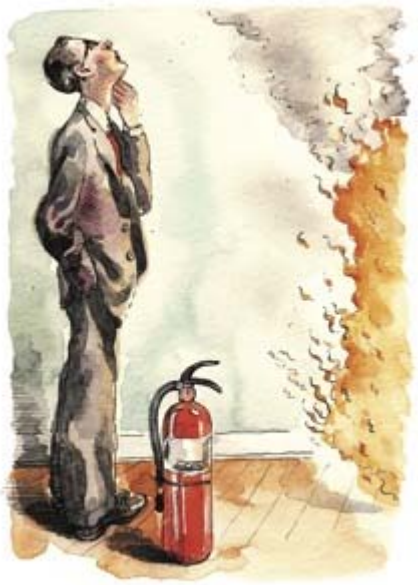
Based on what scientists currently know, a weather-related demise is more likely than a loss in a battle of the wits between Neanderthals and humans, she said.

"It's really difficult to argue that they weren't as good as acquiring resources as early modern humans," she said.

http://www.nytimes.com/2010/10/05/science/05obneanderthal.html?ref=science&pagewanted=print

What does procrastination tell us about ourselves?

by James Surowiecki October 11, 2010



Procrastination interests philosophers because of its underlying irrationality.

Some years ago, the economist George Akerlof found himself faced with a simple task: mailing a box of clothes from India, where he was living, to the United States. The clothes belonged to his friend and colleague Joseph Stiglitz, who had left them behind when visiting, so Akerlof was eager to send the box off. But there was a problem. The combination of Indian bureaucracy and what Akerlof called "my own ineptitude in such matters" meant that doing so was going to be a hassle—indeed, he estimated that it would take an entire workday. So he put off dealing with it, week after week. This went on for more than eight months, and it was only shortly before Akerlof himself returned home that he managed to solve his problem: another friend happened to be sending some things back to the U.S., and Akerlof was able to add Stiglitz's clothes to the shipment. Given the vagaries of intercontinental mail, it's possible that Akerlof made it back to the States before Stiglitz's shirts did.

There's something comforting about this story: even Nobel-winning economists procrastinate! Many of us go through life with an array of undone tasks, large and small, nibbling at our conscience. But Akerlof saw the experience, for all its familiarity, as mysterious. He genuinely intended to send the box to his friend, yet, as he wrote, in a paper called "Procrastination and Obedience" (1991), "each morning for over eight months I woke up and decided that the *next* morning would be the day to send the Stiglitz box." He was always *about* to send the box, but the moment to act never arrived. Akerlof, who became one of the central figures in behavioral economics, came to the realization that procrastination might be more than just a bad habit. He argued that it revealed something important about the limits of rational thinking and that it could teach useful lessons about phenomena as diverse as substance abuse and savings habits. Since his essay was published, the study of procrastination has become a significant field in academia, with philosophers, psychologists, and economists all weighing in.

Academics, who work for long periods in a self-directed fashion, may be especially prone to putting things off: surveys suggest that the vast majority of college students procrastinate, and articles in the literature of procrastination often allude to the author's own problems with finishing the piece. (This article will be no exception.) But the academic buzz around the subject isn't just a case of eggheads rationalizing their slothfulness. As various scholars argue in "The Thief of Time," edited by Chrisoula Andreou and Mark D. White (Oxford; $65)—a collection of essays on procrastination, ranging from the resolutely theoretical to the surprisingly practical—the tendency raises fundamental philosophical and psychological issues. You may have thought, the last time you blew off work on a presentation to watch "How I Met Your Mother," that you were just slacking. But from another angle you were actually engaging in a practice that illuminates the fluidity of human identity and the complicated relationship human beings have to time. Indeed, one essay, by the economist George Ainslie, a central figure in the study of procrastination, argues that dragging our heels is "as fundamental as the shape of time and could well be called the basic impulse."

"You say it's a win-win, but what if you're wrong-wrong and it all goes bad-bad?"

Ainslie is probably right that procrastination is a basic human impulse, but anxiety about it as a serious problem seems to have emerged in the early modern era. The term itself (derived from a Latin word meaning "to put off for tomorrow") entered the English language in the sixteenth century, and, by the eighteenth, Samuel Johnson was describing it as "one of the general weaknesses" that "prevail to a greater or less degree in every mind," and lamenting the tendency in himself: "I could not forbear to reproach myself for having so long neglected what was unavoidably to be done, and of which every moment's idleness increased the difficulty." And the problem seems to be getting worse all the time. According to Piers Steel, a business professor at the University of Calgary, the percentage of people who admitted to difficulties with procrastination quadrupled between 1978 and 2002. In that light, it's possible to see procrastination as the quintessential modern problem.

It's also a surprisingly costly one. Each year, Americans waste hundreds of millions of dollars because they don't file their taxes on time. The Harvard economist David Laibson has shown that American workers have forgone huge amounts of money in matching 401(k) contributions because they never got around to signing up for a retirement plan. Seventy per cent of patients suffering from glaucoma risk blindness because they don't use their eyedrops regularly. Procrastination also inflicts major costs on businesses and governments. The recent crisis of the euro was exacerbated by the German government's dithering, and the decline of the

American auto industry, exemplified by the bankruptcy of G.M., was due in part to executives' penchant for delaying tough decisions. (In Alex Taylor's recent history of G.M., "Sixty to Zero," one of the key conclusions is "Procrastination doesn't pay.")

Philosophers are interested in procrastination for another reason. It's a powerful example of what the Greeks called *akrasia*—doing something against one's own better judgment. Piers Steel defines procrastination as willingly deferring something even though you expect the delay to make you worse off. In other words, if you're simply saying "Eat, drink, and be merry, for tomorrow we die," you're not really procrastinating. Knowingly delaying because you think that's the most efficient use of your time doesn't count, either. The essence of procrastination lies in not doing what you think you should be doing, a mental contortion that surely accounts for the great psychic toll the habit takes on people. This is the perplexing thing about procrastination: although it seems to involve avoiding unpleasant tasks, indulging in it generally doesn't make people happy. In one study, sixty-five per cent of students surveyed before they started working on a term paper said they would like to avoid procrastinating: they knew both that they wouldn't do the work on time and that the delay would make them unhappy.

Most of the contributors to the new book agree that this peculiar irrationality stems from our relationship to time—in particular, from a tendency that economists call "hyperbolic discounting." A two-stage experiment provides a classic illustration: In the first stage, people are offered the choice between a hundred dollars today or a hundred and ten dollars tomorrow; in the second stage, they choose between a hundred dollars a month from now or a hundred and ten dollars a month and a day from now. In substance, the two choices are identical: wait an extra day, get an extra ten bucks. Yet, in the first stage many people choose to take the smaller sum immediately, whereas in the second they prefer to wait one more day and get the extra ten bucks. In other words, hyperbolic discounters are able to make the rational choice when they're thinking about the future, but, as the present gets closer, short-term considerations overwhelm their long-term goals. A similar phenomenon is at work in an experiment run by a group including the economist George Loewenstein, in which people were asked to pick one movie to watch that night and one to watch at a later date. Not surprisingly, for the movie they wanted to watch immediately, people tended to pick lowbrow comedies and blockbusters, but when asked what movie they wanted to watch later they were more likely to pick serious, important films. The problem, of course, is that when the time comes to watch the serious movie, another frothy one will often seem more appealing. This is why Netflix queues are filled with movies that never get watched: our responsible selves put "Hotel Rwanda" and "The Seventh Seal" in our queue, but when the time comes we end up in front of a rerun of "The Hangover."

The lesson of these experiments is not that people are shortsighted or shallow but that their preferences aren't consistent over time. We want to watch the Bergman masterpiece, to give ourselves enough time to write the report properly, to set aside money for retirement. But our desires shift as the long run becomes the short run.

Why does this happen? One common answer is ignorance. Socrates believed that *akrasia* was, strictly speaking, impossible, since we could not want what is bad for us; if we act against our own interests, it must be because we don't know what's right. Loewenstein, similarly, is inclined to see the procrastinator as led astray by the "visceral" rewards of the present. As the nineteenth-century Scottish economist John Rae put it, "The prospects of future good, which future years may hold on us, seem at such a moment dull and dubious, and are apt to be slighted, for objects on which the daylight is falling strongly, and showing us in all their freshness just within our grasp." Loewenstein also suggests that our memory for the intensity of visceral rewards is deficient: when we put off preparing for that meeting by telling ourselves that we'll do it tomorrow, we fail to take into account that tomorrow the temptation to put off work will be just as strong.

Ignorance might also affect procrastination through what the social scientist Jon Elster calls "the planning fallacy." Elster thinks that people underestimate the time "it will take them to complete a given task, partly

because they fail to take account of how long it has taken them to complete similar projects in the past and partly because they rely on smooth scenarios in which accidents or unforeseen problems never occur." When I was writing this piece, for instance, I had to take my car into the shop, I had to take two unanticipated trips, a family member fell ill, and so on. Each of these events was, strictly speaking, unexpected, and each took time away from my work. But they were really just the kinds of problems you predictably have to deal with in everyday life. Pretending I wouldn't have any interruptions to my work was a typical illustration of the planning fallacy.

Still, ignorance can't be the whole story. In the first place, we often procrastinate not by doing fun tasks but by doing jobs whose only allure is that they aren't what we should be doing. My apartment, for instance, has rarely looked tidier than it does at the moment. And people do learn from experience: procrastinators know all too well the allures of the salient present, and they want to resist them. They just don't. A magazine editor I know, for instance, once had a writer tell her at noon on a Wednesday that the time-sensitive piece he was working on would be in her in-box by the time she got back from lunch. She did eventually get the piece—the following Tuesday. So a fuller explanation of procrastination really needs to take account of our attitudes to the tasks being avoided. A useful example can be found in the career of General George McClellan, who led the Army of the Potomac during the early years of the Civil War and was one of the greatest procrastinators of all time. When he took charge of the Union army, McClellan was considered a military genius, but he soon became famous for his chronic hesitancy. In 1862, despite an excellent opportunity to take Richmond from Robert E. Lee's men, with another Union army attacking in a pincer move, he dillydallied, convinced that he was blocked by hordes of Confederate soldiers, and missed his chance. Later that year, both before and after Antietam, he delayed again, squandering a two-to-one advantage over Lee's troops. Afterward, Union General-in-Chief Henry Halleck wrote, "There is an immobility here that exceeds all that any man can conceive of. It requires the lever of Archimedes to move this inert mass."

McClellan's "immobility" highlights several classic reasons we procrastinate. Although when he took over the Union army he told Lincoln "I can do it all," he seems to have been unsure that he could do anything. He was perpetually imploring Lincoln for new weapons, and, in the words of one observer, "he felt he never had enough troops, well enough trained or equipped." Lack of confidence, sometimes alternating with unrealistic dreams of heroic success, often leads to procrastination, and many studies suggest that procrastinators are self-handicappers: rather than risk failure, they prefer to create conditions that make success impossible, a reflex that of course creates a vicious cycle. McClellan was also given to excessive planning, as if only the ideal battle plan were worth acting on. Procrastinators often succumb to this sort of perfectionism.

Viewed this way, procrastination starts to look less like a question of mere ignorance than like a complex mixture of weakness, ambition, and inner conflict. But some of the philosophers in "The Thief of Time" have a more radical explanation for the gap between what we want to do and what we end up doing: the person who makes plans and the person who fails to carry them out are not really the same person: they're different parts of what the game theorist Thomas Schelling called "the divided self." Schelling proposes that we think of ourselves not as unified selves but as different beings, jostling, contending, and bargaining for control. Ian McEwan evokes this state in his recent novel "Solar": "At moments of important decision-making, the mind could be considered as a parliament, a debating chamber. Different factions contended, short- and long-term interests were entrenched in mutual loathing. Not only were motions tabled and opposed, certain proposals were aired in order to mask others. Sessions could be devious as well as stormy." Similarly, Otto von Bismarck said, "Faust complained about having two souls in his breast, but I harbor a whole crowd of them and they quarrel. It is like being in a republic." In that sense, the first step to dealing with procrastination isn't admitting that you have a problem. It's admitting that your "you"s have a problem.

If identity is a collection of competing selves, what does each of them represent? The easy answer is that one represents your short-term interests (having fun, putting off work, and so on), while another represents your

long-term goals. But, if that's the case, it's not obvious how you'd ever get anything done: the short-term self, it seems, would always win out. The philosopher Don Ross offers a persuasive solution to the problem. For Ross, the various parts of the self are all present at once, constantly competing and bargaining with one another—one that wants to work, one that wants to watch television, and so on. The key, for Ross, is that although the television-watching self is interested only in watching TV, it's interested in watching TV not just now but also in the future. This means that it can be bargained with: working now will let you watch more television down the road. Procrastination, in this reading, is the result of a bargaining process gone wrong.

The idea of the divided self, though discomfiting to some, can be liberating in practical terms, because it encourages you to stop thinking about procrastination as something you can beat by just trying harder. Instead, we should rely on what Joseph Heath and Joel Anderson, in their essay in "The Thief of Time," call "the extended will"—external tools and techniques to help the parts of our selves that want to work. A classic illustration of the extended will at work is Ulysses' decision to have his men bind him to the mast of his ship. Ulysses knows that when he hears the Sirens he will be too weak to resist steering the ship onto the rocks in pursuit of them, so he has his men bind him, thereby forcing him to adhere to his long-term aims. Similarly, Thomas Schelling once said that he would be willing to pay extra in advance for a hotel room without a television in it. Today, problem gamblers write contracts with casinos banning them from the premises. And people who are trying to lose weight or finish a project will sometimes make bets with their friends so that if they don't deliver on their promise it'll cost them money. In 2008, a Ph.D. candidate at Chapel Hill wrote software that enables people to shut off their access to the Internet for up to eight hours; the program, called Freedom, now has an estimated seventy-five thousand users.

Not everyone in "The Thief of Time" approves of the reliance on the extended will. Mark D. White advances an idealist argument rooted in Kantian ethics: recognizing procrastination as a failure of will, we should seek to strengthen the will rather than relying on external controls that will allow it to atrophy further. This isn't a completely fruitless task: much recent research suggests that will power is, in some ways, like a muscle and can be made stronger. The same research, though, also suggests that most of us have a limited amount of will power and that it's easily exhausted. In one famous study, people who had been asked to restrain themselves from readily available temptation—in this case, a pile of chocolate-chip cookies that they weren't allowed to touch—had a harder time persisting in a difficult task than people who were allowed to eat the cookies.

Given this tendency, it makes sense that we often rely intuitively on external rules to help ourselves out. A few years ago, Dan Ariely, a psychologist at M.I.T., did a fascinating experiment examining one of the most basic external tools for dealing with procrastination: deadlines. Students in a class were assigned three papers for the semester, and they were given a choice: they could set separate deadlines for when they had to hand in each of the papers or they could hand them all in together at the end of the semester. There was no benefit to handing the papers in early, since they were all going to be graded at semester's end, and there was a potential cost to setting the deadlines, since if you missed a deadline your grade would be docked. So the rational thing to do was to hand in all the papers at the end of the semester; that way you'd be free to write the papers sooner but not at risk of a penalty if you didn't get around to it. Yet most of the students chose to set separate deadlines for each paper, precisely because they knew that they were otherwise unlikely to get around to working on the papers early, which meant they ran the risk of not finishing all three by the end of the semester. This is the essence of the extended will: instead of trusting themselves, the students relied on an outside tool to make themselves do what they actually wanted to do.

Beyond self-binding, there are other ways to avoid dragging your feet, most of which depend on what psychologists might call reframing the task in front of you. Procrastination is driven, in part, by the gap between effort (which is required now) and reward (which you reap only in the future, if ever). So narrowing that gap, by whatever means necessary, helps. Since open-ended tasks with distant deadlines are much easier to postpone than focussed, short-term projects, dividing projects into smaller, more defined sections helps.

That's why David Allen, the author of the best-selling time-management book "Getting Things Done," lays great emphasis on classification and definition: the vaguer the task, or the more abstract the thinking it requires, the less likely you are to finish it. One German study suggests that just getting people to think about concrete problems (like how to open a bank account) makes them better at finishing their work—even when it deals with a completely different subject. Another way of making procrastination less likely is to reduce the amount of choice we have: often when people are afraid of making the wrong choice they end up doing nothing. So companies might be better off offering their employees fewer investment choices in their 401(k) plans, and making signing up for the plan the default option.

It's hard to ignore the fact that all these tools are at root about imposing limits and narrowing options—in other words, about a voluntary abnegation of freedom. (Victor Hugo would write naked and tell his valet to hide his clothes so that he'd be unable to go outside when he was supposed to be writing.) But before we rush to overcome procrastination we should consider whether it is sometimes an impulse we should heed. The philosopher Mark Kingwell puts it in existential terms: "Procrastination most often arises from a sense that there is too much to do, and hence no single aspect of the to-do worth doing. . . . Underneath this rather antic form of action-as-inaction is the much more unsettling question whether anything is worth doing at all." In that sense, it might be useful to think about two kinds of procrastination: the kind that is genuinely akratic and the kind that's telling you that what you're supposed to be doing has, deep down, no real point. The procrastinator's challenge, and perhaps the philosopher's, too, is to figure out which is which. ♦

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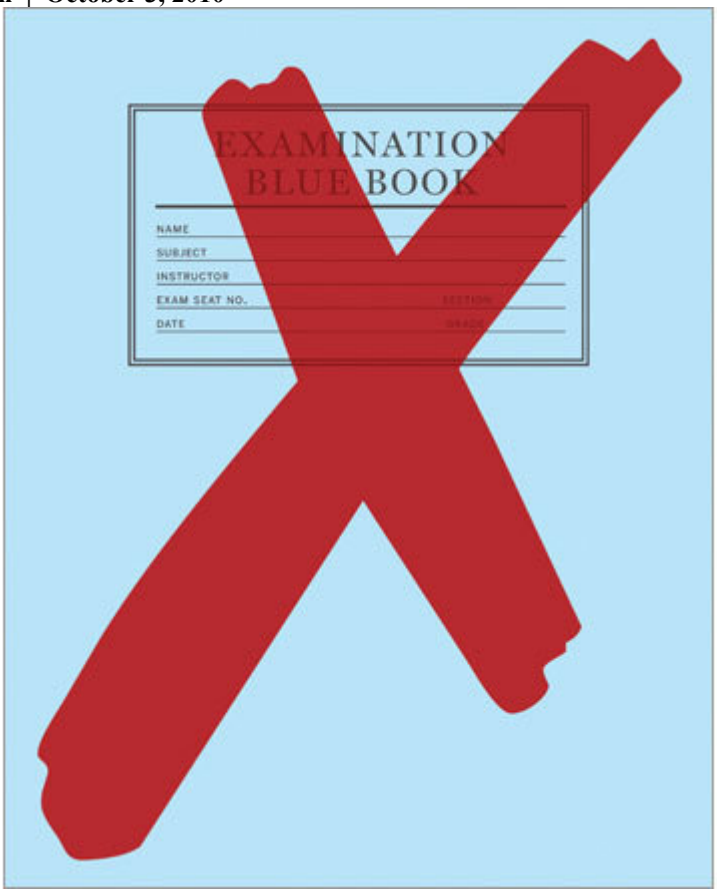
The test has been canceled

Final exams are quietly vanishing from college

By Keith O'Brien | October 3, 2010



They incite panic in the souls of even the most diligent students. Everything about final exams is fraught with terror: the blue books passed out from the front of the room, the clock ticking on the wall, three hours to finish in some large auditorium with banked seating, and grade point averages hanging in the balance. If professors listen closely enough, they can hear the sound of pens scribbling and caffeine pumping through the veins of 200 students who have been cramming for days, intent on learning, if for no other reason than they don't want to fail.

These exams are not just a rite of passage, but a fundamental and longstanding tool that American college professors have been using, in some format, since the 1830s. Now comes the twist, the pop-quiz question of the day: What happens when the final exam starts vanishing from American higher education?

The answer: No one knows. But apparently we're about to find out.

Across the country, there is growing evidence that final exams — once considered so important that universities named a week after them — are being abandoned or diminished, replaced by take-home tests, papers, projects, or group presentations. Anecdotally, longtime professors say they have been noticing the

trend for years. And now, thanks to a recent discussion at Harvard University, there are statistics that make clear just how much the landscape has changed.

In the spring term at Harvard last year, only 259 of the 1,137 undergraduate courses had a scheduled final exam, the lowest number since 2002, according to Jay M. Harris, the dean of undergraduate education. Harris said he's hesitant to read too much into the numbers, which, he said, don't include whatever final exams were scheduled in language courses, don't reflect the other forms of assessment that have replaced exams, and don't account for small seminar classes, which typically would not have a traditional, sit-down, blue-book final.

But the low rate of actual scheduled finals at Harvard last spring — just 23 percent — was considered significant enough to prompt one striking change. For years, final exams in Cambridge were considered a given, and the bureaucratic rules reflected that reality. Courses were simply assumed to include a seated, three-hour final exam; any professor who wished to opt out had to request permission. But that wasn't happening, Harris said, forcing the registrar's office to track down professors each semester, only to learn that, no, they were not planning on a final exam. So starting this fall, the onus has been flipped: The university will assume there will be no finals in courses. Any professor who actually wants to hold one will need to say so.

The change, which was first reported in Harvard Magazine, is not a statement on the value of final exams one way or the other, Harris said. But the shrinking role of big, blockbuster tests at Harvard and colleges elsewhere is raising serious pedagogical questions about 21st century education: How best do students learn? And what's the best way to assess that? Is the disappearance of high-stakes, high-pressure final exams a sign that universities are failing to challenge today's students, or is it just a long overdue acknowledgment that such tests aren't always the best indicator of actual knowledge?

"You can interpret this in two ways," said Robert Bangert-Drowns, dean of the school of education at the University at Albany SUNY. "One way is, institutions for higher education are abdicating their responsibility for having high standards and demanding high performance from their students. But on the other hand, if you looked at a lot of final exams in courses you'd think, 'This is not a very valuable standard.' These tests ask the kind of questions that students may never be asked again in their lives, in detail that they may never be asked again in their lives."

There's nothing magical about finals, Bangert-Drowns added. They can be arbitrary and abstract — an inauthentic gauge of what someone knows. Research, by Bangert-Drowns and others, shows that frequent testing is more beneficial. And yet, many still find value in the final exam. It might be stressful, even terrifying, but it has the singular power to force students to go back over material, think critically about what they have read, review hard-to-grasp-topics once more, and even talk about the subject matter with classmates and instructors — all of which enhance learning.

"You can measure an institution's performance, a department's performance," said James Engell, Gurney professor of English literature and professor of comparative literature at Harvard. "But the real question is: How much did your students learn? How much better are they at something now than they were when they started? And I think examinations — whether they're final examinations or other kinds of examinations — play a real part in that."

Exams, in one form or another, have been a part of higher education in America since the very beginning. Students attending Harvard in the 1640s, shortly after the college was founded, were required to take both

entrance and graduation exams, according to Arthur Levine's "Handbook on Undergraduate Curriculum," an exhaustive, 662-page history of the subject.

But these early examinations were oral. The goal was often rote memorization: getting students to recite text verbatim. These "recitations," as they were called, were despised by students, required almost no intellectual analysis, and became increasingly hard to manage as college enrollment climbed and class sizes grew. Consequently, in the 1830s, Yale and Harvard began introducing written biennial tests. The notion spread, and by the late 19th century, such exams had become accepted practice on many campuses, according to John R. Thelin, author of "A History of American Higher Education."

"Prior to that time," Thelin said, "the idea that undergraduates would have known how to, or been inclined to, write three-hour essays on some intellectual topic would have been pretty unlikely."

So began the era of the grand final exam: great, sweeping tests, often taken in huge collegiate halls or auditoriums by large numbers of students on the clock. It was an efficient way to assess students in large numbers. But in more recent decades, researchers have questioned whether such finals are truly the best way to help students learn.

"With final exams, it's study, study, study. Take the exam — and now it's gone. Move on," said Linda Serra Hagedorn, a professor at Iowa State University and president-elect of the Association for the Study of Higher Education. "The better approach is to have a more holistic approach to learning where it's smaller increments, where one learns in steadier and smaller increments."

Such views are not only increasingly shared among professors, but also backed up by a growing number of studies. One such study, published last year, focused on more than 1,500 students taking algebra at Richard J. Daley College in Chicago between 2004 and 2006. M. Vali Siadat, the chairman of the math department there, compared the outcomes of algebra students who took weekly, cumulative quizzes over the course of the semester with those who received less rigorous, regular assessment.

Those tested weekly not only did better on the midterm and the final exams, but better overall, outperforming their classmates who did not receive regular quizzing by about 16 percent by the end of the semester. With regular, cumulative testing, Siadat concluded, the students were simply better prepared.

"The students know the final is just another act," said Siadat, who coauthored a paper on these findings last year with his Richard J. Daley colleague Euguenia Peterson. "It's going to be cumulative just like the previous tests. They're ready for it and they tend to do well."

University professors around the country have tried implementing such changes in recent years, putting more emphasis on weekly or even daily quizzes, smaller tests, and papers and less emphasis on formal final exams. At the University of Arizona recently, roughly one third of professors have reduced the value of large exams in students' overall grades, according to Thomas Fleming, a senior lecturer and associate astronomer at the university who chairs a committee overseeing general education courses. Fleming, who is part of the trend himself, said many professors have made the shift after realizing that some students simply aren't good at taking exams. And perhaps not surprisingly, students are thrilled to avoid the terror of the blue books.

According to a poll that Fleming took last spring in a large 600-student astronomy course, 93 percent of students said they'd prefer weekly quizzes over a couple of large midterms and a final. Seventy-eight percent reported actually learning more that way, and almost all of them — 98 percent — said they were less stressed taking short, weekly quizzes than they were taking large exams.

"Some of it is just the whole situation, a psychological thing," Fleming said. "You're sitting in a room with maybe 150 other people. The clock's up there. You have maybe 50 minutes to do the exam and the fact that you're under pressure can lead to brain lock. You can panic."

And all the panic may be for naught. In a wired world, where Internet search engines have reduced the need for memorization of facts, final exams might not be as useful as they once were, some professors suggest. "Life is not structured like the exam anymore," explained Charles S. Maier, Saltonstall professor of history at Harvard. "Life is open book; it's not closed book."

Still, many are troubled by the idea that professors are giving fewer finals. Siadat said it's clear to him that students aren't doing well on in-class final exams. Otherwise, he said, professors wouldn't be eliminating them. And Maier suggested that other issues may be contributing to the trend at Harvard. Recent cutbacks have made it necessary, he said, for professors or their assistants to monitor their own final exams — an unwelcome task at best, and a nuisance at worst.

"A lot of people said, 'I don't want to go through that,' " Maier said. "They didn't say it openly. But it probably was a factor."

He and others would like to see more discussion of the issue. Harris, Harvard's dean of undergraduate education, said he'd like to gather more information on how different forms of assessment are working. One idea, he suggested, would be to follow up with students several months after a course has ended to see what information they have retained. Meantime, the academic calendar at Harvard pushes on through the fall.

This semester, according to the calendar, classes end on Dec. 2. The next 10 days are dedicated to reading period — a time when students are historically supposed to be preparing for final exams. And then there's still another nine days set aside for students to take the finals themselves — at least for the diminishing number of students who actually have finals to take.

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http://www.boston.com/bostonglobe/ideas/articles/2010/10/03/the_test_has_been_canceled/?page=full

Color Preferences Determined by Experience

How we feel about a color depends on our relationship with that particular shade.

By Emily Sohn | Fri Oct 1, 2010 07:00 AM ET

Yellow or pink flowers? The green or blue sweater? From cars to furniture to iPods, we make decisions about color all the time. Now, scientists are starting to figure out why we like the hues we do.

It is our experiences that determine which colors we prefer, suggests a new study, which was the first to experimentally test the long-suspected idea that people like the colors of the things they like.

The findings may help explain why blue is pleasing to people everywhere, why Japanese women tend to like light colors, and why dark yellow is generally unappealing, among other trends.

On the flip side, the study also hints at why one woman might buy orange socks, while the next shopper picks brown -- in turn, offering tantalizing fodder for designers, artists and marketing experts.

"I might like purple more than you because my sister's bedroom was purple and I had positive experiences there," said Karen Schloss, a graduate student in psychology at the University of California, Berkeley. "Your own personal preference is determined by all the entities you've encountered of that color and how much you liked them."

In their attempts to understand why people like certain colors, scientists have focused on evolution. The main theory is that we like colors that are tied to things that are healthy and promote survival.

A blue sky, for example, indicates calm weather, which might explain why blue tends to be a favored color across cultures. Dark yellows and oranges, on the other hand, invoke urine, feces, vomit and rotting food. As expected, there is usually a dip in preference for these hues in studies around the world.

Scientists have also predicted, with mixed results, a preference for red among women, who would've needed to spot red berries against green foliage in our ancestral hunter-gatherer societies.

Despite those general trends, there are wide-ranging differences among individuals about which colors they like. Schloss and colleague Stephen Palmer wanted to know why.

As part of a series of experiments, the researchers showed slide shows of colored objects to a group of participants. The images were biased, so that some people might see nice red things, like yummy strawberries, but unpleasant green images like slime. Others saw unpleasant red things like blood but nice green objects, like trees. Afterwards, the researchers reported in the *Proceedings of the National Academy of Sciences*, people preferred whichever color had been linked to the positive images they saw, whether red or green.

In another preliminary study, the researchers found that Berkeley students who ranked highest in school spirit had the strongest preferences for blue and gold, their school's colors, and the most distaste for red and white, the colors of their rival Stanford.

Spirited Stanford students showed the opposite pattern, suggesting that social affiliations can influence which colors we like at different times in our lives.

"Their study is a really neat experiment to prove something that we have suspected for a long time," said Yazhu Ling, a vision scientists at the University of East Anglia in the United Kingdom. She and colleagues established a theory that our systems for ranking colors are hardwired, even if our actual color preferences are malleable.

"You see loads of articles online about what color you like and what that says about what kind of person you are," she added. "There is not actually scientific support for that. But it shows that people are generally interested in the subtle differences between people and what has driven that. Color provides a tool to understand why we like some things more than others."

http://news.discovery.com/human/colors-preferences-evolution-style.html#mkcpgn=rssnws1

Invisible America

In immigrants' rooms, a photographer documents a fragile stability

By Dushko Petrovich | October 3, 2010

The national immigration debate, such as it is, depends to a surprising degree on the invisibility of its main characters. The angry tone, the controversial laws, the various stereotypes and idealizations all concern people who, for obvious reasons, cannot come forward and announce themselves, much less tell their stories. The threat of deportation requires they be, if not unseen, then unidentified. So while they are attacked as an amorphous specter and defended mostly by proxy, the undocumented immigrants themselves remain unspecific, vulnerable, and largely unacknowledged as individuals.

Mary Beth Meehan, a photographer living in Providence, noticed this "imposed obscurity" and wanted to address it. She had been taking pictures in her native Brockton for years, but this issue seemed vexingly paradoxical: How to photograph this community without endangering its members? How to document the undocumented?

Meehan had been working on a different project this April when she happened to take a few pictures in the home of a family from Guinea-Bissau. Knowing not to include them in the frame, she focused instead on their living room (Kevin Costner was on the DVD), and the kitchen sink, where they were preparing some fish. When SB 1070 was passed in Arizona a few days later, Meehan says, she quickly recognized these images as "seeds of a larger project," which has since grown into a fascinating and multifaceted series depicting various living spaces of immigrants from Mexico, Colombia, and El Salvador, along with Cape Verde and Guinea-Bissau. As she continues to expand by reaching out to other families and nationalities, Meehan hopes her photos — which invariably depict living spaces *without* their inhabitants — "might be a way of somehow making these people visible."

The curious magnetism of the images lies in that very contradiction. Once you know the subject matter, the subject's absence becomes both conspicuous and revealing.

We are first of all forced to recognize that people are standing behind or beside the camera because they can't show their faces. Everything we do see — the carefully appointed dining room, the children's neat beds, the adjacent gerbil cage — would be evacuated if their owners were identified. This important fact lends a provisional air to interiors that would otherwise seem remarkably stable. The objects are often quite ordinary, but their missing owners signal the scene's underlying disquiet.

The palpable lack of inhabitants also puts a certain pressure on the viewer. If not voyeurs exactly, we do become interlopers, peering into strangers' rooms, perusing their (sometimes unfamiliar) belongings. We are suddenly the ones who feel foreign. Should we take off our shoes? What is the custom in Guinea-Bissau? Nobody appears to greet or guide us, so the sense of mere visitation persists — a discomfort that lengthens,

perhaps, into empathy for our unknown hosts, who must often have these same feelings themselves, but on a vastly different scale.

At the same time, these pictures also convey a poignant hope of belonging. These interiors aren't unkempt hovels or weird criminal dens, but emphatically *homes*, the kind we all recognize. Their otherwise unremarkable details — a pink backpack, flowers on the table, the home entertainment system — speak plainly of a wish (and sustained effort) to establish a normal life in Brockton. At heart, the power of these photos lies in the fact that we *can* identify with the spaces; we can see their living room is a lot like ours, or maybe like our grandparents' when they first moved here.

The question of privacy comes up gently but repeatedly. We know that these families have invited Meehan — and they seem to have tidied up (as anyone would) — but it's hard not to imagine other, less sympathetic visitors searching the same grounds. One picture in particular seems to bolster itself against this weight: A wooden door is posted with an illustration of Christ knocking on a similar door, along with a hand-made sign that declares "I love you Papi," complete with seven hearts, in bright marker on graph paper. These paper guardians sit above and below a deadbolt, reminding us how tenuous — and tender — this domestic arrangement must be.

In some of the pictures, deportation (or escape?) actually seems imminent. We see a child's packed suitcase, or a bed with just a sheet, and we wonder if the people have been removed not just from the photos but from their homes as well. (Meehan says she recently attended the "deportation party" of one of the families she worked with.) We start to feel eerily like tourists in Pompeii, examining some undetermined state of departure frozen in time. Where did they go? What caused them to leave?

We scavenge the room for clues, but given only a few details of decoration — along with their countries of origin — we strain to imagine the actual inhabitants. How long have they been here? Where do they work? Of course, the photos don't divulge this information, so the more we look, the more we're left confronting our own ignorance.

Our emotions, whatever they may be, struggle to fill the void. Along with their physical attributes, we are left to imagine the privation of their home countries, the harrowing border crossings, the unknowing children. Without being able to see the people who hover just outside the camera's frame, our feelings have no place to land. Our own experience of immigration, our political views, even the order in which we see them can determine, from one moment to the next, whether we find these images beautiful or repellent, exotic or familiar, interesting or banal. Still, the pictures do not put forth a political argument, or attempt to fully catalog the experience, or even make an overtly emotional appeal.

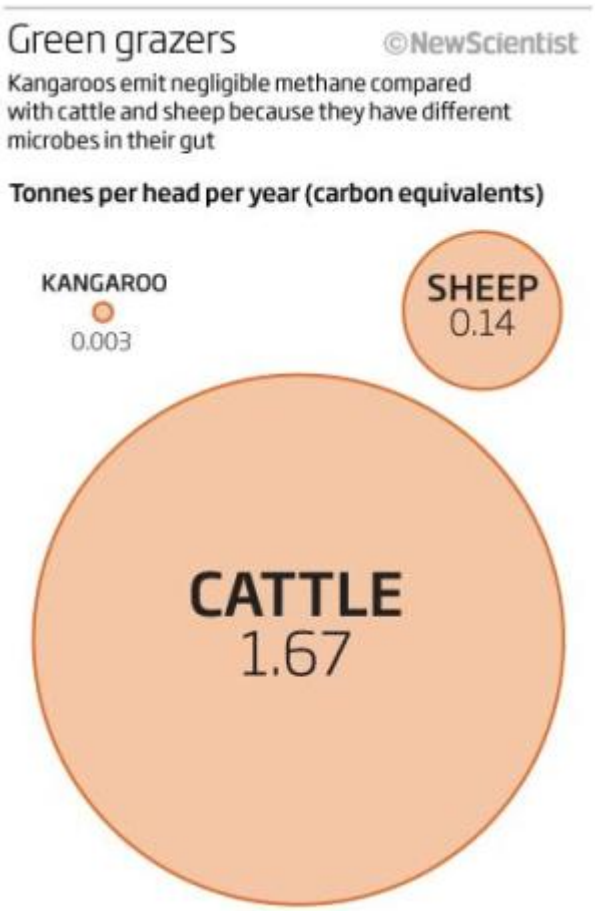
Instead, they withdraw, modestly offering us a space (technically someone else's) where we can ourselves encounter certain aspects of an undocumented life. In a literal sense, the immigrants themselves do of course remain unseen, but their endeavors to raise children, to earn a decent living, to build somehow a more dignified life — all of this is suddenly made visible. As these pictures shift our focus from border patrols and state legislatures to the human particulars of individual homes, they orient us away from willful neglect and toward these lives as they are actually lived.

Dushko Petrovich, a painter and critic, teaches at Boston University and is a founding editor of Paper Monument. ■

http://www.boston.com/bostonglobe/ideas/articles/2010/10/03/invisible_america/

Eating Skippy: Is kangaroo the kindest meat?

- 06 October 2010 by **Wendy Zukerman**
- Magazine issue 2781.



Green grazers

*Can kangaroo meat's green credentials convince a dedicated veggie to turn kangatarian? **New Scientist** goes hunting for an answer*

CAUGHT in the spotlight, the large kangaroo watches us impassively before returning to its grazing. After checking through his rifle sight, Tom Garrett slides on his ear defenders and advises me to do likewise.

As a vegetarian for the past 10 years, I'm an unlikely candidate for a hunting party. But considering my plans, shouldn't I take a look for myself at how these animals are slaughtered? You see, I'm thinking of becoming a kangatarian - someone who eats no meat apart from kangaroo.

One reason for the dietary switch is personal. After a long battle with anaemia that is hard to combat with iron tablets, I feel that what my body really needs is the occasional hunk of red meat.

But there are other factors involved. Kangaroos are arguably the most ethically and environmentally sound source of meat on the planet. The animals whose flesh ends up on supermarket shelves live wild before dying a humane death. They have a different digestive system to ruminants like cattle and sheep, so emit negligible methane, making roo meat the number one choice for combating global warming. What's more, one kangaroo

consumes about a third as much plant material as a sheep, and just 13 per cent of the water. This is a significant benefit in a country that suffers periodic droughts, which climate change may worsen.
Kangaroos are culled to keep their numbers down, but with demand for kangaroo meat limited, most animals end up as pet food or are left to rot. What if, instead of treating them as a pest, Australia started farming kangaroos in earnest?
There would be practical difficulties to overcome, not to mention significant resistance from animal rights groups. But shifting away from cattle and sheep farming towards kangaroos would allow the country to reduce its methane emissions and water consumption in one fell swoop. "For greenies who care about environmental issues, kangaroo meat is perfect," says Garrett, a professional kangaroo harvester.
Kangaroo numbers have been on the rise ever since Europeans settled in Australia around 200 years ago. Farmers dug waterholes and killed predators such as dingoes and wedge-tailed eagles, giving roos an easy life. There are now thought to be more than 50 million kangaroos in Australia.

TV star

Kangaroos have long been culled to stop them overgrazing the land and outcompeting livestock, especially during droughts. In the 1950s an industry started to make use of the meat and skins, with the excess exported to Europe. It is now a highly regulated industry, to ensure the harvest is sustainable. Only four species can be shot, and the maximum quota is 20 per cent of the kangaroo population in the areas where harvesting is permitted, which equates to about 4 million animals a year. Extra licenses can be granted purely to stop local overgrazing.
Kangaroo meat was not available in Australia for human consumption until 1980 - 20 years later than most countries it was exported to. There were mixed reactions to the idea of eating a charismatic wild animal that features on the Australian coat of arms and in children's TV shows like *Skippy the Bush Kangaroo*. Many animal rights groups remain opposed to kangaroo harvesting, saying it is cruel, not only to the adults that are shot, but also to their joeys. Do they have a point?
By law, adult kangaroos must be killed by a shot to the head from a high-powered rifle. A report published this year by the animal welfare group RSPCA Australia says this leads to instant insensibility quickly followed by death. Kangaroo harvesters are good shots: according to the report, around 95 per cent of carcasses were indeed shot in the head.
Things get more complicated if the roo is female. A doe usually has a young joey in her pouch, and by law it must be dispatched by a blow to the head. In practice, it is coshed with a metal pipe or swung against the side of a truck. "Blunt trauma is an aesthetically displeasing procedure, but when done correctly is an acceptable method of euthanasia," says the RSPCA report.
A doe usually also has a joey that is "young at foot" - in other words, still hanging around its mother. By law these joeys should be shot as well, but they can be hard to identify because they may be not be close to their mother when she is killed. Inevitably some joeys will be overlooked.
Animal rights groups, such as Australia's Voiceless, say any orphaned young at foot will starve to death. But Adam Munn, a marsupial biologist at the University of Wollongong, New South Wales, says no one knows exactly how old a joey must be to survive without its mother. He adds, though, that even if orphaned joeys could fend for themselves, "it's possible that the young will die from stress as they are looking for their mother". The RSPCA report says the fate of the young at foot remains an open question that "cannot go on being ignored".
The fate of young-at-foot joeys remains an open question that cannot go on being ignored
This dispute over animal welfare got me thinking that before quitting vegetarianism, I ought to see how kangaroo meat gets from the grasslands to the kitchen. So I arranged to meet Garrett in Amby, Queensland.
On the night we go hunting, it's cold and wet. "Just like us, kangaroos don't like the rain," Garrett says. Usually he wouldn't bother hunting roos in this weather, but as I'm here we drive to Amby Hills, an area covering 10,000 hectares and brimming with the beasts. Once there, Garrett flicks on a spotlight on the top of the truck, readies his rifle and scans for pairs of ears poking out of the grass.
Garrett spots a roo about 90 metres away. I hold my breath. "It's a female," he sighs, and drives on. This is how Garrett says he avoids "the joey issue" - by killing only males. He has another incentive to do so: harvesters are paid by the kilogram, and males are bigger than females.

While driving, Garrett continues scanning the grasslands with his spotlight. Suddenly he stops. The light has picked out a kangaroo about 60 metres away. Garrett looks through his rifle sight and confirms that he has found a buck. He squeezes the trigger and the roo goes down, shot in the head. By the time we drive up, it is dead. Garrett cuts the aorta, letting it bleed, and removes the head, claws and guts. He then hooks the roo to the back of the truck and drives on. "When you put cows into the abattoir they are moaning and distressed," says Garrett. "Did you see any distress in that roo before I shot it?" I gulp, but I have to admit he's right. Cows going into the abattoir are moaning and distressed. Did you see any distress in that roo before I shot it? The experience convinces me that kangaroos can be harvested humanely. Another big plus is the meat's green credentials. Numerous academics and lobby groups are calling for the kangaroo meat industry to be ramped up as a way of tackling Australia's methane emissions.

Environmental scientist and campaigner Tim Flannery, who was chairman of the Copenhagen Climate Council, is a fan of kangaroo harvesting. Invited to make the prestigious Australia Day address in 2002, he said in his speech: "I look forward to the day when we forget about whether it's a pie or a souvlaki that's being eaten, and ask instead what the meat is - whether it's sustainably harvested kangaroo, or beef from a polluting feedlot."

So what might a kangaroo farm look like? Not like a traditional livestock farm, says John Kelly of the Kangaroo Industry Association of Australia. For one thing, it would not have fences, as they would have to be around 3 metres high to keep in a kangaroo and would be too costly. In any case you wouldn't want to confine kangaroos because they have a low stress threshold. When chased, captured or even handled, they can get a rush of adrenaline leading to a condition called capture myopathy. This causes muscle damage and gives the meat a bad taste.

The only option, Kelly says, would be a kind of kangaroo ranch, with the animals allowed to roam more or less where they like, as happens with cattle in Australia's extensive rangelands. Farmers would merely manage the land to encourage roo breeding, by reducing other livestock, encouraging the right grasses and digging waterholes.

Those who are opposed to kangaroo farming say this calls its green credentials into question. "If we want to ramp up the numbers, we need to maintain artificial watering points throughout the landscape, which are environmentally detrimental because you favour water-dependent species," says David Croft of THINKK, a group that studies kangaroos at the Institute for Sustainable Futures in Sydney.

Kangaroo farmers would also face problems if an area becomes overgrazed. Unlike cattle, kangaroos can't simply be moved onto another pasture, due to capture myopathy. And because they need such large areas for grazing, irrigation becomes impractical, says Steve McLeod of the New South Wales government's Vertebrate Pest Research Unit.

On my hunting expedition with Garrett, the rain gets steadily worse, and we head home after 20 minutes without spotting another kangaroo. This highlights another problem with kangaroo harvesting - it can be a haphazard affair.

Still, none of these problems seems insurmountable. Farmers can probably increase the supply of kangaroo meat, assuming the public develops more of an appetite for it. Although kangaroo is available in shops and restaurants, most Australians see it as an occasional treat rather than a staple like chicken or beef - a bit like venison in the UK. A 2008 survey of 1590 Australians found that only 15 per cent eat kangaroo at least four times a year. The survey found that people were put off eating kangaroo because it is expensive and they were not sure how to cook it (for some ideas, see "Lean cuisine"). The government could, if it chose, tackle both issues easily enough with subsidies and advertising campaigns. Kangaroo meat even ticks the healthy eating box, as like all game it has little saturated fat.

The joey issue need not be a deal-breaker. Already, about 70 per cent of the animals brought to processors are males, suggesting that other harvesters follow Garrett's strategy. If the public becomes more concerned, the government could mandate that only males be shot. More realistically, some farms might decide to introduce "males only" policies on ethical grounds, in the same way that chicken farms can be free-range or battery.

If a fifth of Australia's beef consumption were replaced by the same quantity of kangaroo meat, the country's greenhouse gas emissions could be cut by up to 16 megatonnes a year, or 3 per cent, according to a team at Australian Wildlife Services, a consultancy in Canberra (*Conservation Letters*, vol 1, p 119).

That might not sound like much, but it represents a 28 per cent cut in emissions from agriculture. What's more, it is an attractive option compared with other schemes, such as carbon capture and storage, which will require expensive new infrastructure. Another plan, to reduce livestock's methane emissions by changing their gut microbes, might well need another 20 years of research before it can be implemented.

Bouncing to freedom

In contrast, boosting kangaroo farming is "very doable", says George Wilson, one of the authors of the Australian Wildlife Services study, "just by working with an industry that already exists". As for cattle and sheep farming, they could be gradually scaled down while kangaroo ranching is scaled up.

Could kangaroos be the answer for other countries looking to cut methane emissions? Unlikely, says McLeod. Kangaroos' vulnerability to capture myopathy would preclude exporting them en masse, and they reproduce too slowly for a population to be bred from scratch. Even if those obstacles could be overcome, wannabe roo farmers would face their new stock bouncing off to freedom, since they can't be fenced in. Still, Munn points out that, in New Zealand at least, there are islands with feral populations of kangaroos and wallabies. "As long as the climate and feed are suitable then I don't see why not," he says.

The morning after my night of kangaroo hunting, I head outside to shoot some kangaroos of my own - with a camera, that is. From a distance I see them munching the grass and hopping around with their friends. So can I bring myself to eat one?

For a slew of unscientific reasons, I remain reluctant. I'm not completely comfortable with an animal dying for my benefit. But a few weeks later my housemate, having debated the ethics with me, cooks up a kangaroo stroganoff and hands me a plateful.

I hesitate, then tuck in. After a decade of vegetarianism I can hardly remember what meat tastes like, but this seems nice enough. Pretty soon I have scoffed the lot. So for now, my blood cells are happily brimming with iron. But I won't be eating Skippy again until I really need to.

Lean cuisine

With its low fat content, kangaroo meat can become dry if cooked for too long. "Once you overcook it, it is very tough," says Sam Liu, chef at Vons Restaurant in Melbourne, Australia, where the signature dish is kangaroo with spicy plum sauce.

With a prime cut, such as fillet or loin, Liu recommends cooking it medium rare: sear it quickly under a hot grill, then put it in the oven for 5 minutes. "It's the best way to eat kangaroo," he says.

For a stir-fry, he suggests sautéing a fillet for 3 to 5 minutes, then removing it from the pan. Next you cook the vegetables in the wok while thinly slicing the fillet, to be added to the vegetables immediately before serving.

Up for an Aussie barbie? To make roo burgers, take 500 grams of ground kangaroo meat, 200 grams of breadcrumbs soaked in milk, two eggs, and spices. Combine in a bowl and make patties. Place them on a hot, oiled barbecue and cook for 5 minutes a side.

Wendy Zukerman is an Asia Pacific reporter for New Scientist

http://www.newscientist.com/article/mg20827811.400-eating-skippy-is-kangaroo-the-kindest-meat.html?full=true&print=true

How to find out if exo-Earths host life

- 06 October 2010 by **David Shiga**

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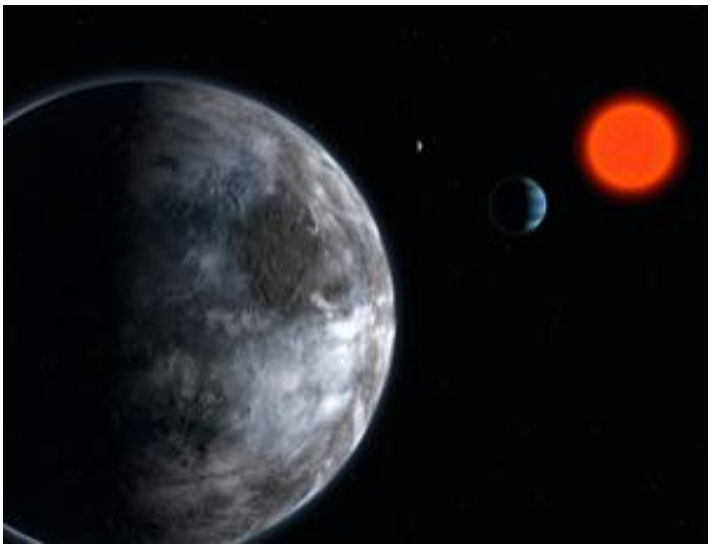

Gliese 581 g: the first of many Goldilocks planets (Image: L.Calçda/ESO)

SO CLOSE, yet so far. Gliese 581 g is the first planet discovered that is the right mass and distance from its star for the surface to be awash with liquid water and perhaps life. Chances are we'll never know for sure without an armada of space telescopes, and their future looks uncertain. But a 2014 mission could tell us whether any habitable worlds with better viewing angles have signs of life.
Gliese 581 g is 20 light years from our solar system and three to four times as massive as Earth. The planet is likely to be rocky and lies squarely in the habitable zone around its star, where temperatures are just right for liquid water to exist on its surface.
To find evidence for life we would need to measure the light spectrum of the planet's atmosphere and look for the signature of water vapour, as well as possible by-products of life, such as oxygen and methane.
That would mean launching an expensive array of space telescopes to tease out the faint glow of the planet from the powerful glare of its star. NASA and the European Space Agency were hoping to launch such a mission in 2014, called the Terrestrial Planet Finder (TPF), or Darwin.
But in 2006 NASA backed away from the mission, postponing it indefinitely to free up more funds for human space exploration. Darwin/TPF was dealt another blow this August, when a key panel of US astronomers failed to recommend its construction in the next decade.
All is not lost, however, according to Paul Butler of the Carnegie Institution in Washington DC, co-discoverer of the new planet. He says the ground-based instruments that helped him discover it should soon turn up a flood of worlds in the habitable zones of their stars. "Over the next 10 years, I would be shocked if there weren't many tens of these things," he says.
About 5 to 10 per cent of these should, unlike Gliese 581 g, pass in front of their parent stars as seen from Earth, making it easier to measure their atmospheric spectra, Butler says. The James Webb Space Telescope could make such observations after it is launched in 2014, at least for the nearest stars (*New Scientist*, 16 May 2009, p 10). We may not have to wait too long before we see signs of a planet with life.

http://www.newscientist.com/article/mg20827813.500-how-to-find-out-if-exoearths-host-life.html?full=true&print=true

Black widow pulsar is fattest collapsed star yet

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Eating its way to new extremes (Image: NASA/CXC/M. Weiss)

A CANNIBALISTIC collapsed star is growing so fat from the partner it is slowly devouring that it is likely to be the most massive neutron star yet measured. The observation suggests that neutron stars can grow much bigger than previously thought before collapsing to become a black hole.
The star in question is a "black widow" pulsar, a type of rotating neutron star that is highly magnetised. It rotates in tandem with a smaller partner, which its gravitational field slowly destroys.
Previously the most massive neutron star known was between 1.66 and 1.68 times as massive as the sun. Now Marten van Kerkwijk of the University of Toronto, Canada, and his colleagues estimate that the black widow pulsar B1957+20 (depicted right) is 2.4 solar masses (arxiv.org/abs/1009.5427).
This rules out the popular "Brown-Bethe" model, which says the maximum mass for a neutron star is about 1.5 solar masses before collapse into a black hole is inevitable, as well as other models.
"Two solar masses would exclude a whole bunch of models and 2.4 solar masses would blow just about anything away," says co-author Shrinivas Kulkarni of the California Institute of Technology in Pasadena.

http://www.newscientist.com/article/mg20827814.100-black-widow-pulsar-is-fattest-collapsed-star-yet.html?full=true&print=true

Sun's activity flies in face of climate expectations

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Not behaving quite as expected (Image: Paul A. Souders/Corbis)

IF NEW satellite data can be trusted, changes in solar activity warmed the Earth when they should have cooled it.

Joanna Haigh of Imperial College London studied satellite measurements of solar radiation between 2004 and 2007, when overall solar activity was in decline. The sun puts out less energy when its activity is low, but different types of radiation vary to different degrees. Until now, this had been poorly studied.

Haigh's measurements showed that visible radiation increased between 2004 and 2007, when it was expected to decrease, and ultraviolet radiation dropped four times as much as predicted.

Haigh then plugged her data into an atmospheric model to calculate how the patterns affected energy filtering through the atmosphere. Previous studies have shown that Earth is normally cooler during solar minima.Yet the model suggested that more solar energy reached the planet's surface during the period, warming it by about 0.05 °C (*Nature*, DOI: 10.1038/nature09426).

The effect is slight, but it could call into question our understanding of the sun's subtle effects on climate. Or could it? Stefan Brönnimann of the University of Bern in Switzerland says Haigh's study shows the importance of looking at radiation changes in detail but cautions that the results could be a one-off. He points out that the sun's most recent cycle is known to have been atypical

http://www.newscientist.com/article/mg20827813.700-suns-activity-flies-in-face-of-climate-expectations.html

Breaking the noise barrier: Enter the phonon computer

- Updated 14:06 07 October 2010 by **Justin Mullins**
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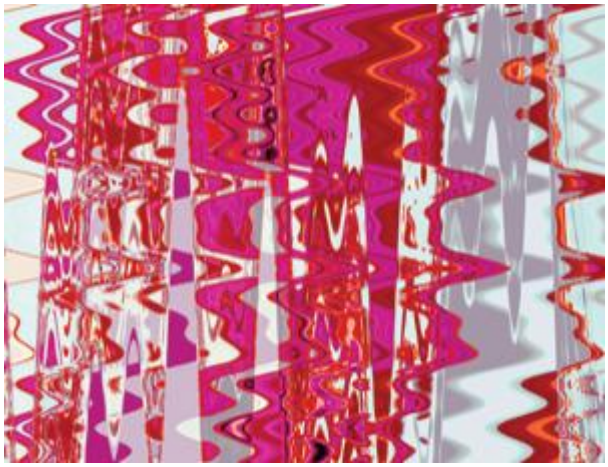


Noise: drowning out data or part of the solution? (Image: Ulrike Klingseis/Superstock)

Noise is a chip designer's worst enemy. But handled properly it could become a powerful ally – and usher in the age of phonon computing

In 2001, Pat Gelsinger, then the chief technology officer of Intel, made a striking prediction about the future of microchips. If current design trends continue, he said, microchips will be running at 30 gigahertz by the end of the decade. However, he added, at this speed they will be generating more heat per cubic centimetre than a nuclear reactor.

Sure enough, by 2003, Intel and other chip-makers had found that their plans for faster processors were running into trouble. For a chip to speed up, its transistors need to be shrunk, but smaller transistors must consume less power or they overheat. With chip-makers unable to keep to the reduced heat budget, the race for faster chips hit a wall (see diagram).

At best, today's microprocessors can operate at just 3 GHz or so. To deliver a major performance boost, chip-makers have resorted to putting several processors, or cores, on the same chip. This keeps heat at manageable levels. Just.

Designing transistors that need far less power is, it turns out, no easy task. One of the main reasons is that microchips still require plenty of power to overcome electrical noise, which tends to flip the 1s and 0s in digital data, destroying information. The codes that computers rely on to transmit information have built-in checks to combat this.

The effects of noise become more serious in chips that run at low power since the actual signals being handled by a chip become smaller and can be more easily overwhelmed. The worry is that low-power chips will never be possible because a sea of noise will always drown the information they are trying to process. Noise, it seems, is a fundamental barrier for chip designers.

Yet a growing number of researchers and chip-makers are exploring ways to overcome noise, and the signs are encouraging. New insights into the role of noise are allowing them to build processors that can not only tolerate noise but actually exploit it to perform calculations.

Unexpected boost

This could lead to a new generation of nanoscale devices that can manipulate noise, just as existing devices manipulate electrons. In fact, it may one day be possible to use noise itself to store, carry and process

information, opening up a new era of ultra-low-power computing. A chip designer's worst enemy could turn out to be a powerful ally.

Electrical noise - essentially any unwanted signal - can arise from a number of sources. One of the most common is heat, which can increase the random motion of atoms and electrons in the metals or semiconductors of circuit components. This can lead to unwanted fluctuations in current or voltage. If the magnitude of this noise is large enough it can turn an electronic circuit to junk.

Though digital circuits are more resistant to noise than analogue designs, they remain vulnerable. To see why, think of a digital switch such as a transistor. It works by producing either a low or high voltage as an output, the equivalent to a 0 or 1. If the input voltage rises above some threshold, the output jumps between these states. So if the magnitude of the electrical noise exceeds this threshold, it can flip the state of the switch, leading to errors. No wonder, then, that microchips are fitted with heat sinks and fans.

Yet electrical noise isn't always bad news. We have known for decades that the presence of noise can improve the performance of certain switch-like systems. If the noise level is just below the threshold needed to flip the state of the system, even a tiny input voltage is enough to change the system's state. In effect, the noise increases the sensitivity of the switch - a phenomenon called stochastic resonance. When it occurs in neurons, for example, the process can sharpen our senses (*New Scientist*, 21 June 2008, p 42).

Vital component

This raises the curious prospect that noise could actually be used to improve the performance of electronic circuits. For example, Luca Gammaitoni, a physicist at the University of Perugia in Italy, recently unveiled a type of switch known as a resonant tunnelling diode that benefits from noise in exactly this way. His device can tolerate noise levels that are as large as the input signal itself (*Applied Physics Letters*, DOI: 10.1063/1.3302457).

This kind of assistance needn't be limited to conventional electronic devices. Raj Mohanty at Boston University and colleagues have harnessed noise using a bar of silicon just 20 micrometres long and 300 nanometres wide. This bar naturally vibrates at 3.145 MHz, but apply an alternating voltage and it vibrates more quickly or slowly.

A plot of the bar's vibrational frequency against the applied voltage reveals a strange effect, however. Raise the voltage and the bar vibrates faster. Now lower the voltage to its previous value and the bar's vibrations slow down, but not to the original frequency. This phenomenon, known as hysteresis, means that for a given voltage there are two corresponding vibrational frequencies for the bar. Which one is actually observed depends on whether the voltage has been increased or lowered to the required value. That makes Mohanty's silicon bar a kind of nanomechanical switch in which the two voltages are inputs representing a 0 and a 1, and the output depends on whether the input is rising or falling.

By simultaneously applying two high-frequency voltages, each of which can be taken to represent either a 0 or a 1, Mohanty devised a way to ensure that the bar's output is 0 unless both inputs are 0, in which case the output is 1. He had built a logic gate - to be precise, a NOR gate.

But there's another important factor in this process: background noise. The exact shape of the hysteresis curve is very sensitive to it. Add slightly more or less noise and the characteristics of the switch change, turning it into a different kind of logic gate. By carefully controlling the noise level, Mohanty can make the bar behave as a NOR gate, an OR gate, an AND gate or a NAND gate - all the logic gates necessary to build a computer (*Nano Letters*, DOI: 10.1021/nl9034175).

Although nanomechanical logic gates are slow compared with conventional switches, they consume two orders of magnitude less power than their conventional cousins. "There's huge potential for these switches, especially in power-hungry devices," says Mohanty. He has in mind remotely operated sensors and processors that may need to work for years without fresh batteries. Nanomechanical versions of these devices could be ready in five to seven years, he says.

In the meantime, noise-based logic may be possible on a much grander scale. For the last couple of years, Laszlo Kish at Texas A&M University in College Station and colleagues have been working on the theoretical properties of a logic system that uses large-scale random noise signals. Their idea is to represent the 0s and 1s of digital signals not using voltage levels as in conventional computers, but using the presence or absence of noise.

Because noise is random, it's easy to imagine that noise created by different sources is identical. In fact the opposite is true - noise has a pattern that is characteristic of its source. It is this that makes it possible to keep track of different noise signals and compute with them, says Kish. What's more, any background noise will be different from the noise signals we are working with, making it possible to subtract its effect.
In Kish's scheme, representing a single bit of information requires two independent sources of noise, one representing a 0 and the other a 1, while a string of *n* bits requires 2n sources. That's not a problem, Kish says: transistors can be a good source of noise when operated at low voltage, and we can already fit billions of them on a chip.
Earlier this year Kish and his collaborators published a claim more significant still: that noise signals can be superimposed and sent through a single wire without losing their identity. By operating on a composite signal, or superposition, it becomes possible to carry out two or more calculations simultaneously - much the same trick that quantum computers exploit to speed up calculations. Kish says this kind of logic is especially suited to certain types of calculation, but he and his colleagues are still trying to quantify exactly how this can be realised in practice. So far they have simulated basic circuits for generating composite noise signals, as well as noise-based AND and OR logic gates, among other components. Eventually these could provide fast, low-power processing, they say.
By superimposing noise signals, it becomes possible to carry out two or more calculations simultaneously - much the same trick that quantum computers exploit
Kish's noise-based logic scheme raises another intriguing prospect. Since natural systems have evolved not only to cope with noise but to exploit it, as neurons do with stochastic resonance, could it be that nature has also learned to compute with noise? Kish and his collaborator Sergey Bezrukov of the National Institutes of Health in Bethesda, Maryland, think so. They say their logic scheme could help explain some of the features of neural activity in mammals, such as the delays that seem to occur in certain neural signals. They also suggest a hypothetical scheme by which the brain could efficiently route and encode information using a superposition of noisy neural signals (*Physics Letters A*, DOI: 10.1016/j.physleta.2009.04.073).
Kish's noise-based logic scheme raises another intriguing prospect: could it be that nature has also learned to compute with noise?
We're still a long way from understanding how the brain processes information, says Gammaitoni, who suggests that some radical rethinking may be necessary before we can untangle the details. What is clear is that nature has evolved to cope with noise far more efficiently than conventional electronics can. Whatever new picture of biological computation emerges, it looks as if noise will play a central role.
When this article was first posted, the sentence "In Kish's scheme, representing a single bit of information requires two independent sources of noise, one representing a 0 and the other a 1, while a string of n *bits requires 2n sources" mistakenly referred to "2*^{n} *sources".*

Circuits run on heat

The latest transistors measure just 22 nanometres across, but chip-makers plan to shrink them further still. That means heading into unfamiliar territory, for the properties of materials change when devices are just nanometres across.
At this scale, noise and heat are essentially indistinguishable, manifesting themselves as vibrations in the lattice of atoms forming the material from which the chip is carved. These vibrations can be thought of as quantum objects called phonons, and the study of noise boils down to understanding their physics.
That's hugely challenging, says Luca Gammaitoni of the University of Perugia in Italy. Phonons interact with atoms, electrons and electric fields, or even with each other, in a complicated and non-linear fashion, so a small change in the lattice can lead to a huge change in phonon behaviour.
Nonetheless, the emerging discipline of phonon engineering could lead to devices in which phonons themselves are the information carriers. Instead of hindering the flow of information, noise could actually carry it.
Physicists have already shown that the phonons in a row of ions can behave rather like a computer. Information can be "written" to one ion by zapping it with a laser to change its state. This also modifies the electric forces between the ions, changing the way the row vibrates. Phonons, representing the collective

motion of the row, in effect share the data between the ions, allowing them to "process" it. When processing is complete, the ions can be made to release the "answer" as a photon.
Of course there are important differences between the phonons in a string of ions and those in an ordinary material. The former system is a laboratory creation in which the ions are trapped by an electric field, then cooled and kept isolated from the environment to preserve the quantum information. Phonon behaviour in a solid under everyday conditions is much more complex.
That's not to say that phonon information processing is a lost cause. Far from it. Devices are being built that can manipulate phonons, allowing them to flow in one direction only, for example - the thermal equivalent of a diode.
In 2006, a team led by Alex Zettl at the University of California, Berkeley, showed how this could be done using carbon nanotubes. Zettl embedded the tubes in an asymmetric pile of heavy molecules. The effect was to make each tube behave as if it was more dense at one end than the other. He then measured the way that heat passed along the tubes and found that the flow was greatest towards the "low density" ends. In other words, the phonons moved more easily in one direction than the other (*Science*, DOI: 10.1126/science.1132898).
These thermal diodes could have a number of applications, such as improving the efficiency of thermoelectric converters. This may make it possible to harvest enough heat energy from the environment to power future generations of low-power microchips, doing away with batteries entirely.
The work also indicates that thermal equivalents of electrical circuits are possible. "But we need to prove we can do logic with these devices," says Clivia Sotomayor Torres, an expert on phonons at the Catalan Institute of Nanotechnology in Barcelona, Spain.
Justin Mullins is a consultant at New Scientist

http://www.newscientist.com/article/mg20827801.500-breaking-the-noise-barrier-enter-the-phonon-computer.html

Tune in to the live whale song network

- 16:26 08 October 2010 by **Andy Coghlan**
-

Do you do requests? (Image: Reinhard Dirscherl/Visuals Unlimited/Getty)

Just 2 minutes ago, a sperm whale swam by about 4 kilometres south of Cassis on the French Mediterranean coast. From my desk in London, I heard its whistle. Thanks to a new website, so can you.

The LIDO (Listening to the Deep Ocean Environment) site offers a live feed to 10 hydrophones sprinkled around European waters, and one in Canada. Several more are scheduled to come soon in Canada and in Asia. The network's primary aim is to record and archive long-term subsea noise so that researchers can study the effects of human activity on whales and dolphins.

It is the brainchild of Michel André, a bioacoustician at the Technical University of Catalonia in Barcelona, Spain. He and his colleagues have spent the past 10 years placing hydrophones on the seabed, on existing research platforms that monitor earthquakes and tsunamis, for instance, or detect neutrino particles from space.

"These observatories were already cabled to shore for geophysics and astrophysics data monitoring, so we took advantage of the existing network to install real-time acoustic data hubs on them," says André, who will demonstrate the system next month at a meeting on underwater acoustics technology in Rio de Janeiro, Brazil.

Name that song

"The system is powered from the shore, and streams audio data to a server where the signals are analysed and published directly on the internet," he says.

An algorithm developed by André's laboratory filters the different frequencies in the signal to identify specific sounds, including the songs of 26 species of whales and dolphins, and noise from human activities such as shipping, wind farms, oil and gas drilling, and seismic testing.

"It's the first time we have been able to monitor acoustic events on a large temporal and spatial scale," says André. Until now, most experiments to monitor subsea noise have used temporary hydrophone installations and lasted only weeks.

Noise-shy sea life

With more hydrophones in the network the new system could reveal the effects of noise pollution on whales. Hydrophones can pick up sounds from baleen whales hundreds of kilometres away, so installations in different places could be used to triangulate an animal's position and track its course. It should therefore be possible to determine if animals change course in response to bursts of noise, or alter their preferred routes because of new sources of noise like shipping routes or harbours.

"The data should help us understand whether long-term exposures, in areas with intense shipping, for instance, make animals move out of that area," says Roger Gentry, an adviser for the E&P Sound and Marine Life Joint Industry Programme, set up in 2006 by the International Association of Oil and Gas Producers to investigate the effects of noise pollution on marine life.

"André deserves a lot of credit for thinking in broad terms and using modern technology to make the oceans and marine mammals more familiar and accessible to us all."

André says that it would be possible to place hydrophones on buoys around industrial offshore platforms and include these in the network. They could then provide real-time alerts when whales and dolphins pass nearby, so that noisy operations could be put on hold.

http://www.newscientist.com/article/dn19564-tune-in-to-the-live-whale-song-network.html?full=true&print=true

Stuxnet: the online front line

- 08 October 2010 by **Paul Marks**
- Magazine issue 2781.

Forecasts of cyberwar have been dismissed as hype, but the worm running rampant through Iran's nuclear facilities suggest otherwise, says ***Paul Marks***

IS CYBERWARFARE (a) one of the biggest threats of the 21st century or (b) an elaborate hoax designed to extract money from gullible governments? Stuxnet, the computer worm running rampant in Iran's nuclear facilities, tells us the answer. An analysis of the worm by computer security company Symantec makes it abundantly clear that a few lines of malicious computer code can trip electricity grids, burn out power-station generators, pollute water supplies and sabotage gas pipelines. That cyberattacks can become real-world attacks is no longer a matter of conjecture.

To date, most attacks on computer networks have stayed firmly in the virtual world. In April 2007, for example, Estonia's e-infrastructure was crippled by cyberattacks, supposely at Russian hands after a diplomatic spat over Soviet-era war graves. But since most of us can cope without e-banking, e-commerce or public-service websites for a few hours, those demanding expensive defences to deal with the threat of cyberattacks have often been accused of exaggerating.

Stuxnet shows they were not. Where regular worms merely infect computer systems, stuxnet can reach out into the physical world. It uses vulnerabilities in Microsoft Windows to give an attacker remote control of the specialised factory-floor computers used to control industrial processes. These programmable logic controllers (PLCs) do not run everyday computer languages: each type of machine has its own customised language.

Stuxnet is the first worm designed to attack a PLC in its own language. Its target is one of the most popular models, made by Siemens and used to run oil pipelines, power grids and nuclear plants. The worm can allow attackers to run motors so fast they burn out, to turn off alarms and safety cut-offs, open effluent valves and activate pumps - in other words, carry out industrial sabotage and skulduggery on a massive scale.

The worm allows attackers to carry out industrial sabotage and skulduggery on a massive scale

Stuxnet's origin was unknown as *New Scientist* went to press. Iran suspects the Pentagon or Israel (a biblical reference in its code lends some credence to that claim, and more than a whiff of Dan Brown). Regardless of who wrote it, cyberwar just got real.

Paul Marks is New Scientist's chief technology correspondent

http://www.newscientist.com/article/mg20827815.200-stuxnet-the-online-front-line.html?full=true&print=true

Body organs can send status updates to your cellphone

- 08:00 08 October 2010 by **Duncan Graham-Rowe**

For cardiac patients such as myself, too much excitement can be a shocking experience. If my heart rate gets too high the implanted defibrillator in my chest can think I'm having a heart attack and give me a friendly remedial shock. But such nasty surprises could soon become less of a concern for people like me – by giving our hearts their very own IP addresses.

Dutch research organisation IMEC, based in Eindhoven, this week demonstrated a new type of wireless body area network (BAN). Dubbed the Human++ BAN platform, the system converts IMEC's ultra-low-power electrocardiogram sensors into wireless nodes in a short-range network, transmitting physiological data to a hub – the patient's cellphone. From there, the readings can be forwarded to doctors via a Wi-Fi or 3G connection. They can also be displayed on the phone or sound an alarm when things are about to go wrong, giving patients like me a chance to try to slow our heart rates and avoid an unnecessary shock.

Julien Penders, who developed the system, says it can also work with other low-power medical sensors, such as electroencephalograms (EEGs) to monitor neurological conditions or electromyograms to detect neuromuscular diseases. Besides helping those already diagnosed with chronic conditions, BANs could be used by people at risk of developing medical problems – the so-called "worried well" – or by fitness enthusiasts and athletes who want to keep tabs on their physiological processes during training.

Tied to an Android

IMEC's technology is not the first BAN, but integrates better than earlier versions with the gadgets that many people carry around with them. IMEC has created a dongle that plugs into the standard SD memory card interface of a cellphone to stream data from the sensors in real time and allow the phone to reconfigure the sampling frequency of sensors on the fly. The associated software runs on Google's Android cellphone operating system.

However, IMEC has eschewed common short-range wireless standards such as Bluetooth in favour of the so-called nRF24L01+ radio designed by Nordic Semiconductor in Oslo, Norway. "The problem with Bluetooth is that it will increase the power consumption on the sensor side," says Penders. Using the Nordic system, IMEC's sensors can run continuously, transmitting every 100 milliseconds, for up to seven days between recharges – a Bluetooth system would barely last a day, Penders says.

In the current design, the ECG electrodes are connected to a small necklace that contains the transmitter and battery. The next step will be to use an ultra-low-power radio transmitter, still in development at IMEC, to improve the stamina and portability of the sensors.

With around 18 million people in the UK living with chronic disease, "telehealth" monitoring like this is the way things are going, says Mike Knapton, associate medical director at the British Heart Foundation. Devices already exist that allow people with pacemakers and defibrillators to send telemetry from their implants via a landline to doctors. But using mobile phones would be the natural next step, he says.

Penders presented the work at the Wireless Health Conference in San Diego, California, this week.

http://www.newscientist.com/article/dn19556-body-organs-can-send-status-updates-to-your-cellphone.html

Exoskeleton helps the paralysed walk again

- 18:21 07 October 2010 by **MacGregor Campbell**, Berkeley, California
-

eLEGS is put through its paces (Image: Sarah Peet Photography)

Amanda Boxtel, a wheelchair user, is about to stand up. A skiing accident 18 years ago partially severed her spinal cord leaving her paralysed from the waist down. She slowly pushes herself out of the chair with crutches, teeters backward for a second, then leans forward – and takes a step. Soon she is walking around the warehouse in Berkeley, California, under her own direction.

Boxtel is wearing a new exoskeleton called eLEGS, which could soon help people with spinal injuries to walk with a natural gait. "Walking with eLEGs took some rewiring and relearning," says Boxtel, "but my body has the muscle memory. And I learned to walk really fast."

eLEGS is being readied for clinical trials by Berkeley Bionics, based in Berkeley, California. Unlike other exoskeletons, such as Raytheon's XOS-2, and Berkeley Bionics's HULC, eLEGS is not intended to augment soldiers with super-human strength, but is specifically designed as a rehabilitation device to help restore walking function to people with spinal cord injuries, as well as improving blood circulation and digestion.

Tether me not

The suit consists of a backpack-mounted controller connected to robotic legs. It is driven by four motors, one for each hip and knee. The ankle joint is controlled with passive springs that keep the foot angled so that it can be placed on the ground, heel to toe, as the leg steps. Sensors in the legs relay position information to the control unit, which determines how to bend the joints and, in turn, walk. Onboard lithium-cobalt batteries allow the suit to be operated without a tether to a power source.

While the device can support a wearer's weight, balance is left up to the person, via crutches, which also serve to control the system. To take a step, the wearer pushes down with the crutch opposite to the intended stepping leg. Similar gestures, such as pushing down on both crutches simultaneously, allow the wearer to transition from sitting to standing, or to make turns.

Berkeley Bionics claims eLEGS has the largest range of knee flexion of any exoskeleton, a feature they say offers a more natural gait than other exoskeletons.

Strut their stuff

eLEGS is not the only robotic exoskeleton aimed at restoring walking in paraplegics. ReWalk from Argo Medical Technologies in Haifa, Israel, uses a similar design, with a backpack connected to struts and electric motors that attach to the outside of a person's legs. It is currently being used in clinical trials in the US. AMT claims it will have the suit through the FDA approval process and on the market in 12 to 18 months.

Grant Elliot, an exoskeleton researcher at the Massachusetts Institute of Technology's Media Lab, says rehabilitation devices like eLEGS and ReWalk are promising. Still, he says that attention needs to be paid to such devices to ensure they remain compact enough for their users to move freely without bumping into objects. "Humans are used to moving through human-sized spaces, like narrow hallways," says Elliot.
In a demonstration for New Scientist last week, eLEGS wearers including Boxtel were able to negotiate tight spaces, such as walking between a table and a bin, without difficulty.

John Fogelin, director of engineering at Berkeley Bionics, says the company is working on ways to make the design sleeker by using smaller batteries and thinner struts, aiming for a day when it might be worn underneath one's clothes. The company plans to begin clinical trials in early 2011, and estimates the cost on the market to be in line with that of a high-end wheelchair, around $100,000.

http://www.newscientist.com/article/dn19555-exoskeleton-helps-the-paralysed-walk-again.html

Online army turns the tide on automation

- 16:31 05 October 2010 by **Gareth Morgan**
-

Human help lies within (Image: Noriyuki Araki/Flickr/Getty)

Innovation *is our regular column in which we highlight emerging technologies and predict where they may lead*

Computer automation can take jobs away from people but, thanks to Amazon's Mechanical Turk, humans are fighting back. AMT was inspired by the 18th-century inventor Wolfgang von Kempelen, who dazzled the Roman empress Maria Theresa with a chess-playing automaton. His secret: a human chess master hid inside the machine.

In 2005, online retailer Amazon developed a version that uses a human workforce "hidden" on the internet to solve problems – for a modest price. Typically, the work undertaken is for organisations that need a little human smarts applied to bulk tasks, such as identifying objects in vast collections of images.

An echo of von Kempelen's Turk is found in the offices of robot maker Willow Garage, in Menlo Park, California. Some of the firm's free-roaming robots rely on humans through AMT to help them get their bearings. Whenever one gets lost within the Willow Garage offices, it sends an image to AMT with a request for nearby objects to be identified, using the answers to establish its whereabouts.

Get shorter

At the User Interface Software and Technology symposium in New York City this week there are signs that AMT rivals computer automation on some tasks.

Michael Bernstein at the Massachusetts Institute of Technology, and colleagues, have developed Soylent, an add-on for Microsoft Word that uses AMT workers to check language and grammar. In tests on text from Wikipedia entries, Word's grammar checker picked up about a third of errors; Soylent spotted two-thirds. Solyent's Shortn module tasks the online workers with shortening the text – to meet a word limit, for example. The Word add-on also boasts a macro-writing module, Human Macro, which lets a writer describe how they

want to manipulate text – perhaps changing it into the past tense – without the complication of having to code their own set of instructions within Word.

Say what you see

Meanwhile, Jeffrey Bigham at the University of Rochester, New York, and colleagues, are using the image-analysis capabilities of AMT workers – predominantly based in the US and India – to help the visually impaired. They have created an iPhone app called VizWiz that gets AMT workers to interpret objects in the user's environment – checking the small use-by date on a carton of milk, for example.

The app is able to analyse the iPhone camera's focal length and lens distortion, and data from the built-in accelerometer, to pick out a target object in sufficient detail before sending it. After identification, the result is read aloud.

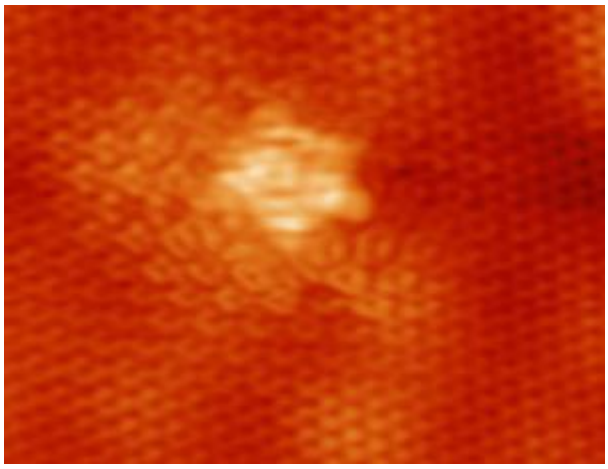
However, despite their lack of real brain power, there is one advantage that computers will continue to hold over their AMT rivals: computers don't charge for their labour.

References: Bernstein's Soylent research paper (pdf); Bigham's VizWiz research paper (pdf)

http://www.newscientist.com/article/dn19544-innovation-online-army-turns-the-tide-on-automation.html

Andre Geim: Why graphene is the stuff of the future

- 11:16 05 October 2010 by **Andre Geim**



Ultra-high vacuum scanning tunnelling microscope image of a point defect in graphene (Image: Nathan Guisinger/Argonne National Laboratory/EMMD Group/ShareAlike 2.0)

***New Scientist** asked Andre Geim, co-winner of the 2010 Nobel prize for physics, to explain the importance of graphene and other 2D materials as part of our forthcoming "50 ideas to change science forever" special. Here's what he wrote*

Everything in our three-dimensional world has a width, length and height. That was what we thought, at least. But this picture overlooks a whole class of materials: crystals one atom or molecule thick, essentially two-dimensional planes of atoms shaved from conventional crystals.

These are turning out to be wonder materials. Take graphene, the single layers of carbon atoms arranged in a honeycomb lattice that my colleagues and I first isolated in 2004. Graphene is stronger and stiffer than diamond, yet can be stretched by a quarter of its length, like rubber. Its surface area is the largest known for its weight.

Despite graphene's thinness it is impermeable to gases or liquids. It conducts heat and electricity better than copper, and can be made into transistors which are faster than those made from silicon.

It makes possible experiments with high-speed quantum particles that researchers at CERN near Geneva, Switzerland, can only dream of.

With such an array of properties, there are high hopes for what we might accomplish with graphene. Optimists say we are entering a carbon age. Even pessimists argue only that the impact will be somewhat less.

Andre Geim is at the University of Manchester, UK

http://www.newscientist.com/article/dn19540-andre-geim-why-graphene-is-the-stuff-of-the-future.html

Scratched glasses give perfect vision for any eyesight

- 04 October 2010 by **Jeff Hecht**
- Magazine issue 2780.

Everything in focus (Image: John Brackenbury/NHPA)

DITCH those bifocals. You might soon wearing spectacles whose lenses allow you to see clearly regardless of how long or short-sighted you are.

With age, the lenses in our eyes often lose the ability to change shape enough to focus light from near objects onto the retina - a condition called presbyopia. This leaves people who were already short-sighted unable to focus on either near or distant objects. Bifocals offer a solution by having two lenses in the same frame, but users must get used to tilting their head up or down to switch focus.

Zeev Zalevsky at Bar-Ilan University in Ramat Gan, Israel, has developed a technique to turn a standard lens into one that perfectly focuses light from anything between 33 centimetres away and the horizon.

It involves engraving the surface of a standard lens with a grid of 25 near-circular structures each 2 millimetres across and containing two concentric rings. The engraved rings are just a few hundred micrometres wide and a micrometre deep. "The exact number and size of the sets will change from one lens to another," depending on its size and shape, says Zalevsky.

The rings shift the phase of the light waves passing through the lens, leading to patterns of both constructive and destructive interference. Using a computer model to calculate how changes in the diameter and position of the rings alter the pattern, Zalevsky came up with a design that creates a channel of constructive interference perpendicular to the lens through each of the 25 structures. Within these channels, light from both near and distant objects is in perfect focus.

"It results in an axial channel of focused light, not a single focal spot," Zalevsky says. "If the retina is positioned anywhere along this channel, it will always see objects in focus."

Zalevsky has fitted one of his lenses to a cellphone camera to confirm the extended focus effect, and he has also tested the lenses on 12 volunteers (*Optics Letters*, vol 35, p 3066). He has now co-founded a company, Xceed Imaging, to develop the technology.

The approach is not without its problems, though: the interference pattern tends to cancel out some of the light passing through the lens, which reduces the contrast of images viewed through it. Pablo Artal of the University of Murcia, Spain, warns that if the contrast reduction becomes too large, the brain will struggle to interpret the information.

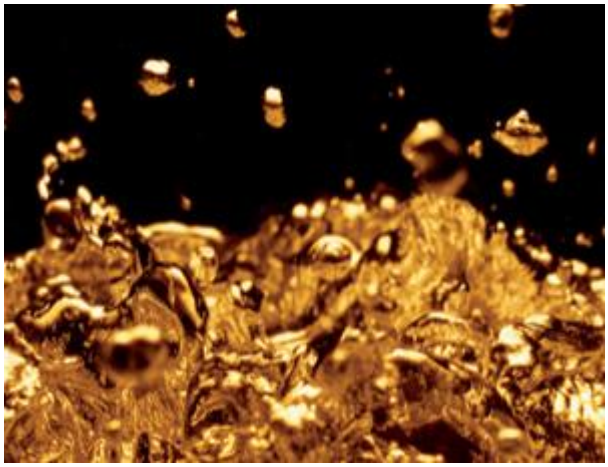
Zalevsky counters that people wearing the lenses do not notice a loss in contrast because the eye is very sensitive to light at low intensity. "Unlike a camera, the brain has a logarithmic and not linear [response to light]." He says that the brain adapts to and minimises the reduced contrast within a few seconds.

This is not the only way in which the brain must adapt to the new lenses. Fixed in a pair of glasses, the lenses would not move as the eye looked in different directions, so the focusing effect would be lost in the regions between the circles. But Zalevsky says that the eye learns to fill in the gaps as it moves from one engraved structure to another, generating a continuous effect.

http://www.newscientist.com/article/mg20827806.000-scratched-glasses-give-perfect-vision-for-any-eyesight.html

First frictionless superfluid molecules created

- 07 October 2010 by **Kate McAlpine**
- Magazine issue 2781.



Some fluids have no friction (Image: Don Farral/Getty)

CHILL them enough and some atoms creep up walls or stay still while the bowl they sit in rotates, thanks to a quantum effect called superfluidity. Now molecules have got in on the act.

Superfluidity is a bizarre consequence of quantum mechanics. Cool helium atoms close to absolute zero and they start behaving as a single quantum object rather than a group of individual atoms. At this temperature, the friction that normally exists between atoms, and between atoms and other objects, vanishes, creating what is known as a superfluid.

To see if molecules could be made superfluid, Robert McKellar of the National Research Council of Canada in Ottawa and colleagues turned to hydrogen, which exists as pairs of atoms. The team created a compressed mixture of hydrogen and carbon dioxide gas and shot it through a nozzle at supersonic speeds. Once released, the molecules spread apart, cooling and arranging themselves so that each CO_2 molecule sat at the centre of a cluster of up to 20 hydrogens.

To test for superfluidity, the team shone an infrared laser at the clusters at wavelengths that CO_2, but not hydrogen, can absorb. This set only the CO_2 molecules vibrating. Under normal conditions this movement would be slowed down due to friction between the moving CO_2 molecules and the surrounding hydrogen. But the researchers found that for clusters of 12 hydrogen molecules, the hydrogen barely impeded the motion of the CO_2.

They conclude that these hydrogen clusters are 85 per cent superfluid (*Physical Review Letters*, DOI: 10.1103/PhysRevLett.105.133401).

As hydrogen is only the second element known to form a superfluid, McKellar says the experiment could be useful for disentangling general qualities of superfluids.

Superfluid molecules might also be used as "nano-fridges", which surround and cool individual protein molecules. Superfluid helium atoms are already used for this but, unlike atoms, molecules can bend and stretch, which might present new ways to manipulate the cooled proteins.

http://www.newscientist.com/article/mg20827813.300-first-frictionless-superfluid-molecules-created.html

Anti-dengue mosquitoes to hit Australia and Vietnam

- 08 October 2010
- Magazine issue 2781.

MOSQUITOES infected with bacteria that stop them transmitting the dengue virus will be released into the wild next year.
Some 100 million people in the tropics get dengue fever each year, and 40,000 are killed by it. The virus's range is expanding, and last week France reported its first locally acquired cases.
Scott O'Neill of the University of Queensland in Brisbane, Australia, and colleagues have found a fruit-fly bacterium called *Wolbachia* that infects *Aedes* mosquitoes, and makes them less able to carry the dengue virus. It also halves their lifespan - which is crucial, as only elderly insects transmit disease.
Wolbachia is passed on through the eggs of infected females, so only descendants of the released mosquitoes will carry it, O'Neill says. But dengue-free descendants should rapidly dominate, as *Wolbachia*-infected females have a competitive advantage: they can reproduce with infected or wild males, and wild females cannot.
Infected mosquitoes will be released in Australia and Vietnam.

http://www.newscientist.com/article/mg20827812.400-antidengue-mosquitoes-to-hit-australia-and-vietnam.html

Antibody reverses final throes of cancer in mice

- 11:28 06 October 2010 by **Andy Coghlan**
- Magazine issue 2781

For the first time, a treatment in mice has shown promise against the final, metastatic stages of terminal cancer. Unusually, the antibody targets healthy tissue, not tumour cells, suggesting normal cells play an unwitting role in terminal cancers.

The mouse treatment uses an antibody that binds exclusively to a receptor found on healthy epithelial cells lining organs and blood vessels, called platelet endothelial cell adhesion molecule 1 (PECAM-1).

"It is both unexpected and counter-intuitive that a receptor expressed on normal epithelial cells plays a significant role in orchestrating the fatal progression of advanced metastases," says Robert Debs of the California Pacific Medical Center Research Institute in San Francisco, head of the research team.

By blocking access to the receptor on healthy cells, the antibody halted further growth of tumour cells in mice; some tumours even got smaller. Experiments are now under way in Debs's lab to try to establish how masking the receptor disrupts tumour growth signals.

The antibody also stopped the weight loss, muscle atrophy and fatigue that characterises terminal cancer.

Debs and his colleagues found that the antibody stopped the growth of secondary tumours from breast, lung, colon and melanoma cancers in mice. But the antibody didn't work against earlier, less-aggressive stages of cancer, suggesting it disrupts a process common only to the final stages of major cancers.

"Given its dramatic activity against pre-terminal metastases," Debs says. "We suspect the antibody will be effective in significantly prolonging life."

This study suggests that we could potentially target and destroy cancer even after it has spread, says Margaret Frame of Cancer Research UK. "Further testing and refinement is needed to establish the value of this as a potential treatment, but it is very encouraging."

Journal reference: *Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.1004654107

http://www.newscientist.com/article/dn19547-antibody-reverses-final-throes-of-cancer-in-mice.html

Thighs and abs have a different take on fat

- 17:58 05 October 2010 by **Debora MacKenzie**
- Magazine issue 2781.

As many women will no doubt attest, not all fat accrues equally. That may be because cells in your thighs and abdomen store fat in different ways.

Michael Jensen and colleagues at the Mayo Clinic in Rochester, Minnesota, put volunteers on a fattening diet for eight weeks and then measured what happened to their fat cells, or adipocytes. While abdominal cells got larger, thigh cells multiplied, by recruiting more adipocytes from pre-fat cells. The more new thigh fat cells recruited, the less abdominal fat people gained.

Fat on the abdomen increases the risk of diabetes and other disorders, while fat on hips and thighs has a protective effect. Jensen thinks thigh fat may soak up excess food energy to keep it away from the abdomen, where fat does more damage.

An individual's tendency to be pear or apple-shaped may in part be set by the ability of their thigh fat cells to recruit more adipocytes. Learning what controls this process may help fight fat's detrimental effects on our health.

Journal reference: *Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.1005259107

http://www.newscientist.com/article/dn19546-thighs-and-abs-have-a-different-take-on-fat.html

Daily choices can affect long-term happiness

- 16:53 05 October 2010 by **Jessica Hamzelou**
- Magazine issue 2781.

Choose wisely when considering a partner, whether to attend church and how you look after your body. These decisions could have a significant effect on your overall life satisfaction. That's according to a study that challenges the theory that life happiness is largely predetermined by your genes.

The widely accepted "set-point" theory of happiness says that an individual's long-term happiness tends to be stable because it depends mainly on genetic factors. The idea is based in part on studies that show identical twins to have more similar levels of life satisfaction than non-identical twins, and suggests that although your level of happiness may occasionally be thrown off by major life events, it will always return to a set level within two years.

To find out whether people really are destined for a certain level of happiness, Bruce Headey at the University of Melbourne in Australia and his team questioned people in Germany about their jobs, lifestyles and social and religious activities. The survey was initially completed by 3000 people annually, but that rose to 60,000 per year by the end of the 25-year study period.

They found that certain changes in lifestyle led to significant long-term changes in reported life satisfaction, rather than causing the temporary deflections in happiness that set-point theory would suggest.

One of the biggest influences on a person's happiness was their partner's level of neuroticism. Those with partners who scored highly on tests for neuroticism were more likely to be unhappy – and to stay unhappy for as long as the relationship lasted.

Altruism and family values also influenced long-term happiness. People whose annual survey responses changed to place a higher priority on altruistic behaviours and family goals were rewarded with a long-term increase in life satisfaction. Those who prioritised career and material success, however, experienced a corresponding lasting decline.

Having strong religious commitments also seemed to help in the pursuit of happiness. "People who attend church regularly seem to be happier than people who are not religious," says Headey.

A person's weight turned out to be another factor for long-term happiness, especially for women. Underweight men scored slightly lower than those with healthy weights, while women reported being significantly less happy when they were obese. Being overweight appeared to have no effect on men's happiness.

Robert Cummins at Deakin University in Burwood, Australia, notes that changes in happiness reported by Headey's team could be influenced by individuals falling into or recovering from depression.

The group suggests its findings may be applied to other populations, having found similar patterns, as yet unpublished, in the UK and Australia.

Journal reference: *Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.1008612107

http://www.newscientist.com/article/dn19545-daily-choices-can-affect-longterm-happiness.html

Hawaii will face more frequent cyclones

- 01 October 2010
- Magazine issue 2780.

HAWAII should prepare for an increasing number of cyclones as a result of global warming, a modelling study predicts.
About 85 tropical cyclones form each year, mostly over the western and eastern Pacific, including the Philippines, southern China and Mexico. Only one or two hit Hawaii every decade.
Tim Li of the University of Hawaii in Honolulu used two climate models to forecast cyclone formation. When he factored in the impact of global warming, he found that by the end of this century, the frequency of tropical cyclones will have fallen by 31 per cent over south-east Asia and grown by 65 per cent over the north central Pacific (*Geophysical Research Letters*, DOI: 10.1029/2010GL045124).
He says this may be driven by an El Niño-like effect which will raise sea surface temperatures more in the east and central Pacific than in the west, creating conditions that are perfect for cyclone formation.

http://www.newscientist.com/article/mg20827803.400-hawaii-will-face-more-frequent-cyclones.html?full=true&print=true

Levitating graphene is fastest-spinning object ever

- 14:29 30 September 2010 by **Miriam Frankel**

A flake of exotic carbon a few atoms thick has claimed a record: the speck has been spun faster than any other object, at a clip of 60 million rotations per minute.
Graphite is made of stacks of carbon sheets. Separate these, and the result is graphene, which shows a suite of novel properties, including incredible strength.
Bruce Kane at the University of Maryland in College Park sprayed charged graphene flakes a micrometre wide into a vacuum chamber. Once there, oscillating electric fields trapped the flakes in mid-air.
Kane then set them spinning using a light beam that is circularly polarised, meaning it passes its momentum to objects in its path. As a result, the flakes started spinning at 60 million rotations per minute, faster than any other macroscopic object.

Pizza dough

Previously, micrometre-sized crystals have been spun at up to 30,000 rpm using a different technology called an optical trap. It is thanks to graphene's amazing strength that the flakes are not pulled apart by the much higher spinning rate, Kane says.
He adds that the graphene flakes are only spinning at a thousandth of their theoretical maximum rate, given graphene's estimated strength. By tweaking the experimental set-up, a graphene flake could potentially be spun even faster.
Kane suggests that spinning could be a way to probe the properties of graphene, or manipulate it in new ways. "I think that the environment of having something levitated, with the option of spinning it, might be a new one for modification, manipulation or growth of small pieces of graphene."
Changgu Lee at the Sungkyunkwan University in Suwon, South Korea, who previously tested graphene's strength, agrees. "When spinning graphene at super-high speed, it will be stretched like pizza dough which will enable scientists to observe some interesting physics," he says.
Journal reference: *Physical Review B*, DOI: 10.1103/PhysRevB.82.115441

http://www.newscientist.com/article/dn19514-levitating-graphene-is-fastestspinning-object-ever.html

Random numbers created out of nothing

- 12:36 30 September 2010 by **Kate McAlpine**
-

It's something from nothing. A random number generator that harnesses the quantum fluctuations in empty space could soon sit inside your computer.

A device that creates truly random numbers is vital for a number of applications, including cryptography. Algorithms can generate numbers that pass statistical tests for randomness, but they're useless for secure cryptography if the algorithm falls into the wrong hands. Other methods using entangled ions to generate random numbers are more reliable, but tend to be slower and more expensive.

Now Christian Gabriel's team at the Max Planck Institute for the Science of Light in Erlangen, Germany, has built a prototype that draws on a vacuum's random quantum fluctuations. These impart random noise to laser beams in the device, which converts it into numbers.

"It's an easy method, and it's good value," says Gabriel.

The team sent a laser into a beam splitter, sheltered from external light sources. Without influence from the vacuum, the two emerging beams would have been identical. However, the lowest energy state of the electromagnetic field carries just enough energy to interact with the laser as it passes through the beam splitter. "The beams carry this quantum noise," says Gabriel.

The exiting beams were captured in two detectors which turned the light into electronic signals, and the signals were subtracted from one another, leaving only the noise from the vacuum and electronics. The team used a mathematical function to tease out the truly random signal of the vacuum. Because they could calculate the total disorder in the system and the portion which comes from the vacuum, they were able to reduce the set of numbers so that the electronic contribution was eliminated and only a fully random string remained.

Though reduced, the stream of bits comes at speedy 6.5 million per second. This is already in line with the speed of commercially available quantum random number generators, say the researchers, but they hope to achieve rates more than 30 times higher.

Collaborator Christoph Marquardt says the generator's optimised speed will be "faster than anything you could buy or that is available in other comparable systems nowadays".

The lab set-up costs about €1000, and the researchers estimate that the cost could fall to about €100. As the device functions at room temperature and could be made to fit in the palm of your hand, it may one day be integrated into a desktop computer.

Antonio Acín of the Institute for Photonic Sciences in Barcelona, Spain, points out that although the quantum noise of the vacuum is tamper-proof, most users won't be able to verify the workings of their random number generators – meaning they'll find it impossible to tell whether they are receiving a unique random stream from the generator or a pre-programmed, statistically random set from elsewhere.

Journal source: Nature Photonics, DOI: 10.1038/nphoton.2010.197

http://www.newscientist.com/article/dn19520-random-numbers-created-out-of-nothing.html

Artificial fertility treatments create a sex bias

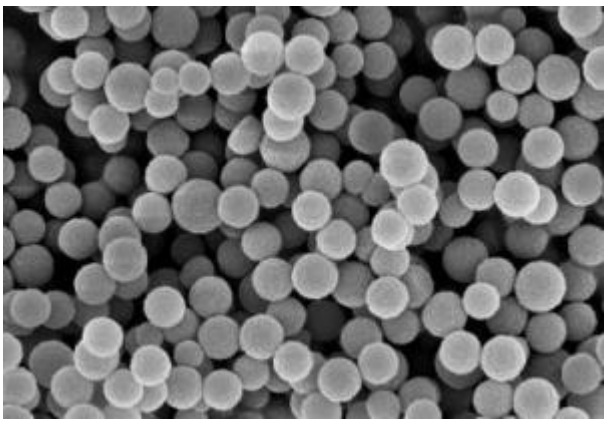
- 02 October 2010
- Magazine issue 2780.

More boys are born after IVF (Image: Howard Breman/Getty)

DIFFERENT fertility treatments affect the ratio of boy babies to girls, and this could have serious consequences as artificial fertility treatment becomes more common.
So says Michael Chapman at the University of New South Wales in Sydney, Australia, following a study that compared different kinds of assisted fertility treatment (AFT). His team recorded the sex of all 13,368 babies born in Australia and New Zealand between 2002 and 2006 using AFT.
They compared two types of reproductive technology: IVF, which involves placing an egg on a dish with up to 1000 sperm, and intracytoplasmic sperm injection (ICSI), in which sperm are injected directly into the egg - an approach used for low-quality, immotile sperm. They also compared the stage an embryo was at when transferred to the womb.
IVF raised the proportion of boys to 53 per cent, while with ICSI it fell to 50 per cent. The natural proportion of boys is 51.5 per cent.
The stage at which the embryo was transferred had the greatest effect. The later the transfer, the more likely it would result in a boy (*British Journal of Obstetrics and Gynaecology*, DOI: 10.1111/j.1471-0528.2010.02731.x).
Chapman suspects the culture medium that is used to grow the embryo is affecting the baby's sex. He is working with clinics to record the type of formula used in the study period.
The culture medium used to grow the embryo may be affecting the ratio of boys to girls

http://www.newscientist.com/article/mg20827803.700-artificial-fertility-treatments-create-a-sex-bias.html?full=true&print=true

Haze on Saturn's Moon Titan May Hold Ingredients for Life



Tiny particles are thought to create the smog-like haze that enshrouds Saturn's moon Titan. (Credit: Courtesy of S. Hörst)

ScienceDaily (Oct. 8, 2010) — In an experiment exploring the chemical processes that might be going on in the hazy atmosphere enshrouding Saturn's largest moon, a University of Arizona-led team of scientists discovered a variety of complex organic molecules -- including amino acids and nucleotide bases, the most important ingredients of life on Earth.

"Our team is the first to be able to do this in an atmosphere without liquid water. Our results show that it is possible to make very complex molecules in the outer parts of an atmosphere," said Sarah Hörst, a graduate student in the UA's Lunar and Planetary Lab, who led the international research effort together with her adviser, planetary science professor Roger Yelle.

The molecules discovered include the five nucleotide bases used by life on Earth to build the genetic materials DNA and RNA: cytosine, adenine, thymine, guanine and uracil, and the two smallest amino acids, glycine and alanine. Amino acids are the building blocks of proteins.

Hörst is presenting the findings at this year's meeting of the Planetary Science Division of the American Astronomical Society in Pasadena, Calif. on Oct. 7.

The results suggest not only that Titan's atmosphere could be a reservoir of prebiotic molecules that serve as the springboard to life, but they offer a new perspective on the emergence of terrestrial life as well: Instead of coalescing in a primordial soup, the first ingredients of life on our planet may have rained down from a primordial haze high in the atmosphere.

Oddball of the solar system

Titan has fascinated -- and puzzled -- scientists for a long time.

"It's is the only moon in our solar system that has a substantial atmosphere," Hörst said. "Its atmosphere stretches out much further into space than Earth's. The moon is smaller so it has less gravity pulling it back down."

Titan's atmosphere is much denser, too: On the surface, atmospheric pressure equals that at the bottom of a 15-foot-deep pool on Earth.

"At the same time, Titan's atmosphere is more similar to ours than any other atmosphere in the solar system," Hörst said. "In fact, Titan has been called 'Earth frozen in time' because some believe this is what Earth could have looked like early in time."

When Voyager I flew by Titan in the 1970s, the pictures transmitted back to Earth showed a blurry, orange ball.

"For a long time, that was all we knew about Titan," Hörst said. "All it saw were the outer reaches of the atmosphere, not the moon's body itself. We knew it has a an atmosphere and that it contains methane and other small organic molecules, but that was it."

In the meantime, scientists learned that Titan's haze consists of aerosols, just like the smog that cloaks many metropolitan areas on Earth. Aerosols, tiny particles about a quarter millionth of an inch across, resemble little snowballs when viewed with a high-powered electron microscope.

The exact nature of Titan's aerosols remains a mystery. What makes them so interesting to planetary scientists is that they consist of organic molecules -- potential ingredients for life.

"We want to know what kinds of chemistry can happen in the atmosphere and how far it can go." Hörst said. "Are we talking small molecules that can go on to becoming more interesting things? Could proteins form in that atmosphere?"

What it takes to make life's molecules

For that to happen, though, energy is needed to break apart the simple atmospheric molecules -- nitrogen, methane and carbon monoxide -- and rearrange the fragments into more complex compounds such as prebiotic molecules.
"There is no way this could happen on Titan's surface," Hörst said. "The haze is so thick that the moon is shrouded in a perpetual dusky twilight. Plus, at -192 degrees Fahrenheit, the water ice that we think covers the moon's surface is as hard as granite."
However, the atmosphere's upper reaches are exposed to a constant bombardment of ultraviolet radiation and charged particles coming from the sun and deflected by Saturn's magnetic field, which could spark the necessary chemical reactions.
To study Titan's atmosphere, scientists have to rely on data collected by the spacecraft Cassini, which has been exploring the Saturn system since 2004 and flies by Titan every few weeks on average.
"With Voyager, we only got to look," says Hörst. "With Cassini, we get to touch the moon a little bit."
During fly-by maneuvers, Cassini has gobbled up some of the molecules in the outermost stretches of Titan's atmosphere and analyzed them with its on-board mass spectrometer. Unfortunately, the instrument was not designed to unravel the identity of larger molecules -- precisely the kind that were found floating in great numbers in Titan's mysterious haze.
"Cassini can't get very close to the surface because the atmosphere gets in the way and causes drag on the spacecraft," Hörst said. "The deepest it went was 900 kilometers (560 miles) from the surface. It can't go any closer than that."
To find answers, Hörst and her co-workers had to recreate Titan's atmosphere here on Earth. More precisely, in a lab in Paris, France.
"Fundamentally, we cannot reproduce Titan's atmosphere in the lab, but our hope was that by doing these simulations, we can start to understand the chemistry that leads to aerosol formation," Hörst said. "We can then use what we learn in the lab and apply it to what we already know about Titan."

Like a spy in a movie

Hörst and her collaborators mixed the gases found in Titan's atmosphere in a stainless-steel reaction chamber and subjected the mixture to microwaves causing a gas discharge -- the same process that makes neon signs glow -- to simulate the energy hitting the outer fringes of the moon's atmosphere.
The electrical discharge caused some of the gaseous raw materials to bond together into solid matter, similar to the way UV sunlight creates haze on Titan. The synthesis chamber, constructed by a collaborating group in Paris, is unique because it uses electrical fields to keep the aerosols in a levitated state.
"The aerosols form while they're floating there," Hörst explains. "As soon as they grow heavy enough, they fall onto the bottom of the reaction vessel and we scrape them out."
"And then," she added, "the samples went on an adventure."
To analyze the aerosols, Hörst had to use a high resolution mass spectrometer in a lab in Grenoble, about a three-hour ride from Paris on the TGV, France's high-speed train.
"I always joke that I felt like a spy in a movie because I would take our samples, put them into little vials, seal them all up and then I'd get on the TGV, and every 5 minutes I'd open the briefcase, 'Are they still there? Are they still there?' Those samples were really, really precious."
Analyzing the reaction products with a mass spectrometer, the researchers identified about 5,000 different molecular formulas.
"We really have no idea how many molecules are in these samples other than it's a lot," Hörst said.
"Assuming there are at least three or four structural variations of each, we are talking up to 20,000 molecules

that could be in there. So in some way, we are not surprised that we made the nucleotide bases and the amino acids."
"The mass spectrometer tells us what atoms the aerosols are made of, but it doesn't tell us the structure of those molecules," Hörst said. "What we really wanted to find out was, what are all the formulas in this mass spectrum?"
"On a whim, we said, 'Hey, it would be really easy to write a list of the molecular formulas of all the amino acids and nucleotide bases used by life on Earth and have the computer go through them.'"
"I was sitting in front of my computer one day -- I had just written up the list -- and I put the file in, hit 'Enter' and went to go do something," she said. "When I came back and looked at the screen, it was printing a list of all the things it had found and I sat there and stared at it for a while. I thought: That can't be right."
"I ran upstairs to find Roger, my adviser, and he wasn't there," Hörst said with a laugh. "I went back to my office, and then upstairs again to find him and he wasn't there. It was very stressful."
"We never started out saying, 'we want to make these things,' it was more like 'hey, let's see if they're there.' You have all those little pieces flying around in the plasma, and so we would expect them to form all sorts of things."
In addition to the nucleotides, the elements of the genetic code of all life on Earth, Hörst identified more than half of the molecular formulas for the 22 amino acids that life uses to make proteins.

Titan: A window into Earth's past?

In some way, Hörst said, the discovery of Earth's life molecules in an alien atmosphere experiment is ironic. Here is why: The chemistry occurring on Titan might be similar to that occurring on the young Earth that produced biological material and eventually led to the evolution of life. These processes no longer occur in the Earth's atmosphere because of the large abundance of oxygen cutting short the chemical cycles before large molecules have a chance to form. On the other hand, some oxygen is needed to create biological molecules. Titan's atmosphere appears to provide just enough oxygen to supply the raw material for biological molecules, but not enough to quench their formation.
"There are a lot of reasons why life on Titan would probably be based on completely different chemistry than life on Earth," Hörst added, "one of them being that there is liquid water on Earth. The interesting part for us is that we now know you can make pretty much anything you want in an atmosphere. Who knows this kind of chemistry isn't happening on planets outside our solar system?"
Funded through NASA's Planetary Atmospheres Research Program, this research was a collaborative effort of an international team including scientists at the Lunar and Planetary Laboratory and department of chemistry at the UA, the Laboratoire de Génie de Procédés et Matériaux of Ecole Central Paris, France, the Laboratoire Atmosphères, Milieux, Observations Spatiales at the Université Versailles St-Quentin, Guyancourt, France, and the Laboratoire de Planétologie de Grenoble of the Université Joseph Fourier, Grenoble, France.

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

http://www.sciencedaily.com/releases/2010/10/101008105847.htm

Yersinia Pestis Bacteria Confirmed as Cause of Middle Ages 'Black Death' Plague Epidemic

Geographical position of the five archaeological sites investigated. Green dots indicate the sites. Also indicated are two likely independent infection routes (black and red dotted arrows) for the spread of the Black Death (1347-1353) after Benedictow. (Credit: Besansky et al. Distinct Clones of Yersinia pestis Caused the Black Death. PLoS Pathogens, 2010; 6 (10): e1001134 DOI: 10.1371/journal.ppat.1001134)

ScienceDaily (Oct. 8, 2010) — The latest tests conducted by anthropologists at the Johannes Gutenberg University Mainz (JGU) have proven that the bacteria Yersinia pestis was indeed the causative agent behind the "Black Death" that raged across Europe in the Middle Ages.

The cause of the epidemic has always remained highly controversial and other pathogens were often named as possible causes, in particular for the northern European regions. Using DNA and protein analyses from skeletons of plague victims, an international team led by the scientists from Mainz has now conclusively shown that *Yersinia pestis* was responsible for the Black Death in the 14th century and the subsequent epidemics that continued to erupt throughout the European continent for the next 400 years. The tests conducted on genetic material from mass graves in five countries also identified at least two previously unknown types of *Yersinia pestis* that occurred as pathogens.

"Our findings indicate that the plague traveled to Europe over at least two channels, which then went their own individual ways," explains Dr Barbara Bramanti from the Institute of Anthropology of Mainz University. The works, published in the open access journal PLoS Pathogens, now provide the necessary basis for conducting a detailed historical reconstruction of how this illness spread.

For a number of years, Barbara Bramanti has been researching major epidemics that were rampant throughout Europe and their possible selective consequences as part of a project funded by the German Research Foundation (DFG). For the recently published work, 76 human skeletons were examined from suspected mass graves for plague victims in England, France, Germany, Italy, and the Netherlands. While other infections such as leprosy can be easily identified long after death by the deformed bones, the problem faced in the search for plague victims lies in the fact that the illness can lead to death within just a few days and leaves no visible traces.

With luck, DNA of the pathogen may still be present for many years in the dental pulp or traces of proteins in the bones. Even then it is difficult to detect, and may be distorted through possible contamination. The team led by Bramanti found their results by analyzing old genetic material, also known as ancient DNA (aDNA): Ten specimens from France, England, and the Netherlands showed a *Yersinia pestis*-specific gene. Because the samples from Parma, Italy and Augsburg, Germany gave no results, they were subjected to another

method known as immunochromatography (similar to the method used in home pregnancy tests for example), this time with success.
Once the infection with *Yersinia pestis* had been conclusively proven, Stephanie Hänsch and Barbara Bramanti used an analysis of around 20 markers to test if one of the known bacteria types "orientalis" or "medievalis" was present. But neither of these two types was found. Instead, two unknown forms were identified, which are older and differ from the modern pathogens found in Africa, America, the Middle East, and the former Soviet Union regions. One of these two types, which are thought to have contributed significantly to the catastrophic course of the plague in the 14th century, most probably no longer exists today. The other appears to have similarities with types that were recently isolated in Asia.
In their reconstruction, Hänsch and Bramanti show an infection path that runs from the initial transportation of the pathogen from Asia to Marseille in November 1347, through western France to northern France and over to England. Because a different type of *Yersinia pestis* was found in Bergen op Zoom in the Netherlands, the two scientists believe that the South of the Netherlands was not directly infected from England or France, but rather from the North. This would indicate another infection route, which ran from Norway via Friesland and down to the Netherlands. Further investigations are required to uncover the complete route of the epidemic.
"The history of this pandemic," stated Hänsch, "is much more complicated than we had previously thought."
Editor's Note: *This article is not intended to provide medical advice, diagnosis or treatment.*

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

Journal Reference:

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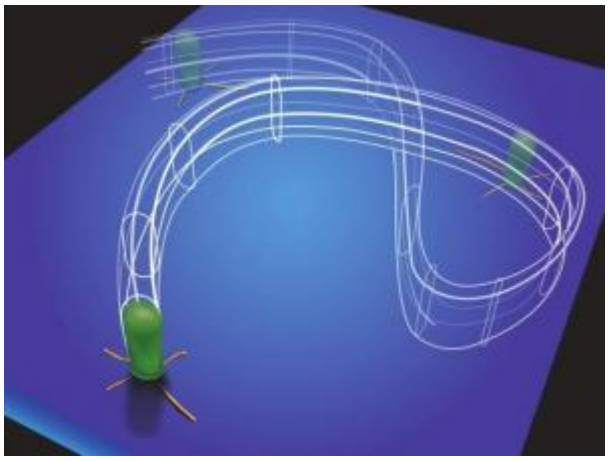
http://www.sciencedaily.com/releases/2010/10/101008112420.htm

Bacteria Can Stand-Up and 'Walk'



Artist's representation of a bacterium "walking." (Credit: Image courtesy of UCLA)

ScienceDaily (Oct. 8, 2010) — Many drug-resistant infections are the result of bacterial biofilms, structured aggregates of bacteria that live on surfaces and that are extremely resistant to environmental stresses. These biofilms impact human health in many ways -- cystic fibrosis, for example, is a disease in which patients die from airway bacterial biofilm infections that are invulnerable to even the most potent antibiotics.

Now, UCLA researchers and their colleagues have found that during the initial stages of biofilm formation, bacteria can actually stand upright and "walk" as part of their adaptation to a surface.

"Bacteria exist in two physiological states: the free-swimming, single-celled planktonic state and the surface-mounted biofilm state, a dense, structured, community of cells governed by their own sociology," said Gerard Wong, a professor of bioengineering at the UCLA Henry Samueli School of Engineering and Applied Science and at the California NanoSystems Institute at UCLA.

"Bacteria in biofilms are phenotypically different from free-swimming bacteria even though they are genomically identical. As part of their adaptation to a surface and to the existence of a community, different genes are turned up and down for bacteria in biofilms, leading to drastically different behavior," he said.

In the study, which appears in the current issue of the journal Science, Wong and his research group describe the new surface adaptation -- the "walking" motility mechanism, which was observed in *Pseudomonas aeruginosa*, a biofilm-forming pathogen partly responsible for the lethal infections in cystic fibrosis.

What enables this upright walking are appendages called type IV pili, which function as the analog of legs. What's more, walking allows *P. aeruginosa* to move with trajectories optimized for surface exploration, so that they can forage more effectively. The upright orientation is also the first step in surface detachment for bacteria.

"We've shown that vertical orientation plays a critical role in key life-cycle events: vertically oriented bacteria can more readily detach from surfaces, allowing them to spread and disperse effectively," said Jacinta Conrad, a former postdoctoral researcher with Wong's group and an assistant professor of chemical and biomolecular engineering at the University of Houston. "Our unique contribution is to directly relate single-cell behavior to specific events in the bacterial life cycle and thereby show how single-cell motility influences biofilm morphology."

The research team was able to develop a series of search engines and computer programs that use particle-tracking algorithms to quantitatively analyze time-lapse microscopy movies of bacterial motion on surfaces.

"Previously, graduate students had to look at cells manually and then laboriously track them from one frame to the next," Wong said. "Our computational approach allows us to increase the volume of data analyzed 100,000-fold and to perform the necessary analysis in a few hours rather than a few months.

"Moreover, we make sense of this mountain of information using search engine-based approaches. This represents a big advance in the way microscopes are used."

The work was conducted in collaboration with a research group at the University of Notre Dame led by Joshua Shrout, an assistant professor in the department of civil engineering and geological sciences and at the Eck Institute for Global Health.

"*P. aeruginosa* infections are unfortunately the leading cause of death for individuals with cystic fibrosis," Shrout said. "In addition to these lung infections, *P. aeruginosa* also causes skin, eye and gastrointestinal infections. As we learn how *P. aeruginosa* colonizes surfaces, perhaps we can develop better methods to treat these infections."

"One of the most exciting factors of this work for me is the potential for widespread impact," Conrad said. "Biofilm formation is ubiquitous in human health and also in a variety of industrial settings. Biofouling due to biofilm formation increases the hydrodynamic drag on ships, leading to increased fuel consumption, and also contributes to increased costs in water treatment, oil recovery and food processing. Controlling biofilm formation will therefore allow us to reduce biofouling-related problems across a wide range of industries."

This research was funded by the National Institutes of Health under the American Recovery and Reinvestment Act, the National Science Foundation and the Cystic Fibrosis Foundation.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of California -- Los Angeles**. The original article was written by Wileen Wong Kromhout.

Journal Reference:

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http://www.sciencedaily.com/releases/2010/10/101007171424.htm

Men Perspire, Women Glow: Men Are More Efficient at Sweating, Study Finds

New research shows that women have to work harder than men in order to start sweating, while men are more effective sweaters during exercise. (Credit: iStockphoto/Steve Cole)

ScienceDaily (Oct. 7, 2010) — Women have to work harder than men in order to start sweating, while men are more effective sweaters during exercise, according to new research published in the journal *Experimental Physiology*.

The study by Japanese scientists at Osaka International University and Kobe University looked at differences between men and women's sweating response to changes in exercise intensity. The researchers asked four groups of subjects (trained and untrained females, trained and untrained males) to cycle continuously for an hour in a controlled climate with increasing intensity intervals.

The results showed that men are more efficient at sweating. While exercise training improves sweating in both sexes, the degree of improvement is greater in men, with the difference becoming even more pronounced as the level of exercise intensity increases. The untrained females had the worst sweating response of all requiring a higher body temperature than the other groups (or work intensity) to begin sweating. In other words, women need to get hotter than men before they get sweaty.

The study's coordinator Yoshimitsu Inoue commented: 'It appears that women are at a disadvantage when they need to sweat a lot during exercise, especially in hot conditions.'

Previous studies have demonstrated that men have a higher sweat output than women, in part because testosterone is believed to enhance the sweating response. Physical training is known to decrease the body's core temperature threshold for the activation of the sweating response, which works to the athlete's advantage and allows them to perform longer. This is the first study, however, to investigate the sex differences in the effects of physical training on the sweating response during exercise.

The findings have implications for exercise and heat tolerance in humans, including shedding light on why the sexes cope differently with extremes of temperature like heat waves.

Inoue believes there may be an evolutionary reason why men and women have evolved to sweat differently. 'Women generally have less body fluid than men and may become dehydrated more easily,' he explains. 'Therefore the lower sweat loss in women may be an adaptation strategy that attaches importance to survival

in a hot environment, while the higher sweat rate in men may be a strategy for greater efficiency of action or labour.'
Inoue says future studies will look more closely at the relationship between reproductive hormones and the sweating response as well as the effectiveness of different kinds of sweat (sweat that evaporates and cools versus sweat that drops off).
In the meantime, Inoue advises women should take more care than men in hot conditions. But he adds, 'Both men and women can acclimate themselves better to heat if they exercise regularly before a heat wave comes.'
***Editor's Note**: This article is not intended to provide medical advice, diagnosis or treatment.*

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

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http://www.sciencedaily.com/releases/2010/10/101007210546.htm

'Living Dinosaurs' in Space: Galaxies in Today's Universe Thought to Have Existed Only in Distant Past

A simulation of a star forming galaxy similar to those observed. Cold gas (red) flowing onto a spiral galaxy feeds star formation. (Credit: Rob Crain, James Geach, the Virgo Consortium, Andy Green & Swinburne Astronomy Productions)

ScienceDaily (Oct. 8, 2010) — Using Australian telescopes, Swinburne University astronomy student Andy Green has found 'living dinosaurs' in space: galaxies in today's Universe that were thought to have existed only in the distant past.

The report of his finding -- Green's first scientific paper -- appears on the cover of the Oct. 7 issue of *Nature*.

"We didn't think these galaxies existed. We've found they do, but they are extremely rare," said Professor Karl Glazebrook, Green's thesis supervisor and team leader.

The Swinburne researchers have likened the galaxies to the 'living dinosaurs' or Wollemi Pines of space -- galaxies you just wouldn't expect to find in today's world.

"Their existence has changed our ideas about how star formation is fuelled and understanding star formation is important. Just look at the Big Bang, which is how we all got here," Glazebrook said.

The galaxies in question look like disks, reminiscent of our own galaxy, but unlike the Milky Way they are physically turbulent and are forming many young stars.

"Such galaxies were thought to exist only in the distant past, ten billion years ago, when the Universe was less than half its present age," Glazebrook said.

"Stars form from gas, and astronomers had proposed that the extremely fast star formation in those ancient galaxies was fuelled by a special mechanism that could exist only in the early Universe -- cold streams of gas continually falling in."

But finding the same kind of galaxy in today's Universe means that that mechanism can't be the only way such rapid star formation is fuelled. Instead it seems that when young stars form, they create turbulence in their surrounding gas. The more stars are forming in a galaxy, the more turbulence it has.

"Turbulence affects how fast stars form, so we're seeing stars regulating their own formation," Green said.

"It's a bit like a little girl deciding how many siblings she should have." "We still don't know where the gas to make these stars comes from though," he said.
Understanding star formation is one of the most basic, unsolved problems of astronomy. Another significant aspect of the paper is that it was authored by a PhD student.
As Glazebrook pointed out, being first author of a *Nature* paper as a student is as rare as the galaxies they've discovered. This is an achievement not lost on the young scientist.
"*Nature* is one of the most prestigious journals in science. It was a pleasant surprise for our work to receive this kind of accolade," Green said.
The study was based on selected galaxies from the Sloan Digital Sky Survey, a kind of census of modern galaxies.
"We studied extreme galaxies to compare them with the ancient Universe," Green said.
He observed them using the Anglo-Australian Telescope (AAT) and the Australian National University's 2.3 metre telescope, both located at Siding Spring Observatory in New South Wales. Professor Matthew Colless, Director of the Australian Astronomical Observatory, which operates the AAT, said that the study highlighted the value of the instruments found at Australia's telescopes.
"They are ideal for studying in detail the nearby counterparts of galaxies seen in the distant Universe by the eight and 10 metre telescopes," he said.
For the next stage of his research, Green plans to use one of these 10 metre telescopes -- in fact the largest optical telescope in the world at the Keck Observatory -- to take an even closer look at the rare galaxies he has discovered.
Green admitted: "Really, we need a bigger telescope, the Giant Magellan Telescope, to understand star formation. But, until it's constructed, Keck is the best tool available."
Green's access to the Keck will be possible thanks to Swinburne's agreement with Caltech, which gives the Swinburne astronomers access to the Keck Observatory in Hawaii for up to 20 nights per year.

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

Journal Reference:

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http://www.sciencedaily.com/releases/2010/10/101007145136.htm

Family Ties Bind Desert Lizards in Social Groups

Desert night lizards live in family groups. Pictured above is an adult female with her 3-day-old offspring. (Credit: Photo by Mitch Mulks)

ScienceDaily (Oct. 8, 2010) — Researchers at the University of California, Santa Cruz, have found that a species of lizard in the Mojave Desert lives in family groups and shows patterns of social behavior more commonly associated with mammals and birds. Their investigation of the formation and stability of family groups in desert night lizards (Xantusia vigilis) provides new insights into the evolution of cooperative behavior.

The researchers reported the results of a five-year study of desert night lizards in a paper published in the *Proceedings of the Royal Society B*: Biological Sciences (published October 6 online in advance of print). Alison Davis, who led the study as a graduate student at UC Santa Cruz and is currently a postdoctoral researcher at UC Berkeley, said one of the unusual characteristics of desert night lizards is that they are viviparous, giving birth to live young instead of laying eggs. What really got her attention, however, was that both young and old lizards could be found huddling together every winter beneath fallen Joshua trees and other desert plant debris.

"This is remarkable, given the fact that in most species of lizards, individuals actively avoid each other," Davis said.

By conducting extensive genetic analyses of these winter social groups, the researchers found that young desert night lizards stay with their mother, father, and siblings for several years after birth. Some groups aggregated under the same fallen log year after year, forming what the researchers termed dynasties. According to Davis, about 20 lizard species are thought to form family groups, and only two of those lay eggs. Viviparity (live birth) is crucial for the evolution of cooperative behaviors, she said.

"Viviparity provides the opportunity for prolonged interaction between the mother and offspring, which predisposes the animal to form a family group," Davis said. "The importance of parent-offspring interaction fits with what is currently understood about evolution of family groups and cooperative behaviors in birds and mammals."

In a classic study of animal social behavior published in 1995, Stephen Emlen of Cornell University described the evolution of family groups in birds and mammals and identified common themes and rules seen in both classes of animals. Davis's findings suggest that the same rules also apply to reptiles, which were not considered in Emlen's theory.

"Biologically, lizards are very different from both mammals and birds, yet a few species of lizards have evolved a social system around nuclear family members that is nearly identical to what we see in ground squirrels, primates, and woodpeckers," Davis said.
Coauthor Barry Sinervo, professor of ecology and evolutionary biology at UCSC, said this similarity between widely separated groups of animals makes the findings particularly interesting. "Establishing a common pattern for how kin-based groups and cooperative behaviors evolve across different taxa gives us an invaluable tool. It helps us to predict where similar group behaviors may be found in other species," he said.
The researchers faced some daunting challenges in their quest to understand the family ties that bind desert night lizards. The first hurdle was to capture the lizards. Adults, which are three to five inches long from the snout to the tip of the tail, are not so hard to find. The babies, however, are tiny, about the weight of a toothpick, and perfectly camouflaged, with skin the color of the sand where they are typically found half buried.
"You have to know what you are looking for," Davis said. She and other graduate and undergraduate students in the Sinervo lab looked under hundreds of logs in search of their shy subjects over the course of five years. They eventually marked 2,120 individual lizards for use in the study.
The second challenge was to determine if lizards living in aggregations were actually related and, if so, how closely. Davis worked with Yann Surget-Groba of Bangor University (U.K.) to sort out DNA microsatellite information collected from each lizard aggregation. She recalled Surget-Groba's amazement when he finished his analysis on one particular aggregation of 13 lizards and exclaimed, "They're all related!"
In this paper, the researchers did not address the advantages of baby lizards staying with their mothers for the first few years of life. The young appear to feed themselves and receive no direct care from parents or other siblings. But Davis said that she suspects there are some survival advantages to the group living arrangement and plans to address that subject in a future paper.
"Determining the fitness consequences of kin-based social groups in this species will be an important next step," Sinervo said.
For now, Davis said she hopes that her study will broaden the appreciation of these unusual animals among scientists and the general public. "Anyone interested in animal social behaviors will be interested in this species," she said.
In addition to Davis and Sinervo, the coauthors of the paper include Ammon Corl of UC Santa Cruz and Yann Surget-Groba of Bangor University and the University of Geneva, Switzerland. The study was funded by a grant from the American Museum of Natural History; awards from the American Society of Ichthyologists and Herpetologists and from the U.S. Department of Education; and an NSF postdoctoral fellowship in biology.

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of California - Santa Cruz**. The original article was written by Donna Hesterman.

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http://www.sciencedaily.com/releases/2010/10/101006120140.htm

Too Much of a Good Thing: Human Activities Overload Ecosystems With Nitrogen

At Lake Atitlan in Guatemala, excess nitrogen promotes algae growth, which leads to eutrophication. Over-nourished by excess nutrients including nitrogen, which drains from nearby farms, swirls of blue-free algae form. The eventual decay of the algae robs the water of oxygen, and thereby creates a dead zone where other plants and animals cannot survive. (Credit: NASA Earth Observatory image by Jesse Allen, based on data from the NASA/GSFC/METI/ERSDAC/JAROS, and U.S./Japan ASTER Science Team)

ScienceDaily (Oct. 8, 2010) — Humans are overloading ecosystems with nitrogen through the burning of fossil fuels and an increase in nitrogen-producing industrial and agricultural activities, according to a new study. While nitrogen is an element that is essential to life, it is an environmental scourge at high levels. According to the study, excess nitrogen that is contributed by human activities pollutes fresh waters and coastal zones, and may contribute to climate change. Nevertheless, such ecological damage could be reduced by the adoption of time-honored sustainable practices.

Appearing in the October 8, 2010 edition of *Science* and conducted by an international team of researchers, the study was partially funded by the National Science Foundation.

The Nitrogen Cycle
The nitrogen cycle--which has existed for billions of years--transforms non-biologically useful forms of nitrogen found in the atmosphere into various biologically useful forms of nitrogen that are needed by living things to create proteins, DNA and RNA, and by plants to grow and photosynthesize. The transformation of biologically useful forms of nitrogen to useful forms of nitrogen is known as nitrogen fixation.

Mostly mediated by bacteria that live in legume plant roots and soils, nitrogen fixation and other components of the nitrogen cycle weave and wind through the atmosphere, plants, subsurface plant roots, and soils; the nitrogen cycle involves many natural feedback relationships between plants and microorganisms.

According to the *Science* paper, since pre-biotic times, the nitrogen cycle has gone through several major phases. The cycle was initially controlled by slow volcanic processes and lightning and then by anaerobic organisms as biological activity started. By about 2.5 billion years ago, as molecular oxygen appeared on Earth, a linked suite of microbial processes evolved to form the modern nitrogen cycle.

Human Impacts on the Nitrogen Cycle
But the start of the 20th century, human contributions to the nitrogen cycle began skyrocketing. "In fact, no phenomenon has probably impacted the nitrogen cycle more than human inputs of nitrogen into the cycle in the last 2.5 billion years," says Paul Falkowski of Rutgers University, a member of the research team.

"Altogether, human activities currently contribute twice as much terrestrial nitrogen fixation as natural sources, and provide around 45 percent of the total biological useful nitrogen produced annually on Earth," says Falkowski. Much of the human contributions of nitrogen into ecosystems come from an 800 percent increase in the use of nitrogen fertilizers from 1960 to 2000.

Another problem: Much of nitrogen fertilizer that is used worldwide is applied inefficiently. As a result, about 60 percent of the nitrogen contained in applied fertilizer is never incorporated into plants and so is free to wash out of root zones, and then pollute rivers, lakes, aquifers and coastal areas through eutrophication. (Eutrophication is a process caused by excess nutrients that depletes oxygen in water bodies and ultimately leads to the death of animal life.)

In addition, some reactions involving nitrogen release nitrogen oxide into the atmosphere. Nitrogen oxide is a greenhouse gas that has 300 times (per molecule) the warming potential of carbon dioxide. In addition, nitrogen oxide destroys stratospheric ozone, which protects the earth from harmful ultraviolet (UV-B) radiation.

Methods to Reduce Nitrogen Overloading
"Natural feedbacks driven by microorganisms will likely produce a new steady-state over time scales of many decades," says Falkowski. "Through this steady state, excess nitrogen added from human sources will be removed at rates equivalent to rates of addition, without accumulating."

But meanwhile, the Earth's population is approaching 7 billion people, and so ongoing pressures for food production are continuing to increase. "There is no way to feed people without fixing huge amounts of nitrogen from the atmosphere, and that nitrogen is presently applied to crop plants very ineffectively." says Falkowski.

So unless promising interventions are taken, the damage done by humans to the Earth's nitrogen cycle will persist for decades or centuries. These promising interventions, which would be designed to reduce the need to use fertilizers that add nitrogen to ecological systems, could include:

- Using systematic crop rotations that would supply nitrogen that would otherwise be provided by fertilizers;
- Optimizing the timing and amounts of fertilizer applications, adopting selected breeding techniques or developing genetically engineered varieties of plants that would increase the efficiency of nitrogen use;

- Using traditional breeding techniques to boost the ability of economically important varieties of wheat, barley and rye to interact favorably with the microbial communities associated with plant root systems and do so in ways that enhance the efficiency of nitrogen use.

"While the processes of eutrophication have been recognized for many years, only recently have scientists been able to begin placing the anthropogenic processes in the context of an understanding of the broader biogeochemical cycles of the planet," says Robert Burnap, an NSF program director. This is an important article because it concisely develops this understanding and also provides reasonable predictions regarding the economic and policy dimensions of the problem."

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

Journal Reference:

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Hubble Astronomers Uncover an Overheated Early Universe

This diagram traces the evolution of the universe from the big bang to the present. Two watershed epochs are shown. Not long after the big bang, light from the first stars burned off a fog of cold hydrogen in a process called reionization. At a later epoch quasars, the black-hole-powered cores of active galaxies, pumped out enough ultraviolet light to reionize the primordial helium. (Credit: NASA, ESA, and A. Feild (STScI))

ScienceDaily (Oct. 7, 2010) — If you think global warming is bad, 11 billion years ago the entire universe underwent, well, universal warming.

The consequence was that fierce blasts of radiation from voracious black holes stunted the growth of some small galaxies for a stretch of 500 million years.

This is the conclusion of a team of astronomers who used the new capabilities of NASA's Hubble Space Telescope to probe the invisible, remote universe.

Using the newly installed Cosmic Origins Spectrograph (COS) they have identified an era, from 11.7 to 11.3 billion years ago, when the universe stripped electrons off from primeval helium atoms -- a process called ionization. This process heated intergalactic gas and inhibited it from gravitationally collapsing to form new generations of stars in some small galaxies. The lowest-mass galaxies were not even able to hold onto their gas, and it escaped back into intergalactic space.

Michael Shull of the University of Colorado and his team were able to find the telltale helium spectral absorption lines in the ultraviolet light from a quasar -- the brilliant core of an active galaxy. The quasar beacon shines light through intervening clouds of otherwise invisible gas, like a headlight shining through a fog. The beam allows for a core-sample probe of the clouds of gas interspersed between galaxies in the early universe.

The universe went through an initial heat wave over 13 billion years ago when energy from early massive stars ionized cold interstellar hydrogen from the big bang. This epoch is actually called reionization because the hydrogen nuclei were originally in an ionized state shortly after the big bang.

But Hubble found that it would take another 2 billion years before the universe produced sources of ultraviolet radiation with enough energy to do the heavy lifting and reionize the primordial helium that was also cooked up in the big bang.

This radiation didn't come from stars, but rather from quasars. In fact the epoch when the helium was being reionized corresponds to a transitory time in the universe's history when quasars were most abundant.

The universe was a rambunctious place back then. Galaxies frequently collided, and this engorged supermassive black holes in the cores of galaxies with infalling gas. The black holes furiously converted some of the gravitational energy of this mass to powerful far-ultraviolet radiation that would blaze out of galaxies. This heated the intergalactic helium from 18,000 degrees Fahrenheit to nearly 40,000 degrees. After the helium was reionized in the universe, intergalactic gas again cooled down and dwarf galaxies could resume normal assembly. "I imagine quite a few more dwarf galaxies may have formed if helium reionization had not taken place," said Shull.

So far Shull and his team only have one sightline to measure the helium transition, but the COS science team plans to use Hubble to look in other directions to see if the helium reionization uniformly took place across the universe.

The science team's results will be published in the October 20 issue of *The Astrophysical Journal*.

Story Source:

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

Journal Reference:

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http://www.sciencedaily.com/releases/2010/10/101007131249.htm

Volcanoes Wiped out Neanderthals, New Study Suggests

The Semeru volcano in Indonesia. New research suggests that climate change following massive volcanic eruptions drove Neanderthals to extinction and cleared the way for modern humans to thrive in Europe and Asia. (Credit: iStockphoto)

ScienceDaily (Oct. 7, 2010) — New research suggests that climate change following massive volcanic eruptions drove Neanderthals to extinction and cleared the way for modern humans to thrive in Europe and Asia.

The research, led by Liubov Vitaliena Golovanova and Vladimir Borisovich Doronichev of the ANO Laboratory of Prehistory in St. Petersburg, Russia, is reported in the October issue of *Current Anthropology*.

"[W]e offer the hypothesis that the Neanderthal demise occurred abruptly (on a geological time-scale) … after the most powerful volcanic activity in western Eurasia during the period of Neanderthal evolutionary history," the researchers write. "[T]his catastrophe not only drastically destroyed the ecological niches of Neanderthal populations but also caused their mass physical depopulation."

Evidence for the catastrophe comes from Mezmaiskaya cave in the Caucasus Mountains of southern Russia, a site rich in Neanderthal bones and artifacts. Recent excavations of the cave revealed two distinct layers of volcanic ash that coincide with large-scale volcanic events that occurred around 40,000 years ago, the researchers say.

Geological layers containing the ashes also hold evidence of an abrupt and potentially devastating climate change. Sediment samples from the two layers reveal greatly reduced pollen concentrations compared to surrounding layers. That's an indication of a dramatic shift to a cooler and dryer climate, the researchers say. Further, the second of the two eruptions seems to mark the end of Neanderthal presence at Mezmaiskaya. Numerous Neanderthal bones, stone tools, and the bones of prey animals have been found in the geological layers below the second ash deposit, but none are found above it.

The ash layers correspond chronologically to what is known as the Campanian Ignimbrite super-eruption which occurred around 40,000 years ago in modern day Italy, and a smaller eruption thought to have occurred

around the same time in the Caucasus Mountains. The researchers argue that these eruptions caused a "volcanic winter" as ash clouds obscured the sun's rays, possibly for years. The climatic shift devastated the region's ecosystems, "possibly resulting in the mass death of hominins and prey animals and the severe alteration of foraging zones."

Enter Modern Humans

Anthropologists have long puzzled over the disappearance of the Neanderthals and the apparently concurrent rise of modern humans. Was there some sort of advantage that helped early modern humans out-compete their doomed cousins? This research suggests that advantage may have been simple geographic location.

"Early moderns initially occupied the more southern parts of western Eurasia and Africa and thus avoided much of the direct impact of the … eruptions," the researchers write. And while advances in hunting techniques and social structure clearly aided the survival of modern humans as they moved north, they "may have further benefited from the Neanderthal population vacuum in Europe, allowing wider colonization and the establishment of strong source populations in northern Eurasia."

While the researchers stress that more data from other areas in Eurasia are needed to fully test the volcanic hypothesis, they believe the Mezmaiskaya cave offers "important supporting evidence" for the idea of a volcanic extinction.

Story Source:

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

Journal Reference:

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Water Discovered on Second Asteroid, May Be Even More Common

Two teams of researchers who made national headlines in April for showing the first evidence of water ice and organic molecules on an asteroid have now discovered that asteroid 65 Cybele contains the same material. (Credit: Gabriel Pérez, Instituto de Astrofisica de Canarias, Spain)

ScienceDaily (Oct. 7, 2010) — Water ice on asteroids may be more common than expected, according to a new study that is being presented at the world's largest gathering of planetary scientists.

Two teams of researchers who made national headlines in April for showing the first evidence of water ice and organic molecules on an asteroid have now discovered that asteroid 65 Cybele contains the same material. "This discovery suggests that this region of our solar system contains more water ice than anticipated," said University of Central Florida Professor Humberto Campins. "And it supports the theory that asteroids may have hit Earth and brought our planet its water and the building blocks for life to form and evolve here."

Campins will present the teams' findings during the 42nd-annual Division of Planetary Sciences Conference (http://dps.aas.org/meetings/2010) in Pasadena, Calif., which concludes Oct. 8.

Asteroid 65 Cybele is somewhat larger than asteroid 24 Themis -- the subject of the teams' first paper. Cybele has a diameter of 290 km (180 miles). Themis has a diameter of 200 km (124 miles). Both are in the same region of the asteroid belt between Mars and Jupiter.The academic article reporting this new finding has been accepted for publication in the European Journal "Astronomy and Astrophysics."

Campins is an expert on asteroids and comets. He received national attention for an article published in Nature showing the first evidence of water ice and organic molecules on asteroid 24 Themis. He's also worked on several science missions with NASA and the European Space Agency.

Campins holds degrees from the University of Kansas and the University of Arizona. He joined UCF in 2002 as the Provost Research Professor of Physics and Astronomy and head of the Planetary and Space Science Group.

Story Source:

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

http://www.sciencedaily.com/releases/2010/10/101007114114.htm

Doctors Evaluating Heart Problems Should Consider Checking Fat Deposits Around the Heart

ScienceDaily (Oct. 6, 2010) — Cardiac imaging researchers at Cedars-Sinai Heart Institute are recommending that physicians not overlook fatty deposits around the heart when evaluating patients for risk of major heart problems.

Although abdominal fat is often considered in making these assessments, recent research suggests that measuring fatty tissue around the heart is an even better predictor, and noninvasive CT scanning may provide this important information.

The recommendation appeared in an editorial comment published in the *Journal of the American College of Cardiology*: Cardiovascular Imaging. Daniel S. Berman, M.D., chief of cardiac imaging at the Cedars-Sinai Heart Institute and Cedars-Sinai's S. Mark Taper Foundation Imaging Center, is the article's first author and a leading authority on cardiac imaging.

The published opinion was prompted by another article in the journal in which researchers provide new evidence linking abdominal fat to instability of coronary arterial plaques. In current theory, people with excess abdominal fat are at higher risk of plaque buildup and heart disease, and plaque that is vulnerable to rupture poses a greater threat than that which is stable.

With co-authors Victor Y. Cheng, M.D., and Damini Dey, Ph.D., Berman cites various studies that link fat around the heart and coronary arteries to inflammation and plaque development and suggests that fat around the heart and coronary arteries "may be more potent determinants of coronary plaque development and progression than visceral abdominal fat." This fat around the heart also has been implicated in the development of major adverse cardiac events (MACE), defined as cardiac-related death, nonfatal heart attack, surgery to bypass blocked heart arteries, or repeated percutaneous coronary intervention (angioplasty) to reopen blocked arteries.

Under Berman's direction, Cedars-Sinai recently completed the largest randomized trial of coronary artery calcium CT scanning, following 2,137 subjects over four years. More than 20,000 patients are now enrolled in an ongoing data registry. This technology identifies plaque deposits in heart arteries by detecting bits of calcium, one of the components of plaque. Additionally, by using software methods, coronary artery calcium CT scanning can also be used to measure fat around the heart and coronary arteries. The two measurements considered together -- plaque and increased fat around the heart -- appear to improve the prediction of patient risk for major heart problems.

In their studies on coronary artery calcium CT scanning, researchers at Cedars-Sinai and at other sites found that patients who had no symptoms of heart disease but experienced a major adverse cardiac event had more fat around the heart than did control subjects who had no events. When they included a measurement of fat volume around the heart with conventional risk factors and coronary calcium scans, they were better able to predict which patients were more likely to experience major heart problems. In another study, researchers found that the amount of fat around the heart was strongly associated with the narrowing of coronary arteries caused by plaque.

"Measurement of pericardial fat from cardiac CT appears primed to ultimately become a routine complement to the information gained from plaque evaluation," the researchers conclude. "This assessment could generate CT information regarding the activity of the atherosclerotic (plaque buildup) process, potentially adding meaningfully to clinical risk assessment."

The work was supported in part by grants from the Eisner Foundation, the Glazer Foundation, the Lincy Foundation, and the National Institute of Biomedical Imaging and Bioengineering (National Institute of Health). Berman receives research grant support from Siemens Medical Systems.
***Editor's Note**: This article is not intended to provide medical advice, diagnosis or treatment.*

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Cedars-Sinai Medical Center**, via EurekAlert!, a service of AAAS.

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Measurements of CO_2 and CO in China's Air Indicate Sharply Improved Combustion Efficiency

ScienceDaily (Oct. 7, 2010) — A collaborative, six-year study of carbon dioxide (CO_2) levels in Beijing and surrounding provinces suggests that combustion efficiency, a component of overall energy efficiency, is improving in the region.

The findings, published in the Sept. 21 issue of *Atmospheric Chemistry and Physics*, are generally consistent with official Chinese government statistics and could bolster their credibility as international negotiations proceed on commitments of China and other nations to combat climate change.

A team of atmospheric scientists and environmental engineers from Harvard University and Tsinghua University in Beijing have continuously measured atmospheric CO_2 and carbon monoxide (CO) levels in rural Miyun, about 100 km northeast of Beijing, since November 2004.

Weather observations such as wind speed and direction (with other evidence) allowed researchers to identify plumes of polluted air from the Beijing urban area and population centers to the south, as opposed to relatively clean air arriving from the north.

The measurements provide the most detailed look at carbon emissions for a specific urbanized and industrialized region of China to date. Moreover, the resulting analysis of CO_2 and CO levels is generally consistent with China's official statistics, showing an upward trend in overall energy efficiency.
"The Chinese government committed to improve energy efficiency in its 11th Five-Year Plan (2006-2010), and this study shows how independent quantitative evidence of its progress can be inferred from the chemistry of its air," said co-author Chris P. Nielsen, Executive Director of the Harvard China Project, based at Harvard's School of Engineering and Applied Sciences (SEAS).

The Harvard and Tsinghua researchers analyzed the ratio of CO_2 to CO at Miyun to evaluate energy efficiency in Beijing.

"Fuel combustion releases energy by converting carbon to CO_2, but some is only converted to CO, losing some of the available chemical energy. High-efficiency combustion processes, such as modern power plants and cars that meet current standards, produce little or no CO, and are thus both more energy-efficient and cleaner," said co-author J. William Munger, Senior Research Fellow at SEAS and at Harvard's Department of Earth and Planetary Sciences (EPS). "Inefficient processes like wood- and coal-burning in domestic stoves convert less than 90 percent of the carbon fuel to CO_2, releasing the remainder as CO and wasting some of the energy. The combustion of outmoded industrial processes can fall somewhere in the middle. Knowing this, there's a lot we can learn from this chemical ratio in the air about combustion efficiency on the ground."

Over the period of study -- and while controlling for daily, seasonal, and weather-induced fluctuations -- the data trends indicated increasing combustion efficiency in the Beijing region. Modernization of industrial boilers, replacing old vehicles with new ones meeting stricter standards, and closing of older industrial facilities can all contribute to this trend.

"The data indicate a trend toward cleaner, more efficient combustion in the Beijing region over several years leading up to the 2008 Olympics " -- when the government instituted particularly strict controls on pollution -- "and as far as we can tell so far, these gains have been maintained since the Olympics," said Munger.
The lead author of the study, Yuxuan Wang, is an Associate Professor in the Department of Environmental Science and Engineering at Tsinghua University and Principal Investigator of the Miyun atmospheric observatory. She completed her Ph.D. and postdoctoral studies at EPS and SEAS, at Harvard.

Wang, Munger, and Nielsen's co-authors include Shicheng Xu, Jiming Hao, and Hong Ma, from the Department of Environmental Science and Engineering and State Key Joint Laboratory of Environment Simulation and Pollution at Tsinghua University in Beijing; and Michael B. McElroy, Gilbert Butler Professor of Environmental Studies at the Department of Earth and Planetary Sciences and the School of Engineering and Applied Sciences at Harvard University. McElroy is also Chair of the Harvard China Project.

The Harvard China Project is a research program focused on China's atmospheric environment, collaborating across schools of Harvard University and with Chinese universities. It conducts interdisciplinary, peer-reviewed studies related to air pollution and greenhouse gases in China, designed to build knowledge and research capacities to help align China's domestic priorities on environment and development with equitable international strategies on climate change. For more information, visit http://chinaproject.harvard.edu.

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

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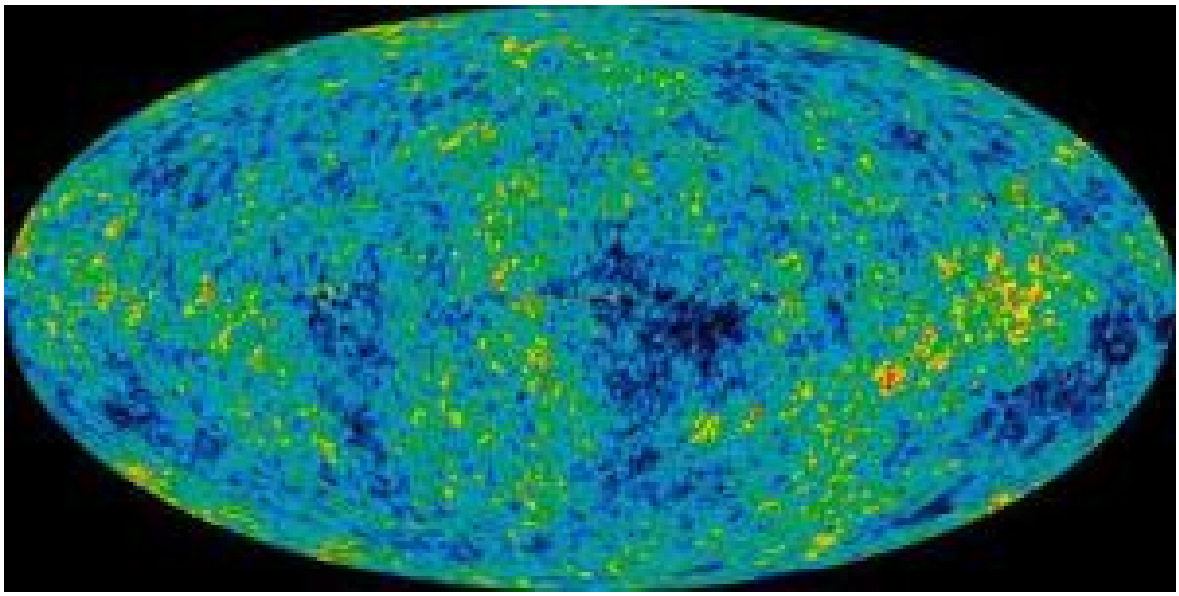
http://www.sciencedaily.com/releases/2010/10/101008105850.htm

NASA's WMAP Project Completes Satellite Operations: Mission Observed Universe's Oldest Light



The detailed, all-sky picture of the infant universe created from seven years of WMAP data. The image reveals 13.7 billion year old temperature fluctuations (shown as color differences) that correspond to the seeds that grew to become the galaxies. The signal from the our Galaxy was subtracted using the multi-frequency data. This image shows a temperature range of ± 200 microKelvin. (Credit: NASA / WMAP Science Team)

ScienceDaily (Oct. 6, 2010) — After nine years of scanning the sky, the Wilkinson Microwave Anisotropy Probe (WMAP) space mission has concluded its observations of the cosmic microwave background, the oldest light in the universe. The spacecraft has not only given scientists their best look at this remnant glow, but also established the scientific model that describes the history and structure of the universe.

"WMAP has opened a window into the earliest universe that we could scarcely imagine a generation ago," said Gary Hinshaw, an astrophysicist at NASA's Goddard Space Flight Center in Greenbelt, Md., who manages the mission. "The team is still busy analyzing the complete nine-year set of data, which the scientific community eagerly awaits."

WMAP was designed to provide a more detailed look at subtle temperature differences in the cosmic microwave background that were first detected in 1992 by NASA's Cosmic Background Explorer (COBE). The WMAP team has answered many longstanding questions about the universe's age and composition.

WMAP acquired its final science data on Aug. 20. On Sept. 8, the satellite fired its thrusters, left its working orbit, and entered into a permanent parking orbit around the sun.

"We launched this mission in 2001, accomplished far more than our initial science objectives, and now the time has come for a responsible conclusion to the satellite's operations," said Charles Bennett, WMAP's principal investigator at Johns Hopkins University in Baltimore.

WMAP detects a signal that is the remnant afterglow of the hot young universe, a pattern frozen in place when the cosmos was only 380,000 years old. As the universe expanded over the next 13 billion years, this light lost energy and stretched into increasingly longer wavelengths. Today, it is detectable as microwaves.

WMAP is in the Guinness Book of World Records for "most accurate measure of the age of the universe." The mission established that the cosmos is 13.75 billion years old, with a degree of error of one percent.

WMAP also showed that normal atoms make up only 4.6 percent of today's cosmos, and it verified that most of the universe consists of two entities scientists don't yet understand.

Dark matter, which makes up 23 percent of the universe, is a material that has yet to be detected in the laboratory. Dark energy is a gravitationally repulsive entity which may be a feature of the vacuum itself. WMAP confirmed its existence and determined that it fills 72 percent of the cosmos.
Another important WMAP breakthrough involves a hypothesized cosmic "growth spurt" called inflation. For decades, cosmologists have suggested that the universe went through an extremely rapid growth phase within the first trillionth of a second it existed. WMAP's observations support the notion that inflation did occur, and its detailed measurements now rule out several well-studied inflation scenarios while providing new support for others.
"It never ceases to amaze me that we can make a measurement that can distinguish between what may or may not have happened in the first trillionth of a second of the universe," says Bennett.
WMAP was the first spacecraft to use the gravitational balance point known as Earth-Sun L2 as its observing station. The location is about 930,000 miles or (1.5 million km) away.
"WMAP gave definitive measurements of the fundamental parameters of the universe," said Jaya Bapayee, WMAP program executive at NASA Headquarters in Washington. "Scientists will use this information for years to come in their quest to better understand the universe."
Launched as MAP on June 30, 2001, the spacecraft was later renamed WMAP to honor David T. Wilkinson, a Princeton University cosmologist and a founding team member who died in September 2002.
For images and more information, visit: http://map.gsfc.nasa.gov

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Story Source:
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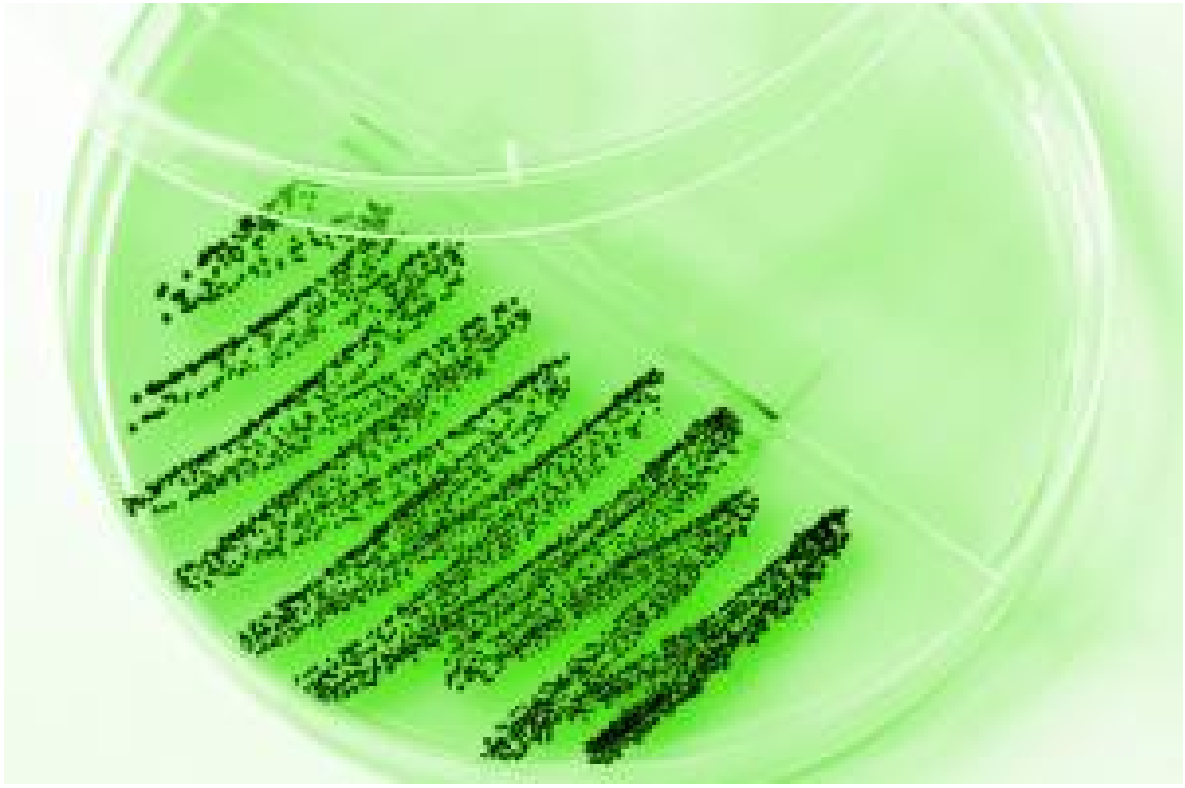
http://www.sciencedaily.com/releases/2010/10/101006185800.htm

Scientists Trick Bacteria Into Embedding Small Molecules in Cell Wall



Staphylococcus Aureus. A team of Yale University scientists has engineered the cell wall of the Staphylococcus aureus bacteria, tricking it into incorporating foreign small molecules and embedding them within the cell wall. (Credit: iStockphoto/Andreas Teske)

ScienceDaily (Oct. 8, 2010) — A team of Yale University scientists has engineered the cell wall of the *Staphylococcus aureus* bacteria, tricking it into incorporating foreign small molecules and embedding them within the cell wall.

The finding, described online in the journal ACS Chemical Biology this week, represents the first time scientists have engineered the cell wall of a pathogenic "Gram-positive" bacteria -- organisms responsible not only for Staph infections but also pneumonia, strep throat and many others. The discovery could pave the way for new methods of combating the bacteria responsible for many of the most infectious diseases.

The team engineered one end of their small molecules to contain a peptide sequence that would be recognized by the bacteria. In *Staphylococcus aureus*, an enzyme called sortase A is responsible for attaching proteins to the cell wall.

"We sort of tricked the bacteria into incorporating something into its cell wall that it didn't actually make," said David Spiegel, a Yale chemist who led the study. "It's as if the cell thought the molecules were its own proteins rather than recognizing them as something foreign."

The scientists focused specifically on the cell wall because it contains many of the components the cell uses to relate to its environment, Spiegel said. "By being able to manipulate the cell wall, we can in theory perturb the bacteria's ability to interact with human tissues and host cells."

The team used three different small molecules in their experiment -- including biotin, fluorescein and azide -- but the technique could be used with other molecules, Spiegel said, as well as with other types of bacteria.

Another advantage to the new technique is that the scientists did not have to first genetically modify the

bacteria in any way in order for them to incorporate the small molecules, meaning the method should work on naturally occurring bacteria in the human body.
Staph infections, such as the drug-resistant MRSA, have plagued hospitals in recent years. More Americans die each year from *Staphylococcus aureus* infections alone than from HIV/AIDS, Parkinson's disease or emphysema.
Being able to engineer the cell walls of not only *Staphylococcus aureus* but a whole family of bacteria could have widespread use in combating these illnesses, Spiegel said, adding that any number of small molecules could be used with their technique. "For example, if we tag these bacteria with small fluorescent tracer molecules, we could watch the progression of disease in the human body in real time." The molecules could also be used to help recruit antibodies that occur naturally in the bloodstream, boosting the body's own immune response to diseases that tend to go undetected, such as HIV/AIDS or cancer.
"This technique has the potential to help illuminate basic biological processes as well as lead to novel therapeutics from some of the most common and deadly diseases affecting us today," Spiegel said.
Other authors of the paper include James Nelson, Alexander Chamessian, Patrick McEnaney, Ryan Murelli and Barbara Kazmiercak (all of Yale University).
Editor's Note: *This article is not intended to provide medical advice, diagnosis or treatment.*

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

Journal Reference:

1. James W. Nelson, Alexander G. Chamessian, Patrick J. McEnaney, Ryan P. Murelli, Barbara I. Kazmiercak, David A. Spiegel. **A Biosynthetic Strategy for Re-engineering theStaphylococcus aureusCell Wall with Non-native Small Molecules**. *ACS Chemical Biology*, 2010; : 101005140058057 DOI: 10.1021/cb100195d

http://www.sciencedaily.com/releases/2010/10/101007171415.htm

Researchers Find No Visible Oil Sands Off Florida Panhandle, Alabama Beaches

The sediment samples did not show any visible signs of contamination, but the samples will undergo further testing to see if they contain any hydrocarbons. (Credit: Image courtesy of University of South Florida)

ScienceDaily (Oct. 8, 2010) — A team of University of South Florida researchers studying the impact of the Deepwater Horizon oil spill on northern Gulf beaches say areas just offshore from some of Florida's most heavily oiled beaches appear to be free of visible oil contamination in the sediments.

The update from the USF Coastal Research Laboratory, led by Geologist Ping Wang, are significant because they allay one of the chief concerns among coastal researchers: that oil which might have sunk just out of sight offshore could be easily stirred up by a storm and be washed onto beaches.

Wang, working with the chair of USF's Department of Integrative Biology Susan Bell and a team of researchers, surveyed areas Sept. 23-27 just off the coast from Santa Rosa Island in Florida west to Gulf Shores, Ala. The five-day expedition is part of ongoing research projects funded by the National Science Foundation in the aftermath of the Deepwater Horizon spill, the nation's largest environmental disaster.

The team found no visually identifiable oil contamination, including no tar balls, tar patties or oil sheets, they said in a new report. Sediment cores gathered by divers also were free of visual evidence of oil. Further laboratory tests are being conducted to look for further hydrocarbon contamination, which often can be invisible and is detected only through sophisticated laboratory tests.

"Since no visually identifiable oil was found on or below the surface in the nearshore zone at any of the sampling sites, we believe that it is unlikely that significant amounts of 'new oil from the nearshore' will be washed onto the beach during storms," Wang said. "However, it should be noted that based on our earlier study of buried oil along the beaches, erosion of buried beach oil and subsequent redistribution is expected during storms."

Bell said researchers will make more detailed observations of diver-collected cores in the lab, including microscopic examination of sand grains, to assess whether there is any indication of oil contamination. The group also plans to survey additional sites.

The work by Wang and the Coastal Geology Lab team garnered worldwide attention this summer when they examined beaches in northwest Florida and Alabama to document the extent of BP oil contamination. The researchers later returned to beaches that had been cleaned by BP crews only to find a thick layer of oil buried inches below the sand and that cleaning machines had chopped oil sheets into tiny tar balls, spreading the contamination on a wider area.

In the most recent exploration, however, their findings reached a more hopeful initial conclusion. The team collected 60 sediment cores and 60 surface sediment samples just off of those heavily contaminated beaches in waters from nine to 45 feet deep. Samples also were also collected in areas such as Pensacola Bay and Perdido Bay, which suffered some of the brunt of the oil contamination in Florida this summer.

The latest update comes as some of the nation's top scientists studying the spill gathered in St. Petersburg Beach Tuesday and Wednesday to compare findings and initial observations on the complex picture left by the Deepwater Horizon blowout. More than 145 researchers gathered in workshops organized by the National Oceanic and Atmospheric Administration, the NSF and the National Science and Technology Joint Sub-Committee on Ocean Science and Technology.

Given the unprecedented nature of the spill, scientists say they are facing a complex series of questions and factors to consider as they begin to chart the long-term impact of the spill on the Gulf environment.

Story Source:

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

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New Tool in the Fight Against Tuberculosis: Algorithm Enables Cell-Scale Simulations

University of Illinois Researcher Nathan Price has created an algorithm that successfully integrates the statistically derived transcriptional regulatory network with a biochemically derived metabolic network. The model, called probabilistic regulation of metabolism, enables researchers to perturb a given regulatory gene or metabolic process and see how that affects the entire network. (Credit: Don Hamerman for the Institute for Genomic Biology / University of Illinois)

ScienceDaily (Oct. 8, 2010) — Researchers at the Institute for Genomic Biology at the University of Illinois have developed a way to harness the prodigious quantities of both genomic and metabolic data being generated with high-throughput genomics and other techniques. They have developed an algorithm that automatically integrates both data sets. The model, called probabilistic regulation of metabolism (PROM), enables researchers to perturb a given regulatory gene or metabolic process and see how that affects the entire network.

"PROM provides a platform for studying the behavior of networks in a wide range of different conditions," says principal investigator Nathan Price, an associate professor of chemical and biomolecular engineering at Illinois.

Using this model the researchers have created the first genome-scale, regulatory-metabolic network of *Mycobacterium tuberculosis*. Their results were published online in the *Proceedings of the National Academy of Sciences*.

Using *E. Coli* as a benchmark, Price and graduate student Sriram Chandrasekaran showed that PROM was more accurate and comprehensive than the previous model for *E. Coli*, which had been done by hand and published in 2004.

After using *E. Coli* as a proof of principle, they targeted tuberculosis, a bacterium that has not been as thoroughly studied as *E. Coli*. Price and Chandrasekaran had less than half the amount of data then they had for *E. Coli* and were still able to create a model that predicted knockout phenotypes 95 percent of the time, says Price.

Price and Chandrasekaran built the algorithm using microarray data, transcription-factor interactions that regulate metabolic reactions, and knock-out phenotypes. The method is both accurate and fast. PROM may prove particularly helpful to tuberculosis researchers because, although when tuberculosis is growing it can be killed, the real challenge is to target the bacterium during its dormant or quiescent stage. PROM may enable researchers to identify and target the pathways keeping the cells alive during dormancy.

PROM also represents a major advance because it successfully integrates the statistically derived transcriptional regulatory network with a biochemically derived metabolic network.

"That is the new part," says Price. "People have created regulatory models and metabolic models. But there has been nothing before that could combine them in this automated fashion. It is difficult to get these two to talk to each other in the right way."

Price and Chandrasekaran created an algorithm that makes use of probability. Earlier models used a Boolean or a binary approach, in which a gene is either on or off. PROM can account for a gene or enzyme that can also be part way on or part way off, so it acts more like a rheostat than a toggle switch.
"People were stuck here for a long time. That's why PROM is such a nice method. It's sort of Boolean but it's probabilistic Boolean. It does allow us to have a continuous variation," says Price.
"These models can guide genome-scale synthetic biology," he adds. "And understanding how the networks are put together lays the foundation for us to design genomes that encode for networks that behave in the way we want them to, such as engineering microbes to convert environmental toxins into biofuels, for example."
***Editor's Note**: This article is not intended to provide medical advice, diagnosis or treatment.*

Story Source:
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Institute for Genomic Biology, University of Illinois at Urbana-Champaign**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. S. Chandrasekaran, N. D. Price. **Probabilistic integrative modeling of genome-scale metabolic and regulatory networks in Escherichia coli and Mycobacterium tuberculosis**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.1005139107

http://www.sciencedaily.com/releases/2010/10/101007131007.htm

Ocean Carbon Sequestration: The World's Best Bad Idea

Putting carbon dioxide in the ocean is a terrible way to deal with climate change. Maybe we should do it.

By Peter Friederici

Takashi Ohsumi of the Central Research Institute of the Electric Power Industry.

Nestled on the narrow neck of a rocky peninsula that juts into the Pacific Ocean, the Seto Marine Laboratory is one of Japan's oldest facilities for studying the abundant fish, marine invertebrates and seaweeds that have sustained people here for centuries. These days, the resort hotels that line the coastline of Shirahama — the name means "white beach" — are a far more important lifeline for the region's economy than fishing. But in the laboratory, amid a welter of bubbling tanks and clattering pumps, a marine biologist named Yoshihisa Shirayama and his staff and student researchers are trying to understand how aquatic creatures adapt to a habitat in rapid flux. To that end, he and his colleagues have built an infrastructure that mirrors a changing ocean; with a few swipes across a touch-screen control pad, he can adjust the concentration of carbon dioxide in tanks that hold sea urchin larvae.

An urchin larva looks like a delta-wing fighter plane, albeit on a microscopic scale. It's difficult to keep these creatures alive for long in the lab, but for a few days, as they begin their growth, they are splendid barometers of their environment. They need calcium carbonate, dissolved in seawater, to begin growing their hard shells. The amount of carbonate in water is a direct function of the concentration of carbon dioxide; as the oceanic CO2 level increases, the water becomes more acidic, and structures made of calcium carbonate begin to dissolve. And the carbon dioxide level, in the open ocean, directly mirrors that of the air.

Since the beginning of the Industrial Revolution, the level of carbon dioxide in the atmosphere, and hence in the ocean's surface waters, has increased by almost 30 percent, from about 280 parts per million to today's level of about 390 ppm. In response, those surface waters have become steadily more acidic.

With its variety of tanks, the Seto lab allows Shirayama and his colleagues to precisely adjust living conditions for the sea urchin larvae. Some live at 280 ppm, some at 390. Others live at levels that the real ocean may experience in the not-so-distant future, assuming that human beings continue to burn fossil fuels and produce greenhouse gas emissions.

The equipment is complex, much of the work preliminary, its implications not ironclad. But so far, the results show a clear trend: As the level of carbon dioxide in the water increases, the sharp points of the larval triangles become less pronounced. By the time the level reaches 2,000 ppm — a concentration that, barring major changes in how we get our energy, the oceans may reach sometime between 2100 and 2200 — the juvenile animals are significantly shorter, more blunt-pointed. They become space shuttles rather than F-15s. They survive, but perhaps only because in the lab's tanks there's nothing to eat them. Such drastic changes don't bode well for the sea urchins or for the other animals that share their living space.

The Seto lab is one of several worldwide that are pioneering the incipient field of research on ocean acidification, an effect of greenhouse gas emissions that may rival climate change itself in the impact it will have on global ecosystems and human economies. But it is also a place at the forefront of what is likely to become a major debate about global change: Namely, to what extent should people alter the oceans in an effort to deal with climate change? And Shirayama is in an unlikely position for a marine biologist. He finds himself advocating for a system that would sequester carbon dioxide deep in the ocean, a process that could blunt the worst impacts of climate change but might also change the ecology of the sea in dramatic and unpredictable ways.

You can't go very far in asking Japanese scientists about carbon sequestration before being asked whether you've talked to Takashi Ohsumi, a puckish engineer with a sardonic laugh who is one of the experts in the field. He works, in semi-retirement, for the Central Research Institute of the Electric

Power Industry, or CRIEPI. In a stark conference room on the institute's campus just outside Tokyo, he can spend hours giving a comprehensive overview of the country's involvement with ocean carbon sequestration.

A brief outline goes something like this: In the late 1980s, faced with growing demand for electricity but intense opposition to new nuclear power plants, the country's electric industry began considering the construction of plants that would burn coal imported from overseas. Officials already knew that the emissions from fossil fuels were likely to contribute to global warming, so they began investigating how to capture and sequester carbon dioxide.

The idea of deliberately depositing carbon in the oceans as a means of dealing with fossil fuel emissions did not arise in Japan — it was proposed by North American and European scientists in the 1970s. But as Ohsumi recounts, it was an idea ideally suited to Japan, a heavily industrialized island where volcanic geology doesn't provide many opportunities for depositing carbon under its land area.

Using both at-sea tests and high-pressure tanks that mimic deep-ocean conditions, he and his colleagues began investigating how carbon dioxide behaves when deliberately deposited in seawater. In shallow water, the effect is much as you'd expect: Drop in a block of dry ice, and it bubbles and dissolves like the fizz in a carbonated drink, contributing its carbon dioxide to the atmosphere as much as to the water. But in deep water — say at about 1,500 meters — the result is different. Because of the increased pressure, the CO2 dissolves into the seawater and remains more or less at the same level beneath the surface. If the water is deep enough — more than about 3,000 meters — the carbon dioxide becomes a liquid denser than seawater and sinks to the bottom, where it pools and remains.

The oceans are already absorbing from the air something like a million tons of carbon dioxide an hour. In other words, people are already injecting large quantities of the gas into all the world's shallow waters, causing the sorts of acidification problems that are under investigation at the Seto marine laboratory. But ocean waters mix slowly. Carbon dioxide placed at a depth of about 1,500 meters, Ohsumi came to believe, might take several hundred years to migrate into surface waters and then into the atmosphere. If it were placed

in depressions at extreme depths — say of 3,000 meters or more — most of it would likely remain in place for thousands of years. Though neither tactic would represent a permanent solution to the problem of greenhouse gas emissions, either would buy time during which mankind could develop alternative energy sources.

By the mid-1990s, researchers from several countries, including Japan, Norway and the U.S., were investigating how ocean carbon sequestration might work in practice, and what its impacts might be. Would it work better to deposit the CO2 through a fixed underwater pipeline or from a moving ship? What would be the effect on fish or on organisms that live on the seafloor? How would deep-ocean currents or turbulence affect the length of time that carbon dioxide remains separate from surface waters? What about the formation of hydrates — ice-like lattices of interwoven carbon dioxide and water molecules that could keep liquid carbon dioxide sequestered from seawater but that also might clog the pipes used to deposit it?

By the turn of the century, scientists were ready to conduct experiments in the ocean. An international team proposed a site off the Big Island of Hawaii, where a deep-ocean pipeline was already in place. The sequestration plan seemed simple: Connect a smaller pipeline to the existing one, pipe about 50 tons of liquid carbon dioxide down it to a depth of 800 meters and see what happens.

As soon as word of the experiment reached the press, though, opposition erupted. Residents, fishermen and Native Hawaiian groups vigorously protested the project — and some protested the idea of sequestration itself, claiming that it would harm sea life or suck away money that would be better spent on developing alternative energy sources. Though the Hawaii Legislature and U.S. Department of Energy ultimately threw their support behind the scientists, the controversy caused the project's proponents to withdraw.

Instead, they chose an alternate site off the coast of Norway and slimmed the size of the carbon dioxide releases to only about 5 tons. The project had a green light from the national government — until the Greenpeace ship *Rainbow Warrior* showed up in Oslo in the summer of 2002 to protest the experiment. "The project," a Greenpeace press release claimed, "is not about better scientific understanding — it's about vested interests attempting to ensure that the fossil fuel industry has a secure future. Research into ocean dumping is taking money and attention away from the real solutions to climate change — phasing out the fossil fuels, which release greenhouse gases, and replacing them with renewable energy such as solar and wind power."

"Greenpeace propaganda claimed that mad scientists want to put CO2 into the sea" is how Ohsumi sums up the environmental group's stance. Faced with this unexpected opposition, Norway's minister of the environment abruptly withdrew the project permit.

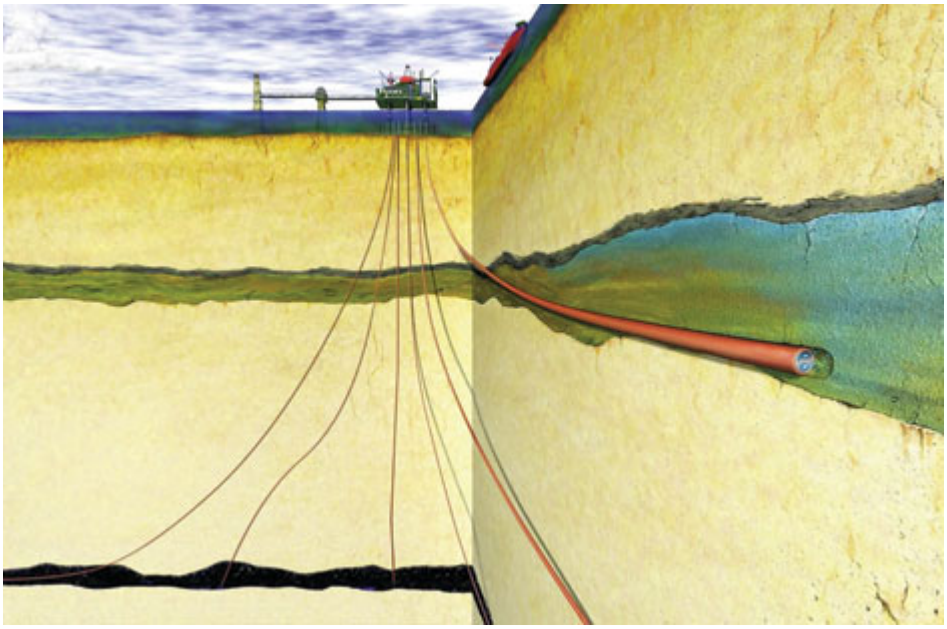
Ohsumi, like many of his colleagues, was demoralized. Three months later, some of them met in Regina, Saskatchewan, to work on drafting a summary on ocean sequestration prospects and research for the next report from the Intergovernmental Panel on Climate Change. Such a chapter was included in the next report, issued in 2006. But by then scientists and policymakers were moving toward a new idea: placing the carbon dioxide underground, rather than in the ocean. Ocean sequestration seemed, so to speak, dead in the water.

"International cooperation," Ohsumi says, "is like this," as he makes his two hands take on the form of a slithering snake.

But the idea of carbon sequestration itself — often known as CCS, for carbon capture and sequestration — did not go away, in Japan or elsewhere. As the difficulties of making meaningful cuts in fossil fuel emissions become more and more apparent, many climatologists, engineers and policymakers are increasingly enthusiastic about — or at least resigned to — the idea of squirreling away carbon dioxide in places where it will remain safely separated from the atmosphere.

"More climate protection is possible with CCS than without it," says Bjorn Utgard, energy policy adviser at the Bellona Foundation, a Norwegian nongovernmental organization that is cautiously supportive of sequestration. He believes that human beings will continue to rely on energy from fossil fuels for decades, and that sequestration is needed to mitigate the damage from their emissions. "If you do CCS on the biggest sources," he says, "you don't really need to have that many hundreds or thousands of projects before you really have an effect."

Norway is a poster child for sequestration. It is a major producer of oil and gas, thanks to the extensive deposits beneath the North Sea. The methane in natural gas is typically found together with naturally occurring carbon dioxide, which producers have historically separated and vented into the atmosphere. Natural gas extracted from the Norwegian part of the North Sea contains about 9 percent carbon dioxide. In 1991, the Norwegian Legislature imposed a tax on the release of carbon dioxide through oil and gas production. With a stroke, it became cheaper to bury that CO2 than to release it, and since 1996, the national petroleum company Statoil has been doing exactly that, compressing and injecting about a million tons of carbon dioxide a year into a saline aquifer 800 meters below the bottom of the North Sea.



At Statoil's Sleipner West rig in the North Sea, carbon dioxide produced along with natural gas is stored in an aquifer more than 800 meters below the sea floor. (Courtesy of Statoil Corp.)

If you want carbon dioxide to stay put underfoot, you look for places where underground strata sit atop one another, like the parts of a complex layer cake. In the North Sea, for example, Statoil injects its carbon dioxide into a layer of dense sand mixed with saltwater. The carbon dioxide is kept from escaping its geological tomb by 800 meters of rock above the sand. Many places worldwide have this layered geological structure, but Japan, with its fractured igneous rocks and high potential for earthquakes, is short on such storage sites.

Engineers were able to find one place where they could do a test. Outside the city of Nagaoka, near the Japan Sea coast, a company named INPEX had been extracting natural gas from a small field formed in igneous rocks. That methane had stayed put there for millions of years suggested that carbon dioxide could, too. It

didn't hurt that local communities were accustomed to the sight of natural gas wells in the midst of fertile fields said to produce Japan's best rice.

Beginning in the summer of 2003, engineers each day sent between 20 and 40 tons of liquefied CO2 down a 1,100-meter-deep well into a zone of gray-greenish tuff saturated with groundwater. Three monitoring wells that were drilled nearby allowed the engineers to follow how the carbon dioxide moved.

After 18 months, more than 10,000 tons of CO2 had been injected. This was, by almost any standard, a trivial amount; during the same period, INPEX separated about a hundred thousand tons of carbon dioxide from the methane it was mining from the Nagaoka gas field and vented it as waste into the atmosphere. But the CO2 has been meticulously monitored since 2005. The results have been encouraging; the carbon dioxide has largely stayed put — even during the magnitude 6.8 Chuetsu earthquake in 2004.

"CO2 is not so mobile — it stays around the injection well," says Kozo Sato, an underground reservoir engineer at the University of Tokyo who has been closely involved in studies of the Nagaoka site. "It's less mobile than we imagined before we performed the experiment."

Those rosy results, though, don't mean that carbon storage on land is going to take hold in Japan. Good sites simply don't exist on land, and even if they did, it's likely that local opposition would derail or slow projects. After the Chuetsu earthquake, some area residents were quick to accuse the injection project of causing the tremors — even though the epicenter was about 12 miles away from the injection site. Opposition to carbon burial under land has delayed or stopped projects in Ohio, the Netherlands and Germany, resulting in the coining of a new phrase: NUMBY, for "not under my backyard."

Even so, research into carbon sequestration will continue; many believe that the enormous inertia behind the fossil fuel economy demands it. At the G8 summit held in Japan in July 2008, world leaders pledged to support carbon sequestration as a strategy for mitigating climate change by underwriting as many as 20 demonstration projects. Through its Ministry of Economy, Trade, and Industry, Japan will underwrite one of them. The plant's construction and operation will be carried out by Japan CCS, a consortium of about three dozen industrial corporations in Japan, including utilities and oil companies.

METI and Japan CCS are examining two potential sites, one in a depleted natural gas field off the east coast of Honshu near the city of Iwaki and one just off the coast of the northern island of Hokkaido. The goal is to test sequestration as a complete process: 100,000 tons of carbon dioxide a year would be captured from either a power plant or refineries, then piped offshore and injected deep beneath the ocean floor.

"Technically, we do not have much concern," says Yoshio Hirama, coordinator/general manager of Japan CCS. "We have transportation technology, we have gas pipelines, and we can convert that pipeline to a CO2 pipeline, taking into account the difference in gas. And we have technology to inject gas into underground reservoirs, but this time it's the CO2 we're going to inject."

Still, carbon capture and sequestration is likely to work on a large scale only if the cost of capturing carbon dioxide from a power plant or any other industrial source can be significantly reduced. At a coal-fired power plant, operating the technology to capture waste carbon dioxide can consume anywhere from 15 to 40 percent of the plant's total energy output. In Japan, officials calculate the cost at about $40 per ton of carbon captured — which will readily translate into higher electric bills. A number of researchers are trying to find cheaper chemical means of capturing waste CO2, but the technical challenges remain formidable.

So do the sociopolitical ones. In Japan, fishermen's associations have long wielded significant influence on the industrial development of coastal areas. Representatives of those associations in the Iwaki area refused to be interviewed for this story, citing the delicate nature of ongoing negotiations. But the head of a fishermen's association at Teradomari, the coastal location nearest the Nagaoka experimental site, was happy to talk. Kazuya Kaneda has been fishing for 48 years, and he makes no bones about his opposition to any burial of CO2 beneath the seabed.

"Because of the earthquakes," he says, "we worry about putting CO2 under the seabed. Nobody can guarantee that such a project would not cause an earthquake. This kind of project would never have public support here because people would worry too much about leakage."

DUMPING OF wastes at sea is regulated by the 1972 London Convention. In 2006, following the debacle of the proposed ocean sequestration experiments in Hawaii and Norway, the signatories amended the convention to allow disposal of carbon dioxide under the seabed, but not in ocean water itself. But advocates of sequestration in — rather than under — the sea insist that their idea is not dead.

There are three principal reasons why ocean sequestration may come to appear attractive in comparison to geological storage. The first is the potential opposition to geological sequestration epitomized by fishermen's associations. Any particular tract of land, whether onshore or offshore, is going to have local values attached to it — and local concerns, well founded or not, about whether injected carbon dioxide could return to the surface. Though no one has proven any connection between carbon dioxide injection and earthquakes, scientists point out that it's practically impossible to prove that a particular sequestration project *won't* cause tremors, especially in a country as seismically active as Japan. On top of this are liability issues — who, or what, would be responsible if carbon dioxide were to leak from a sequestration site?

These challenges point up another, cost. Under the London Convention, wastes injected into the seabed are to be monitored indefinitely. Any company or country doing carbon dioxide injection would need to bear the costs not only of drilling injection wells, but of monitoring them. These additional costs might well be large enough to make an undersea CCS project impractical.

In the abstract, disposing of CO2 in the ocean, rather than under the seabottom, seems to face fewer political problems. There's no particular local constituency for the deep ocean. If carbon dioxide is disposed of in water, a mile or more under the ocean surface, there's no way for it to be released catastrophically into the atmosphere. If it's dissolved in the mid-ocean, there isn't even any way for it to be monitored over time; it will eventually simply disperse.

"Of course, for us, ocean sequestration is like killing two birds with one stone: technologically easier, and the cost is lower," says an official at METI. "However, even if it's a small amount of CO2, it's very hard to get acceptance just to the idea of dissolving CO2 in the ocean. We're not rushing to pursue this. But we haven't given up the idea of pursuing ocean sequestration. Our idea is to first focus on developing technology for subsea carbon sequestration and continue to pursue the technological aspect of ocean sequestration at the same time.

"When the time is right, maybe we will openly ask for permission for our position of wanting to pursue ocean sequestration."

There is a huge drawback to sequestration of carbon dioxide in ocean water: ocean acidification, which Yoshihisa Shirayama is studying at the Seto Marine Laboratory. If carbon dioxide is deliberately placed in the ocean, at whatever depth, it will ultimately reach surface waters and contribute to their acidification. The

results are intimately familiar to Shirayama. The larvae of sea urchins and other marine organisms with external skeletons will grow differently. Adults will grow less and have more trouble surviving. Shellfish will be unable to develop shells. Corals will no longer build reefs. Even fish, which are comparatively robust and can withstand high levels of dissolved carbon dioxide, may be affected: New research has shown that fish larvae exposed to high levels of dissolved CO2 lose their fear of predators. The results of all these ecological changes on economies that rely on the sea will be enormous.

So why would a marine biologist countenance the idea of ocean sequestration? The answer lies in a long-term — some might say pessimistic — view of humanity's probable response to climate change. Like many advocates of ocean sequestration, Shirayama is not optimistic about efforts to rein in fossil fuel emissions. Without major mitigation efforts, he believes, carbon dioxide concentrations in the atmosphere — and hence in the ocean's surface waters — might reach as high as 2,000 parts per million by sometime between 2100 and 2200, or some five times the current level.

Ocean acidification will affect the growth of corals like these, an outcrop of Flynn Reef, a part of Australia's Great Barrier Reef. (wikimedia)

Imagine that he's right — and that carbon dioxide levels stabilized there. As shallow ocean waters slowly mix with deeper waters, atmospheric levels of carbon dioxide would begin to decline; over millennia, some of the carbon dioxide in deep-ocean waters would become bound up with sediments. The 2,000 ppm level would represent a short-term peak that would cause great ecological and economic damage, but over a few centuries, CO2 levels would decline again.

Now imagine that carbon emissions remain the same — but humans decide to extract a lot of CO2 from industrial smokestacks and pump it into the deep ocean. Of course the carbon dioxide will re-emerge — but

advocates say that it would do so over hundreds or even thousands of years, so the atmosphere and surface waters would never reach that damaging peak concentration of 2,000 ppm.

Ocean sequestration, in other words, would speed up the otherwise centuries- or millennia-long process of establishing equilibrium between the atmosphere and the entire ocean. It would not decrease acidification of the entire ocean, but it might limit acidification in the surface waters that are of greatest economic interest to people. In a world of limited resources, it may represent the most efficient way to store a lot of carbon quickly.

Shirayama says the decision on whether to pursue ocean sequestration revolves around a tradeoff. "If you do not do it, the surface ocean may be impacted," he says. "If we do it, the impact on the deep ocean might be larger."

So ocean sequestration may be a bad idea that will cause untold harm to deep-ocean ecosystems we barely understand — but doing it may also represent a better alternative than doing nothing. It's like the amputation of a badly wounded leg: a terrible prospect, unless it's the only way to save a life.

Ralph Keeling, director of carbon dioxide studies at the Scripps Institution of Oceanography, says it is "extremely unlikely" that it's worse to put carbon dioxide into the ocean than, uncontrolled, into the atmosphere. He authored a recent paper arguing that in a climate change world, advocates for every ecosystem will have to give something up to protect the geochemical stability of the entire globe.

"It's clearly not the best option," he says. "But there is not a silver bullet."

The best option would be to greatly reduce carbon dioxide emissions. And some critics argue that sequestration research is a distraction from that solution. "CCS is complete rubbish, both because of its technology as well as political context," Tetsunari Iida, director of the Institute for Sustainable Energy Policies, a Japanese NGO, wrote in an e-mail. "History tells us that technological fix solutions always fail."

Do humans have the collective willpower to wean themselves from fossil fuels? However that question is ultimately answered, ocean sequestration of carbon dioxide is likely to be pursued somewhere, somehow. It likely will re-emerge as a real policy alternative, if not in this decade, then maybe in the next; if not after the next powerful hurricane or deadly heat wave, then after whatever subsequent disaster best epitomizes mankind's energy-climate crisis; if not in the U.S., then in Japan, or Korea, or Taiwan — all heavily industrialized nations with large carbon footprints, ocean frontage and few good options for other means of sequestration.

"Scientific society in Japan has not given up on ocean sequestration," Shirayama says. "Maybe in 10 or 15 years — in the not-very-far future — we need to think about it. Or we need to change our energy economy so that we are not using oil. Maybe that would be the best solution."

http://www.miller-mccune.com/science-environment/ocean-carbon-sequestration-the-worlds-best-bad-idea-23521/?utm_source=Newsletter130&utm_medium=email&utm_content=1012&utm_campaign=newsletters

A So-So HIV Vaccine May Be a Hard Sell

A collection of studies shows that any HIV vaccine, while highly sought by doctors to battle the epidemic, would only be requested by some.

By Brad Wittwer

Research shows the release of an HIV vaccine will mostly bring hypochondriacs out of the woodwork. (MadJack Photography/istockphoto)

An HIV vaccine — the dream of medical science for a quarter-century — isn't all that far off. Given that 2.7 million new HIV infections in 2008 alone brought the world total to 33.4 million infected, there is a genuine need.

But rather than a line out the door the first day of availability, new research by Peter Newman and Carmen Logie of the University of Toronto suggests that an HIV vaccine will mostly cause hypochondriacs to rush to their local clinic and others to, at best, scribble an appointment in the weekly planner.

The team gathered 30 original studies, mostly from North America but also from Africa and Southeast Asia, to analyze HIV vaccine acceptability. Selecting 20 studies involving 7,576 participants between 1996 and 2010, the researchers ranked HIV "vaccine acceptability" — how in demand a vaccine would be — on a 100-point scale for each study. Results ranged from 37.2 to 94.0, with the average being 65.3.

Not surprisingly, results varied depending on how effective the putative vaccine would be. Limiting the testing to 11 studies, acceptability was 73.8 for a high-efficacy vaccine (80-95 percent) versus 40.4 for a moderate-efficacy vaccine (50 percent).

The results "raise cause for concern given the likelihood that initial HIV vaccines may be of low to moderate efficacy," the authors write.

Across studies, acceptance rose alongside vaccination efficacy, duration of protection and perception of being at risk and fell with concerns over side effects, cost, pragmatic obstacles, safety concerns, fear of vaccines and fear of needles. The perception that a vaccine would be very effective drastically increased expectations of

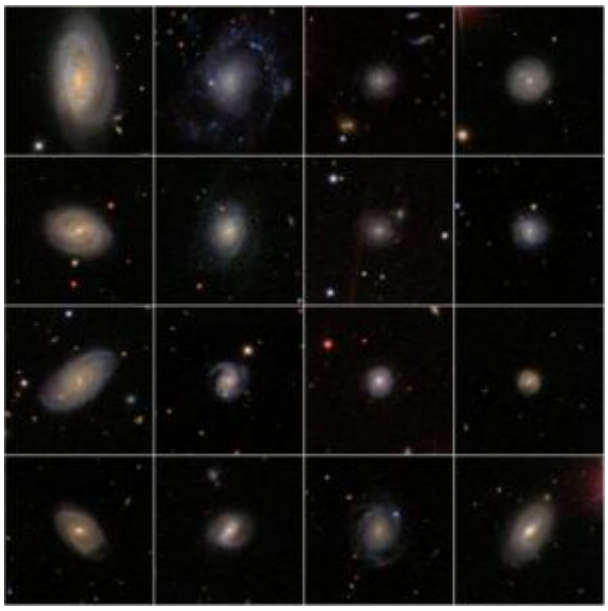
use, while the idea that someone wasn't in the "risk group" for HIV/AIDS infection significantly decreased use.

To overcome this wariness, the researchers propose educating people's perceptions of susceptibility to be more accurate — most underestimate their current risk of infection by the virus but if educated, people would be more apt to request a vaccine as is warranted. They also propose subsidies to reduce costs — free transportation to clinics for example would be one.

The authors emphasize the need for more research, since roughly 75 percent of the studies were conducted in North America and not Africa, which has the highest rates of HIV infection. In different cultural and socio-economic settings, the factors that most affect vaccine acceptability may be altogether different. Cost and pragmatic factors like remote access will take on a new meaning in less-developed nations.

http://www.miller-mccune.com/health/a-so-so-hiv-vaccine-may-be-a-hard-sell-21478/

Universe Likes to Form Galaxies Similar to the Milky Way



A small representation of 16 galaxies (out of 30,000) analyzed by Kamiz Fathi. (Credit: Kambiz Fathi/SDSS)

ScienceDaily (Oct. 12, 2010) — Galaxies like our own Milky Way formed easily and have also been the largest spiral galaxies in the universe for almost 4 billion years.

This is shown in a new study by associate professor Kambiz Fathi of the Department of Astronomy at Stockholm University. The study is now published in the scientific journal *The Astrophysical Journal Letters.*

Astronomers believe that galaxies are formed by a complex interplay between the processes that affect not only the stars and gas but also to supermassive black holes and possibly also the mysterious dark matter that surrounds every galaxy and whose nature remains unexplained.

"Galaxy formation history may be telling us something about the places in the universe where life can form," says Kambiz Fathi. Large galaxies like the Milky Way swim in a sea of many smaller galaxies, and in this process assimilate the small galaxies, sort of in the same fashion as "mergers and acquisitions" in the financial world.

"The new results show that spiral galaxies, such as the Milky Way, appears to have worked in the same way, easily formed, and have been the largest spiral galaxies in the universe for at least the last 3.4 billion years," says Kambiz Fathi.

Since the 1970s, astronomers have noticed that the number of stars in these unremarkable, middle regions of spiral galaxies is never much larger than in the Milky Way. This upper limit is known as Freeman's Law, named after the Australian astronomer Ken Freeman, who first described it. Astronomers have previously checked Freeman's Law for a few tens of galaxies. Kambiz Fathi has made a far more comprehensive investigation and found that this applies more widely than previously thought.

To come to this conclusion, Kambiz Fathi measured the images of 30,000 galaxies using the resources from the European Virtual Observatory, which gives astronomers the opportunity to use the power of the internet and large databases to reuse and combine observations from many different telescopes in innovative ways.

Since the speed of light is finite, we see distant galaxies as they were when the universe is younger than it is now. This effect allows astronomers to investigate how the universe and its galaxies have changed just by looking at objects at very large distances.

For each of the 30,000 galaxies, Kambiz Fathi estimated the number of stars in the parts of the galaxies where spiral arms are prominent. Our own sun occupies just such a place in the Milky Way.

Story Source:

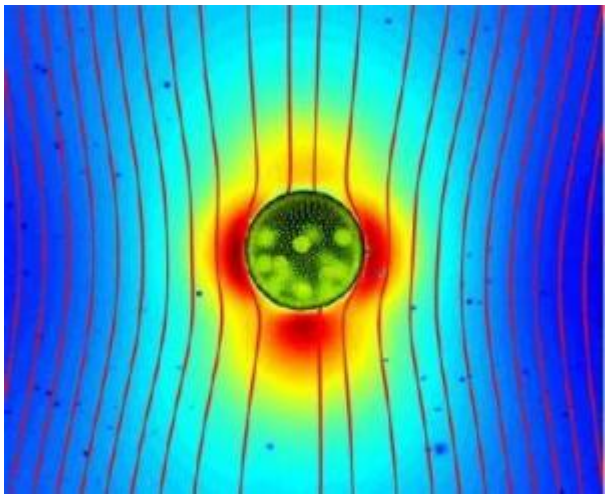
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Expertanswer**, via AlphaGalileo.

Journal Reference:

1. Kambiz Fathi. **Revisiting the Scale Length–μ0 Plane and the Freeman Law in the Local Universe**. *The Astrophysical Journal*, 2010; 722 (1): L120 DOI: 10.1088/2041-8205/722/1/L120

http://www.sciencedaily.com/releases/2010/10/101011090227.htm

Global Carbon Cycle: Tiny Creatures May Play a Crucial Role in Mixing Ocean Nutrients



Researchers have mapped the flow field around a swimming Volvox carteri microbe by tracking the movements of tiny tracer particles. The spherical Volvox is swimming towards the top of the image. Streamlines appear as red curves, and the color map corresponds to the fluid velocity. (Credit: K. Drescher, R. E. Goldstein, N. Michel, M. Polin, and I. Tuval, University of Cambridge)

ScienceDaily (Oct. 12, 2010) — Two separate research groups are reporting groundbreaking measurements of the fluid flow that surrounds freely swimming microorganisms. Experiments involving two common types of microbes reveal the ways that one creature's motion can affect its neighbors, which in turn can lead to collective motions of microorganism swarms. In addition, the research is helping to clarify how the motions of microscopic swimmers produces large scale stirring that distributes nutrients, oxygen and chemicals in lakes and oceans.

A pair of papers describing the experiments will appear in the Oct. 11 issue of the APS journal *Physical Review Letters.*

In order to observe the flow that microorganisms produce, researchers at the University of Cambridge tracked the motion of tiny tracer beads suspended in the fluid surrounding the tiny swimmers. They used the technique to study the fluid around two very different types of creatures: a small, blue-green form of algae called *Chlamydomonas reinhardtii* that swims by paddling with a pair of whip-like flagella, and the larger, spherical alga *Volvox carterii* that propels itself with thousands of flagella covering its surface.

The tracer beads showed that the two types of organisms generate distinctly different flow patterns, both of which are much more complex than previously assumed. In a related study performed at Haverford College in Pennsylvania, researchers used a high speed camera to track the flow of tracer particles around *Chlamydomonas* in a thin, two-dimension film of fluid over the course of a single stroke of its flagella.

The studies should help scientists develop new models to predict the fluid motions associated with aquatic microorganisms. The models will provide clearer pictures of the ways microbes mix bodies of water, and potentially offer insights into the role plankton plays in the carbon cycle as it stirs the world's oceans.

David Saintillan (University of Illinois at Urbana Champagne) gives an overview of the microorganism swimming research in a Viewpoint article in the October 11 edition of *APS Physics.*

Story Source:

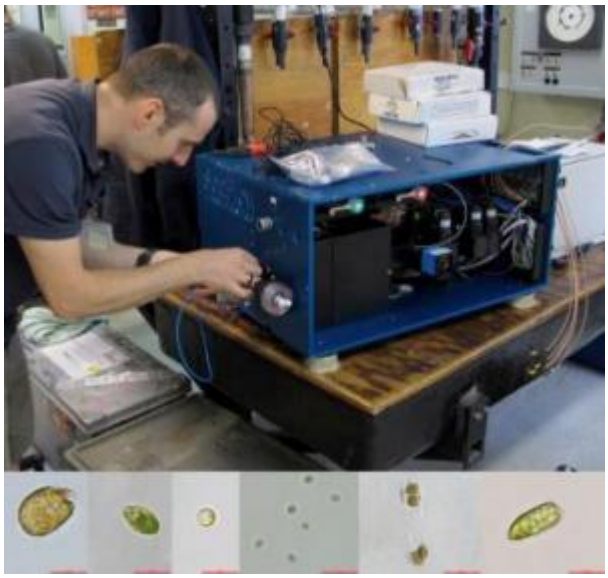
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **American Physical Society**.

Journal References:

1. David Saintillan. **A quantitative look into microorganism hydrodynamics**. *Physics*, 2010; 3 DOI: 10.1103/Physics.3.84
2. Knut Drescher, Raymond Goldstein, Nicolas Michel, Marco Polin, Idan Tuval. **Direct Measurement of the Flow Field around Swimming Microorganisms**. *Physical Review Letters*, 2010; 105 (16) DOI: 10.1103/PhysRevLett.105.168101
3. Jeffrey Guasto, Karl Johnson, J. Gollub. **Oscillatory Flows Induced by Microorganisms Swimming in Two Dimensions**. *Physical Review Letters*, 2010; 105 (16) DOI: 10.1103/PhysRevLett.105.168102

http://www.sciencedaily.com/releases/2010/10/101011090004.htm

Invisible World Teeming With Microscopic Algae Revealed



Top: Francois Ribalet prepares the SeaFlow at the start of a recent expedition. Bottom: Phytoplankton like those pictured range in size from 1 to 20 microns and can be automatically counted and classified by SeaFlow technology using sensors and computers. (Credit: Top: University of Washington. Bottom: Francois Ribalet)

ScienceDaily (Oct. 12, 2010) — It just got easier to pinpoint biological hot spots in the world's oceans where some inhabitants are smaller than, well, a pinpoint.

Microscopic algae are called phytoplankton and range from one to hundreds of microns in size -- the smallest being 1/100th the size of a human hair. But as tiny as they may be, communities of the phytoplankton south of Vancouver Island, British Columbia, are big players when it comes to carbon: They take up 50 percent of the carbon dioxide going from the atmosphere into the oceans there.

"We thought that had to be a mistake at first," says Francois Ribalet, a UW post-doctoral researcher in oceanography and lead author of a *Proceedings of the National Academy of Sciences* paper on the discovery published online in September.

"They are such small cells to do so much," he says.

Phytoplankton, like plants on land, take up carbon from carbon dioxide during photosynthesis to build cells. Phytoplankton anchor the oceanic food web so where one finds a lot of phytoplankton, one usually finds a healthy collection of fish and animals. If not eaten, phytoplankton die and sink, carrying their carbon with them. Worldwide, ocean phytoplankton consume as much carbon dioxide as the Earth's forests and land plants combined.

"Being able to readily detect and track blooms of these small-celled phytoplankton is critical for understanding their impact in the oceans and global carbon cycle," Ribalet says.

SeaFlow, a device being developed at the UW, is making that task easier, he says. The instrument is a flow cytometer that measures the size and pigment composition of each single phytoplankton present in a sample at a rate of thousands of cells per second.

Typically biologists with traditional cytometers looked for phytoplankton using tablespoon-sized samples of water collected 10 to 50 miles or more from each other.

SeaFlow can sample seawater continuously making it possible to analyze samples every three minutes or two samples per mile traveled, says Jarred Swalwell, a research engineer with oceanography and lead developer.

That's because the instrument taps into the system found on board most oceanographic research vessels that supplies running seawater to shipboard labs for such things as keeping specimens alive.

In this way SeaFlow collects more samples in a day than most scientists gather on an entire cruise, Swalwell says. And SeaFlow sensors and banks of computers, not scientists with traditional cytometers and microscopes, sort the characteristics of phytoplankton communities to determine what's present.

SeaFlow takes five minutes to do what used to take him two months, Ribalet says.

A prototype of the device revealed the biological hotspot off Vancouver Island and, for the first time, a marine ecotone, something oceanographers knew must exist but had no way to locate before now.

Ecotones are where different habitats overlap, where a prairie and forest meet, for example, or a river and estuary intersect. Ectones are rich with species because plants and animals from both ecosystems might be found there, as well as those adapted specifically to this hybrid environment. The ecotone discovered by Ribalet and colleagues is a 40-mile-wide region where ocean water rich with nitrates met coastal water rich with iron and where not just one, but five oceanic phytoplankton communities were detected taking full advantage of the carbon and nutrients concentrated there.

"This was just unexpected diversity," Ribalet says. "It flies in the face of the textbooks."

Ribalet and Swalwell imagine additional marine ecotones and biological hot spots could be detected if SeaFlows were installed on various ships and set up in a way to automatically alert scientists when phytoplankton abundance takes an interesting turn. Just such a SeaFlow set up has already been permanently mounted on the UW's vessel, the Thomas G. Thompson.

Other co-authors on the paper from the UW are professor of oceanography Virginia Armbrust, research scientist Adrian Marchetti, doctoral research assistants Katherine Hubbard and Colleen Durkin, and research engineer Rhonda Morales; Kristina Brown and Philippe Tortell from University of British Columbia; and Marie Robert from Fisheries and Oceans Canada. The work was funded by the Gordon and Betty Moore Foundation, National Science Foundation, National Institutes of Environmental Health and Sciences and the National Oceanic and Atmospheric Administration.

Story Source:

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

Journal Reference:

1. F. Ribalet, A. Marchetti, K. A. Hubbard, K. Brown, C. A. Durkin, R. Morales, M. Robert, J. E. Swalwell, P. D. Tortell, E. V. Armbrust. **Unveiling a phytoplankton hotspot at a narrow boundary between coastal and offshore waters**. *Proceedings of the National Academy of Sciences*, 2010; 107 (38): 16571 DOI: 10.1073/pnas.1005638107

http://www.sciencedaily.com/releases/2010/10/101006094055.htm

How Voracious Comb Jellyfish Makes Itself 'Invisible' to Prey

The North American comb jellyfish Mnemiopsis leidyi has a simple structure with two large oral lobes for catching prey. (Credit: Photo by Lars Johan Hansson)

ScienceDaily (Oct. 11, 2010) — Despite its primitive structure, the North American comb jellyfish can sneak up on its prey like a high-tech stealth submarine, making it a successful predator. Researchers, including one from the University of Gothenburg, have now been able to show how the jellyfish makes itself hydrodynamically 'invisible'.

The North American comb jellyfish *Mnemiopsis leidyi* has long been known to consume vast quantities of zooplankton. A few years ago the species became established in Northern Europe.

Like many other jellyfish, *Mnemiopsis leidyi* has a large gelatinous body. The large size increases its chances of encountering prey, but can also be a disadvantage since the prey organisms are often highly sensitive to movements in the water. Nevertheless, the comb jellyfish manages to catch large amounts of copepod plankton, which are known for their acute escape response.

Able to catch the world's most vigilant plankton

"Copepods have a well developed ability to detect even the slightest water disturbance," says Lars Johan Hansson, a researcher at the Department of Marine Ecology at the University of Gothenburg. "They can swim well clear of the source of water deformation in just a split second. How the comb jellyfish is able to approach and catch some of the animal world's most vigilant plankton has up until now been unknown."

The researchers used advanced video technology to study water flows around and within the comb jellyfish. These measurements were then used to calculate the water deformation generated by the jellyfish and compare this with the levels that trigger an escape response in copepods.

"It emerged that the comb jellyfish uses microscopic, hairlike cilia inside its oral lobes to generate a feeding current that carefully transports water between the lobes. As the water accelerates slowly and is transported undisturbed into the jellyfish together with the prey, there is nothing that alarms the prey until it is next to the capture site inside the lobes, by which time it's too late to escape. This makes the jellyfish a hydrodynamically silent predator."

The research on the ability of the comb jellyfish to capture its prey was carried out jointly by researchers from the USA, Norway and the Department of Marine Ecology at the University of Gothenburg.

The study has been published in the journal *Proceedings of the National Academy of Sciences*.

Story Source:

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

Journal Reference:

1. S. P. Colin, J. H. Costello, L. J. Hansson, J. Titelman, J. O. Dabiri. **Stealth predation and the predatory success of the invasive ctenophore Mnemiopsis leidyi**. *Proceedings of the National Academy of Sciences*, 2010; 107 (40): 17223 DOI: 10.1073/pnas.1003170107

http://www.sciencedaily.com/releases/2010/10/101010183703.htm

New Understanding of Bizarre Extinct Mammal: Shares Common Ancestor With Rodents, Primates

University of Florida vertebrate paleontologist Jonathan Bloch examines the full skeleton of Labidolemur kayi, a 55-million-year-old extinct mammal with odd ecological adaptations. Reddish-brown epoxy was used during the preparation process to hold the skeleton together. Photo taken Thursday Sept. 30, 2010, at the Florida Museum of Natural History. (Credit: Florida Museum photo by Kristen Grace)

ScienceDaily (Oct. 11, 2010) — University of Florida researchers presenting new fossil evidence of an exceptionally well-preserved 55-million-year-old North American mammal have found it shares a common ancestor with rodents and primates, including humans.

The study, scheduled to appear in the Oct. 11 online edition of the *Zoological Journal of the Linnean Society,* describes the cranial anatomy of the extinct mammal, *Labidolemur kayi*. High resolution CT scans of the specimens allowed researchers to study minute details in the skull, including bone structures smaller than one-tenth of a millimeter. Similarities in bone features with other mammals show *L. kayi*'s living relatives are rodents, rabbits, flying lemurs, tree shrews and primates.

Researchers said the new information will aide future studies to better understand the origin of primates.

"The specimens are among the only skulls of apatemyids known that aren't squashed completely flat," said study co-author Jonathan Bloch, an associate curator of vertebrate paleontology at the Florida Museum of Natural History on the UF campus. "They're preserved in three dimensions, which allows us to look at the morphology of the bones in a way that we never could before."

Scientists have disputed the relationships of Apatemyidae, the family that includes *L. kayi*, for more than a century because of their unusual physical characteristics. With can opener-shaped upper front teeth and two unusually long fingers, apatemyids have been compared to a variety of animals, from opossums to woodpeckers.

"There are only a few examples in the history of mammals where you get such an incredibly odd ecological adaptation," Bloch said.

Like a woodpecker's method of feeding, *L. kayi* used percussive foraging, or tapping on trees, to locate insects. It stood less than a foot tall, was capable of jumping between trees and looked like a squirrel with a couple of really long fingers, similar to the aye-aye, a lemur native to Madagascar, Bloch said.

Apatemyids have been preserved for tens of millions of years and are well known from Europe and North America.

The skeletons analyzed in the publication were recovered from freshwater limestone in the Bighorn Basin by co-author Peter Houde of New Mexico State University. Located just east of Yellowstone National Park in Wyoming, the site is known as one of the best in the world for studying the evolution of mammals during the 10 million years following the extinction of the dinosaurs, Bloch said.

Mary Silcox, first author of the study and a research associate at the Florida Museum, said scans of the specimens began about 10 years ago, during her postdoctoral work at The Pennsylvania State University.

"It's not like medical CT, it's actually an industrial CT scanner," said Silcox, an assistant professor of anthropology at the University of Toronto Scarborough. "Because this is a small animal, we needed to be able to study it at a very high resolution. The high resolution CT data were a critical part."

Doug Boyer of Stony Brook University is also a co-author of the study, part of the team's larger research to understand the relationships of apatemyids to other mammals. Bloch and colleagues are currently writing a detailed analysis of *L. kayi*'s skeleton.

John Wible, curator of mammals at the Carnegie Museum of Natural History and one of the researchers who reviewed the study, said it provides valuable information for understanding the evolutionary relationships of mammals.

"It is now clear that any assessment of the origins of primates in the future will have to include apatemyids," Wible said. "Apatemyids are not some freakish dead-end, but significant members of our own history."

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Florida**, via EurekAlert!, a service of AAAS. The original article was written by Danielle Torrent.

Journal Reference:

1. Mary T. Silcox, Jonathan I. Bloch, Doug M. Boyer, Peter Houde. **Cranial anatomy of Paleocene and Eocene Labidolemur kayi (Mammalia: Apatotheria), and the relationships of the Apatemyidae to other mammals**. *Zoological Journal of the Linnean Society*, 2010; DOI: 10.1111/j.1096-3642.2009.00614.x

http://www.sciencedaily.com/releases/2010/10/101011142411.htm

Huge Parts of World Are Drying Up: Land 'Evapotranspiration' Taking Unexpected Turn

The soils in large areas of the Southern Hemisphere, including major portions of Australia, Africa and South America, have been drying up in the past decade, a group of researchers conclude in the first major study to ever examine "evapotranspiration" on a global basis. (Credit: iStockphoto/Domenico Pellegriti)

ScienceDaily (Oct. 11, 2010) — The soils in large areas of the Southern Hemisphere, including major portions of Australia, Africa and South America, have been drying up in the past decade, a group of researchers conclude in the first major study to ever examine "evapotranspiration" on a global basis.

Most climate models have suggested that evapotranspiration, which is the movement of water from the land to the atmosphere, would increase with global warming. The new research, published online this week in the journal *Nature,* found that's exactly what was happening from 1982 to the late 1990s.

But in 1998, this significant increase in evapotranspiration -- which had been seven millimeters per year -- slowed dramatically or stopped. In large portions of the world, soils are now becoming drier than they used to be, releasing less water and offsetting some moisture increases elsewhere.

Due to the limited number of decades for which data are available, scientists say they can't be sure whether this is a natural variability or part of a longer-lasting global change. But one possibility is that on a global level, a limit to the acceleration of the hydrological cycle on land has already been reached.

If that's the case, the consequences could be serious.

They could include reduced terrestrial vegetation growth, less carbon absorption, a loss of the natural cooling mechanism provided by evapotranspiration, more heating of the land surface, more intense heat waves and a "feedback loop" that could intensify global warming.

"This is the first time we've ever been able to compile observations such as this for a global analysis," said Beverly Law, a professor of global change forest science at Oregon State University. Law is co-author of the study and science director of the AmeriFlux network of 100 research sites, which is one major part of the FLUXNET synthesis that incorporates data from around the world.

"We didn't expect to see this shift in evapotranspiration over such a large area of the Southern Hemisphere," Law said. "It is critical to continue such long-term observations, because until we monitor this for a longer period of time, we can't be sure why this is occurring."

Some of the areas with the most severe drying include southeast Africa, much of Australia, central India, large parts of South America, and some of Indonesia. Most of these regions are historically dry, but some are actually tropical rain forests.

The rather abrupt change from increased global evapotranspiration to a near halt in this process coincided with a major El Nino event in 1998, the researchers note in their report, but they are not suggesting that is a causative mechanism for a phenomenon that has been going on for more than a decade now.

Greater evapotranspiration was expected with global warming, because of increased evaporation of water from the ocean and more precipitation overall. And data indeed show that some areas are wetter than they used to be.

However, other huge areas are now drying out, the study showed. This could lead to increased drought stress on vegetation and less overall productivity, Law said, and as a result less carbon absorbed, less cooling through evapotranspiration, and more frequent or extreme heat waves.

Some of the sites used in this study are operated by Law's research group in the central Oregon Cascade Range in the Metolius River watershed, and they are consistent with some of these concerns. In the last decade there have been multiple years of drought, vegetative stress, and some significant forest fires in that area.

Evapotranspiration returns about 60 percent of annual precipitation back to the atmosphere, in the process using more than half of the solar energy absorbed by land surfaces. This is a key component of the global climate system, linking the cycling of water with energy and carbon cycles.

Longer term observations will be needed to determine if these changes are part of decadal-scale variability or a longer-term shift in global climate, the researchers said.

This study was authored by a large group of international scientists, including from OSU; lead author Martin Jung from the Max Planck Institute for Biogeochemistry in Germany; and researchers from the Institute for Atmospheric and Climate Science in Switzerland, Princeton University, the National Center for Atmospheric Research in Colorado, Harvard University, and other groups and agencies.

The regional networks, such as AmeriFlux, CarboEurope, and the FLUXNET synthesis effort, have been supported by numerous funding agencies around the world, including the Department of Energy, NASA, National Science Foundation, and National Oceanic and Atmospheric Administration in the United States.

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:

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http://www.sciencedaily.com/releases/2010/10/101010133630.htm

New Mongoose-Like Carnivorous Mammal Discovered in Madagascar

Durrell's vontsira (Salanoia durrelli) -- the first new carnivorous mammal to be discovered for 24 years. It was discovered on the Island of Madagascar by a team from Durrell Wildlife Conservation Trust (DWCT), the Natural History Museum, London, Nature Heritage, and Conservation International (CI). (Credit: © Durrell Wildlife Conservation Trust)

ScienceDaily (Oct. 11, 2010) — A new species of small carnivore, known as Durrell's vontsira (*Salanoia durrelli)* has been identified by researchers from the Durrell Wildlife Conservation Trust, the Natural History Museum, London, Nature Heritage, Jersey, and Conservation International (CI). The small, cat-sized, speckled brown carnivore from the marshes of the Lac Alaotra wetlands in central eastern Madagascar weighs just over half a kilogramme and belongs to a family of carnivores only known from Madagascar. It is likely to be one of the most threatened carnivores in the world.

The findings are outlined in the latest issue of the taxonomic journal *Systematics and Biodiversity*.

The carnivore was first seen swimming in a lake by researchers from the Durrell Wildlife Conservation Trust on a field trip surveying bamboo lemurs *(Hapalemur griseus alaotrensis)* in 2004. After briefly examining the animal, the team suspected they had witnessed a new species and so took photographs. By examining brown-tailed vontsira (*Salanoia concolor*) specimens in the Natural History Museum's collections, Museum zoologists confirmed the animal was a new species. The brown-tailed vontsira is the closest relative of the new species, which zoologists named in honour of the conservationist and writer Gerald Durrell, who died 15 years ago.

Fidimalala Bruno Ralainasolo, a conservation biologist working for Durrell Wildlife Conservation Trust who originally captured the new carnivore, commented: "We have known for some time that a carnivore lives in the Lac Alaotra marshes, but we've always assumed it was a brown-tailed vontsira that is also found in the eastern rainforests. However, differences in its skull, teeth, and paws have shown that this animal is clearly a different species with adaptations to life in an aquatic environment. It is a very exciting discovery and we decided to honour our founder, the world renowned conservationist Gerald Durrell, by naming this new species after him. However, the future of the species is very uncertain because the Lac Alaotra marshes are extremely threatened by agricultural expansion, burning and invasive plants and fish. It is a highly significant site for wildlife and the resources it provides people, and Durrell Wildlife Conservation Trust is working closely with local communities to ensure its sustainable use and to conserve Durrell's vontsira and other important species."

Paula Jenkins, Natural History Museum zoologist said: "We know very little about the small mongoose-like vontsiras because they are poorly known and rarely seen or studied in the field. This research is a fantastic example of the importance and relevance that Museum collections have for contemporary scientific research. Though people may know that museums such as the Natural History Museum hold reference collections, few people are aware how critical these collections are to our understanding of the world today."

Stephan M Funk of Nature Heritage, formerly at Durrell Wildlife Conservation Trust and co-author of the paper, said: "Population genetics and evolution of the Durrell's vontsira and related species remain badly understood, highlighting the importance of future research. More important, however, is the protection of the wetlands around Lac Alaotra, which remain highly threatened."

The habitat of Durrell's vontsira has been suffering from a number of threats over the past decades, from introduced fish to silting and pollution from fertiliser and pesticides. While the conservation status of the new species remains to be formally evaluated, it is likely to be threatened as a result of small population size, restricted distribution and the impact of habitat degradation.

Remarkably, Lac Alaotra hit the headlines only a few months ago when the extinction of the Alaotra grebe (Tachybaptus rufolavatus) was announced. Now a new species has been described from the very area where the last Alaotra grebe was seen.

Frank Hawkins of Conservation International, co-author of the paper describing the species, said: "This species is probably the carnivore with one of the smallest ranges in the world, and likely to be one of the most threatened. The Lac Alaotra wetlands are under considerable pressure, and only urgent conservation work to make this species a flagship for conservation will prevent its extinction."

Story Source:

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

http://www.sciencedaily.com/releases/2010/10/101011083904.htm

How the Deaf Have Super Vision: Cat Study Points to Brain Reorganization

Using congenitally deaf cats and hearing cats, researchers showed that only two specific visual abilities are enhanced in the deaf: visual localization in the peripheral field and visual motion detection. (Credit: iStockphoto)

ScienceDaily (Oct. 11, 2010) — Deaf or blind people often report enhanced abilities in their remaining senses, but up until now, no one has explained how and why that could be. Researchers at The University of Western Ontario, led by Stephen Lomber of The Centre for Brain and Mind have discovered there is a causal link between enhanced visual abilities and reorganization of the part of the brain that usually handles auditory input in congenitally deaf cats.

The findings, published online in *Nature Neuroscience*, provide insight into the plasticity that may occur in the brains of deaf people.

Cats are the only animal besides humans that can be born deaf. Using congenitally deaf cats and hearing cats, Lomber and his team showed that only two specific visual abilities are enhanced in the deaf: visual localization in the peripheral field and visual motion detection. They found the part of the auditory cortex that would normally pick up peripheral sound enhanced peripheral vision, leading the researchers to conclude the function stays the same but switches from auditory to visual.

"The brain is very efficient, and doesn't let unused space go to waste," says Lomber, an associate professor in the Department of Physiology and Pharmacology at the Schulich School of Medicine & Dentistry, and Department of Psychology in the Faculty of Social Science. "The brain wants to compensate for the lost sense with enhancements that are beneficial. For example, if you're deaf, you would benefit by seeing a car coming far off in your peripheral vision, because you can't hear that car approaching from the side; the same with being able to more accurately detect how fast something is moving."

Lomber and his team are trying to discover how a deaf brain differs from a hearing brain to better understand how the brain handles cochlear implants. If the brain has rewired itself to compensate for the loss of hearing, what happens when hearing is restored? "The analogy I use is, if you weren't using your cottage and lent it to a friend. That friend gets comfortable, maybe rearranges the furniture, and settles in. They may not want to leave just because you've come back," explains Lomber.

He also plans to conduct research to see if these changes in the brain also happen to those who could hear at one time, or if auditory experience prevents the changes from occurring.

The other authors on the paper are Andrej Kral of Medical University Hannover in Germany and Alex Meredith of Virginia Commonwealth University. The research was funded by the Canadian Institutes of Health Research.

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

Story Source:

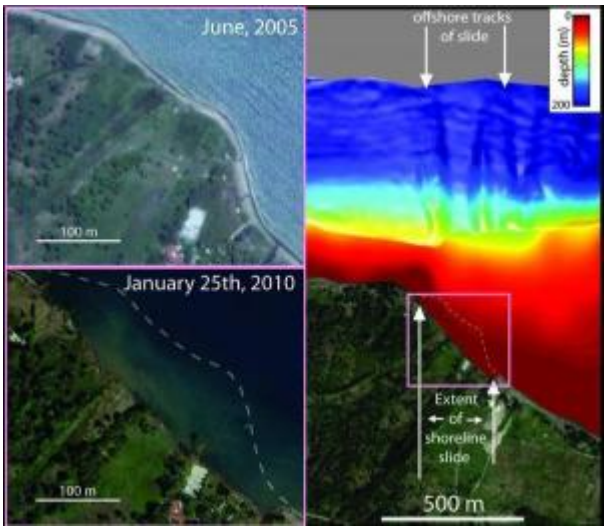
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Western Ontario**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Stephen G Lomber, M Alex Meredith, Andrej Kral. **Cross-modal plasticity in specific auditory cortices underlies visual compensations in the deaf**. *Nature Neuroscience*, 2010; DOI: 10.1038/nn.2653

http://www.sciencedaily.com/releases/2010/10/101010133604.htm

Tsunami Risk Higher in Los Angeles, Other Major Cities Than Thought, Haiti Study Suggests



Following the Jan. 12 Haiti earthquake, sediments near the town of Grand Goave slid into the sea, triggering a tsunami. Satellite images before (top left) and after (bottom left) show the location of the landslide. Seafloor bathymetry collected with sonar (right) reveals the slide path. (Credit: Image courtesy of University of Texas at Austin)

ScienceDaily (Oct. 11, 2010) — Geologists studying the Jan. 12 Haiti earthquake say the risk of destructive tsunamis is higher than expected in places such as Kingston, Istanbul, and Los Angeles.

Like Haiti's capital, these cities all lie near the coast and near an active geologic feature called a strike-slip fault where two tectonic plates slide past each other like two hands rubbing against each other.

Until now, geologists did not consider the tsunami risk to be very high in these places because when these faults rupture, they usually do not vertically displace the seafloor much, which is how most tsunamis are generated. This latest research suggests even a moderate earthquake on a strike-slip fault can generate tsunamis through submarine landslides, raising the overall tsunami risk in these places.

"The scary part about that is you do not need a large earthquake to trigger a large tsunami," said Matt Hornbach, research associate at The University of Texas at Austin's Institute for Geophysics and lead author on a paper describing the research in the Oct. 10 online edition of the journal *Nature Geoscience*.

"Organizations that issue tsunami warnings usually look for large earthquakes on thrust faults," said Hornbach. "Now we see you don't necessarily need those things. A moderate earthquake on a strike-slip fault can still be cause for alarm."

Within minutes after the magnitude 7 Haiti earthquake, a series of tsunami waves, some as high as 9 feet (3 meters), crashed into parts of the shoreline. A few weeks later, a team of scientists from the U.S. and Haiti conducted geological field surveys of sites on and offshore near the quake's epicenter.

The scientists determined the tsunamis were generated primarily by weak sediment at the shore that collapsed and slid along the seafloor, displacing the overlying water. Combined with newly discovered evidence of

historic tsunamis, the survey revealed a third of all tsunamis in the area are generated in this way. Geologists had previously estimated only about 3 percent of tsunamis globally are generated through submarine landslides.

"We found that tsunamis around Haiti are about 10 times more likely to be generated in this way than we would have expected," said Hornbach.

In addition to Hornbach, team members from The University of Texas at Austin include: Paul Mann, Fred Taylor, Cliff Frohlich, Sean Gulick and Marcy Davis. The team also includes researchers from Queens College, City University of New York; U.S. Geological Survey, University of Missouri; Lamont-Doherty Earth Observatory of Columbia University; University of California, Santa Barbara; Bureau of Mines and Energy (Haiti); and Universite d'Etat de Haiti.

The researchers gathered data on faults beneath the seafloor and land, vertical movement of the land, bathymetry (underwater topography) of the seafloor and evidence of tsunami waves. They worked on foot, on a small inflatable boat and on the 165-foot research vessel Endeavor.

This research was funded by a Rapid Response grant from the National Science Foundation and The University of Texas at Austin's Jackson School of Geosciences.

With additional funding from The Society for Geophysics' Geoscientists Without Borders program, Hornbach and others are now conducting a new research project in nearby Jamaica to assess the tsunami threat there.

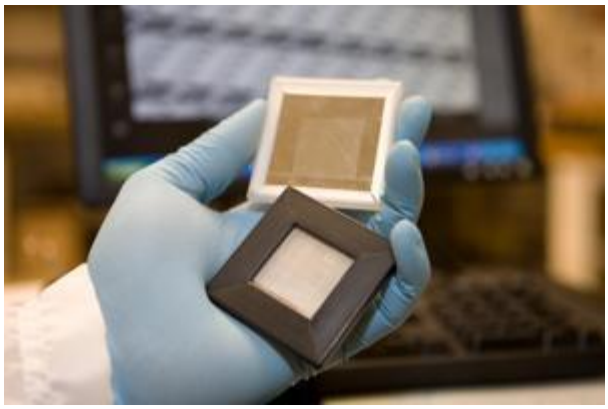
"The geology of Kingston, Jamaica is nearly identical to Port Au Prince, Haiti," said Hornbach. "It's primed and ready to go and they need to prepare for it. The good news is, they have a leg up because they're aware of the problem."

Story Source:

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

http://www.sciencedaily.com/releases/2010/10/101010133626.htm

Breakthrough E-Display Means Electronics With High Speed, High Readability and Low Power Usage



UC student Shu Yang holds prototypes of the e-Display technology developed by UC. (Credit: Photo by Lisa Ventre)

ScienceDaily (Oct. 11, 2010) — Until today, electronic devices could never have it all: high readability in bright sunlight and the ability to display high-speed content -- then hold that image indefinitely with absolutely zero electrical power usage. A new e-Display design from the University of Cincinnati changes that picture.

The Oct. 4 issue of the journal *Applied Physics Letters* contains a new electrofluidics design from the University of Cincinnati and start-up company Gamma Dynamics that promises to dramatically reshape the image capabilities of electronic devices.

This patent-pending electrofluidics breakthrough by the Novel Devices Laboratory at the University of Cincinnati and partner companies Gamma Dynamics, Dupont and Sun Chemical follows about seven years of work. According to lead researcher Jason Heikenfeld, UC associate professor of electrical and computer engineering in the College of Engineering & Applied Science, and John Rudolph, president of Gamma Dynamics, the breakthrough is even more impressive when you realize that similar research efforts elsewhere have lasted a decade without achieving similar results.

Importantly, this new "zero power" e-Design from UC can be manufactured with existing equipment and technology.

Said Heikenfeld, "What we've developed breaks down a significant barrier to bright electronic displays that don't require a heavy battery to power them."

He explained that, currently, electronic devices fall into two basic camps. The first includes those devices that offer limited function and slow speed but require little power to operate. These would include e-readers like the Kindle.

In the second camp, devices like cell phones, laptops and the iPad provide high color saturation and high-speed capability for video and other functions but at a cost of high-power usage.

Heikenfeld stated, "Conventional wisdom says you can't have it all with electronic devices: speed, brightness and low-cost manufacturing. That's going to change with the introduction of this new discovery into the

market. This idea has been in the works for a while, but we did not start really pushing the project until we thought we could make it manufacturable."

A New Design That Makes Use Of Reflection

Before describing UC's new "zero-power" design, it's helpful to understand the basic design of existing electronic devices.

Think of an e-reader as a bunch of micro-sized buckets (or pixels) of mixed black and white paint, where you can move the black and white pigments to the top or the bottom of the bucket. Just like mixing paint, the process is not fast. That's somewhat close to how today's e-readers work. The slow movement of these particles forms the text and grayscale images you see on an e-reader. These devices use practically no power unless you are switching the screen. It's actually making use of ambient light to make the particles visible. When the user turns the device on or off or switches a page, he's electronically "mixing the paint" (or pixels) to create the overall image or text page.

Faster, color-saturated, high-power devices like a computer's liquid-crystal display screen, an iPad or a cell phone require high power, in part, because they need a strong internal light source within the device (that "backlights" the screen) as well as color filters in order to display the particles as color/moving images. The need for an internal light source within the device also means visibility is poor in bright, natural light.

The new "zero-power" design combines the best features of both these kinds of devices. It requires low-power because it makes use of ambient light vs. a strong, internal light source within the device. As such and because of its low-power requirements, this new technology will make for more environmentally friendly electronic devices, stated Heikenfeld.

Yet, even though an electronic device with this eletrofluidic technology would lack a strong, internal light source, it would still display bright images at high speed. How?

Behind the display screen are two layers of liquid (oil and a pigment dispersion fluid like an inkjet fluid). Between the two layers are reflective electrodes. Think of these electrodes as a highly reflective mirror.

Ambient light enters through the display screen and through the first layer of liquid and hits the reflective electrodes. When the light hits that reflective electrode, it bounces back out to the viewer's eye, creating the perception of a bright, color-saturated image ... or text or video.

A small electric charge powers the movement of these oil and pigment-dispersion liquids. The movement occurs between a bottom layer behind the reflective electrodes and a top layer in front of the reflective electrodes. When the pigmented substance is positioned in the "top" layer (sandwiched between the ambient light and reflective electrodes), it creates a reflected ray of colored light which combines with literally millions of ambient light rays to produce a full-color display.

(The closest competition with similar brightness is electrochromic technology, which does not switch quickly enough to create video images. And the closest competition that is really low power but can still "do" video is called "Mirasol" technology developed by Quallcomm. However, when trying to display a color like white, the "Mirasol" technology has about one-third the brightness level of the UC technology being announced. "Mirasol," in fact, resembles greyed newsprint.)

New Technology Can Be Manufactured With Current Facilities And Equipment

Importantly, the new e-Display design is manufacturable with current facilities and technology. Manufacturability using the same equipment as that used for current LCDs was essential since a new LCD plant costs around $2 billion.

When Will This Technology Be Available To Consumers?

According to Gamma Dynamics' Rudolph, this electrofluidics breakthrough will change the display technology used in a myriad of electronic devices. e-Readers like the Amazon Kindle will be able to display color and video. Devices like cell phones and iPads will require much less power and will be readable even in bright sunlight.

He estimated consumers will likely first see it in action as grocery-store shelf labels and advertising displays in about three years' time.

Currently, liquid-crystal displays are attached to some grocery-store shelves, providing product and price information. These run on battery power; however, the batteries are insufficient to meet the LCDs' high power requirements. So, their brightness levels are insufficient to attract shoppers' attention. Stores still attach paper labels to them in order to indicate sale items or barcodes with eye-catching brightness.

Rudolph said that by substituting the UC-developed electrofluidic e-Display technology, these shelf-label devices would become bright and eye-catching. Given the frequency with which shelf labels are updated, the store labels should then operate for at least five years without the need for battery replacement.

As mentioned, Gamma Dynamics, Dupont and Sun Chemical partnered with UC in this research. Partial support was also provided by grants from the National Science Foundation, the Army Research Laboratory and the Air Force Research Laboratory.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Cincinnati**. The original article was written by M.B. Reilly.

Journal Reference:

1. S. Yang, K. Zhou, E. Kreit, J. Heikenfeld. **High reflectivity electrofluidic pixels with zero-power grayscale operation**. *Applied Physics Letters*, 2010; 97 (14): 143501 DOI: 10.1063/1.3494552

http://www.sciencedaily.com/releases/2010/10/101005104339.htm

Bacteria Grow Electrical Hair: Specialized Bacterial Filaments Shown to Conduct Electricity

Mohamed El-Naggar, assistant professor of physics and astronomy at USC College, explains electron transport along biological nanowires produced by bacteria. (Credit: Image courtesy of University of Southern California)

ScienceDaily (Oct. 11, 2010) — Some bacteria grow electrical hair that lets them link up in big biological circuits, according to a University of Southern California biophysicist and his collaborators.

The finding suggests that microbial colonies may survive, communicate and share energy in part through electrically conducting hairs known as bacterial nanowires.

"This is the first measurement of electron transport along biological nanowires produced by bacteria," said Mohamed El-Naggar, assistant professor of physics and astronomy at the USC College of Letters, Arts and Sciences.

El-Naggar was the lead author of a study appearing online in *Proceedings of the National Academy of Sciences.*

Knowing how microbial communities thrive is the first step in finding ways to destroy harmful colonies, such as biofilms on teeth. Biofilms have proven highly resistant to antibiotics.

The same knowledge could help to promote useful colonies, such as those in bacterial fuel cells under development at USC and other institutions.

"The flow of electrons in various directions is intimately tied to the metabolic status of different parts of the biofilm," El-Naggar said. "Bacterial nanowires can provide the necessary links … for the survival of a microbial circuit."

A bacterial nanowire looks like a long hair sticking out of a microbe's body. Like human hair, it consists mostly of protein.

To test the conductivity of nanowires, the researchers grew cultures of Shewanella oneidensis MR-1, a microbe previously discovered by co-author Kenneth Nealson, Wrigley Professor of Geobiology at USC College.

Shewanella tend to make nanowires in times of scarcity. By manipulating growing conditions, the researchers produced bacteria with plentiful nanowires.

The bacteria then were deposited on a surface dotted with microscopic electrodes. When a nanowire fell across two electrodes, it closed the circuit, enabling a flow of measurable current. The conductivity was similar to that of a semiconductor -- modest but significant.

When the researchers cut the nanowire, the flow of current stopped.

Previous studies showed that electrons could move across a nanowire, which did not prove that nanowires conducted electrons along their length.

El-Naggar's group is the first to carry out this technically difficult but more telling experiment.

Electricity carried on nanowires may be a lifeline. Bacteria respire by losing electrons to an acceptor -- for Shewanella, a metal such as iron. (Breathing is a special case: Humans respire by giving up electrons to oxygen, one of the most powerful electron acceptors.)

Nealson said of Shewanella: "If you don't give it an electron acceptor, it dies. It dies pretty rapidly."

In some cases, a nanowire may be a microbe's only means of dumping electrons.

When an electron acceptor is scarce nearby, nanowires may help bacteria to support each other and extend their collective reach to distant sources.

The researchers noted that Shewanella attach to electron acceptors as well as to each other, forming a colony in which every member should be able to respire through a chain of nanowires.

"This would be basically a community response to transfer electrons," El-Naggar explained. "It would be a form of cooperative breathing."

El-Naggar and his team are among the pioneers in a young discipline. The term "bacterial nanowire" was coined in 2006. Fewer than 10 studies on the subject have been published, according to co-author Yuri Gorby of The J. Craig Venter Institute in San Diego, discoverer of nanowires in Shewanella.

Gorby and others became interested in nanowires when they noticed that reduction of metals appeared to be occurring around the filaments. Since reduction requires the transfer of electrons to a metal, the researchers suspected that the filaments were carrying a current.

Nanowires also have been proposed as conductive pathways in several diverse microbes.

"The current hypothesis is that bacterial nanowires are in fact widespread in the microbial world," El-Naggar said.

Some have suggested that nanowires may help bacteria to communicate as well as to respire.

Bacterial colonies are known to share information through the slow diffusion of signaling molecules. Nealson argued that electron transport over nanowires would be faster and preferable for bacteria.

"You want the telegraph, you don't want smoke signals," he said.

Bacteria's communal strategy for survival may hold lessons for higher life forms.

In an op-ed published in Wired in 2009, Gorby wrote: "Understanding the strategies for efficient energy distribution and communication in the oldest organisms on the planet may serve as useful analogies of sustainability within our own species."

In addition to El-Naggar, Gorby and Nealson, the study's authors were Thomas Yuzvinsky of USC College; Greg Wanger of The J. Craig Venter Institute; and Kar Man Leung, Gordon Southam, Jun Yang and Woon Ming Lau from the University of Western Ontario.

Funding for the research came from the Air Force Office of Scientific Research, the U.S. Department of Energy, the Legler-Benbough Foundation, the J. Craig Venter Institute, the Canadian Natural Science and Engineering Research Council, the Canada Foundation for Innovation and Surface Science Western.

Story Source:

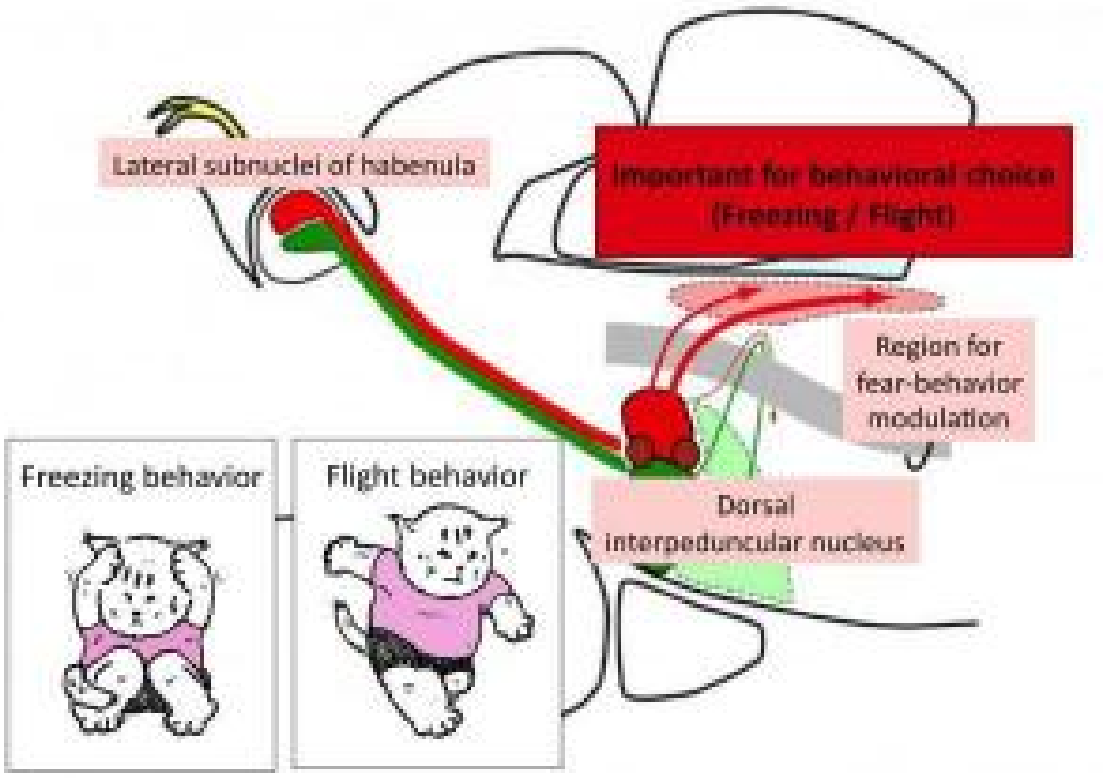
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Southern California**. The original article was written by Carl Marziali.

Journal Reference:

1. M. Y. El-Naggar, G. Wanger, K. M. Leung, T. D. Yuzvinsky, G. Southam, J. Yang, W. M. Lau, K. H. Nealson, Y. A. Gorby. **Electrical transport along bacterial nanowires from Shewanella oneidensis MR-1**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.1004880107

http://www.sciencedaily.com/releases/2010/10/101011173247.htm

Neural Pathways Governing Switching of Fear Responses in Zebrafish Identified



Neural circuit from lateral subnuclei of habenula to region for fear-behavior modulation. (Credit: © RIKEN)

ScienceDaily (Oct. 12, 2010) — A new study on the behavior of the zebrafish by researchers at the RIKEN Brain Science Institute has uncovered a key role for a region of the brain called the habenula nucleus in the development of fear responses. The discovery provides valuable insights applicable to the treatment of post-traumatic stress disorder (PTSD) and other mental illnesses.

The survival of any living organism is crucially dependent on the actions it takes when faced with fearful situations. Fear responses are likewise important to the social well-being of human beings, where its malfunction has been linked to a variety of mental disorders. Yet while numerous brain regions have been connected to the memory of fearful experiences, the neural pathways governing how such experiences are translated into the selection of behavior remain a mystery.

To unravel this mystery, the researchers analyzed neural pathways of the zebrafish, a model organism with a simple brain, focusing on an evolutionarily-conserved region called the habenula nucleus present in all vertebrate species. Using fluorescent tracers, they identified a specific pathway connecting the lateral nuclei of the habenula (HbL), via the dorsal interpeduncular nucleus (dIPN), to a structure likely to correspond to regions in the mammalian brain implicated in the modulation of fear behaviors. Transgenic zebrafish with this pathway silenced were then subject to fear-conditioning tasks and compared to a control population.

To their surprise, the researchers found a dramatic difference between the groups: while normal zebrafish learned to invoke a flight response at the sight of a stimulus (red light, conditioned stimulus) associated with a fearful stimulus (electric shock, unconditioned stimulus), the transgenic fish responded by freezing, indicating an impaired response strategy. Published in Nature Neuroscience, the findings for the first time connect the experience-dependent selection of fear responses to a specific region of the brain, opening new paths for research and promising insights into related mental disorders such as PTSD.

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

Story Source:

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

Journal Reference:

1. Masakazu Agetsuma, Hidenori Aizawa, Tazu Aoki, Ryoko Nakayama, Mikako Takahoko, Midori Goto, Takayuki Sassa, Ryunosuke Amo, Toshiyuki Shiraki, Koichi Kawakami, Toshihiko Hosoya, Shin-ichi Higashijima, Hitoshi Okamoto. **The habenula is crucial for experience-dependent modification of fear responses in zebrafish**. *Nature Neuroscience*, 2010; DOI: 10.1038/nn.2654

http://www.sciencedaily.com/releases/2010/10/101011081908.htm

Dogs Showing Separation-Related Behavior Exhibit a 'Pessimistic Mood'

Dogs can be pessimistic too. A study has gained new insight into the minds of dogs, discovering that those that are anxious when left alone also tend to show 'pessimistic' like behaviour. (Credit: iStockphoto)

ScienceDaily (Oct. 11, 2010) — Many dogs become distressed when left home alone, and they show it by barking, destroying things, or toileting indoors. Now, a new study reported in the October 12th issue of *Current Biology,* suggests that this kind of separation anxiety occurs most often in dogs that also show "pessimistic"-like behavior.

"We know that people's emotional states affect their judgments; happy people are more likely to judge an ambiguous situation positively," said Mike Mendl of the University of Bristol. "Now it seems that this may also apply to dogs; dogs that behaved anxiously when left alone also tended to judge ambiguous events negatively. Their anxious behavior may reflect an underlying negative emotional state."

The new findings also raise the possibility that some dogs may be more prone to responding anxiously when left alone than others, and that this is related to their general mood. That's important because "separation-related behavior is common in dogs, so predicting which dogs may develop this, and treating them appropriately, is very important for ensuring good dog welfare," Mendl said.

The researchers conducted the study with 24 dogs, both male and female, that had recently entered into one of two animal re-homing centers (shelters) in the United Kingdom. Each dog was first tested for separation anxiety-related behaviors. A researcher interacted with each dog in an isolated room for 20 minutes. The following day, they took the dog back to the room and then left it alone for a period of five minutes while its behavior was captured on video. In those five minutes, the researchers observed barking, jumping on furniture, scratching at the door, and repetitive behaviors to varying extents depending on the dog.

In order to study decision making in those same dogs, the researchers trained them to expect that when a bowl was placed at one location in a room (the "positive" position), it would contain food, but when placed at another location (the "negative" position), it would be empty. They then placed the bowl in ambiguous locations in between the positive and negative positions. Dogs that ran quickly to those ambiguous locations, as if expecting the positive food reward, were classed as making relatively "optimistic" decisions. Dogs that didn't approach the bowl as if they were expecting a food reward were judged to be "pessimistic."

An analysis of the two sets of behavioral data found that dogs that made more "pessimistic" judgments about whether they would find a food bowl empty or full also expressed more separation-related behaviors.

The results suggest that behavior regarded as "problematic" for owners also has emotional significance for the animals concerned, even when the behavior itself isn't being expressed, the researchers conclude. Mendl says the results also suggest that "optimistic" versus "pessimistic" decision making may be a valuable new indicator of animal emotion.

Dog owners should take note. "Some owners think that dogs showing anxious behaviors in response to separation are fine and do not seek treatment for their pets," Mendl says, noting that he and his colleagues have validated treatments for dealing with these types of behaviors in past work. "This study suggests that at least some dogs showing separation-related behaviors may have underlying negative emotional states, and owners are encouraged to seek treatment to enhance the welfare of their dogs."

Story Source:

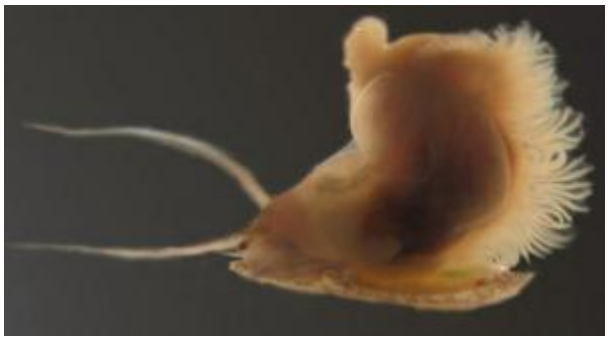
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Cell Press**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Michael Mendl, Julie Brooks, Christine Basse, Oliver Burman, Elizabeth Paul, Emily Blackwell and Rachel Casey. **Dogs showing separation-related behaviour exhibit a 'pessimistic' cognitive bias**. *Current Biology*, Volume 20, Issue 19, R839-R840, 12 October 2010 DOI: 10.1016/j.cub.2010.08.030

http://www.sciencedaily.com/releases/2010/10/101011125828.htm

Scientists Turn Snails Into Slug-Like Creatures



Marisa transformed. (Credit: Heinz Köhler and Irene Gust, Universität Tübingen)

ScienceDaily (Oct. 12, 2010) — Biologists have re-shaped the body design of snails. Exposure to platinum results in the formation of an internal shell instead of the normal external shell. During embryogenesis of the freshwater snail, *Marisa cornuarietis*, a time slot of just one or two days determines whether the animals form an outer shell or not. Reprogramming of the direction of growth of the molluscs´ shell-generating tissue during this sensitive phase prevents the development of the usual convoluted shell. In lieu thereof a small hollow cone grows inside the body -- similar to whats happens in squids.

This new program has implications also for other organs: the gill is not located in a mantle cavity over the head, as usual, but rather no mantle cavity is formed at all and the gill remains at the posterior end of the visceral sac and floats freely in the water. These results which recently have been published in *Evolution & Development* by the group of Prof. Heinz Köhler and Prof. Rita Triebskorn from the Institute for Evolution and Ecology of Tübingen University, Germany, support the theory of 'macromutation'-based radical developmental shifts caused by modifications of signal transduction pathways which may have led to sudden body plan alterations during evolution.

Initially, the phenomenon of snail-slug conversion was discovered by Raphaela Osterauer, PhD candidate supervised by Heinz Köhler, while studying the toxicity of metal ions. Some years ago, the group had established a comparatively sensitive embryo toxicity test on the basis of developing *Marisa* eggs. When testing the noble metal platinum, which is released into the environment by abrasion from automobile catalytic converters, she found the embryos lacking a shell when being exposed to high concentrations of bivalent platinum ions. Further experiments revealed crucial relevance of exactly that small time slot in which the direction of growth of the shell gland´s tissue is defined. During one or two days only, this tissue is either programmed to evaginate and to form a shell-secreting mantle covering the dorsal part of the snail´s body or, alternatively in the presence of platinum, to invaginate into the gastropod´s body.

It is thus possible to spatially re-direct the shell-forming tissue with all irreversible consequences for the formation of the mantle and the shell and the position of the gill simply by a temporary exposure to platinum ions. After removal of platinum, the artificial slug embryos proceed with their development according to the new developmental program, hatch from their eggs, feed as usual, and do not change their new body plan anymore. They reach an age of more than half a year. During his time, an internal calcareous shell in the shape of a slightly bend, hollow cone grows inside of the body of these animals which remains after their death. Since also extant slugs, sea-slugs, and cephalopods bear small internal shells, the artificial *Marisa* slugs may serve as a model organisms to investigate the evolution of shell internalization. In recent studies, the Köhler and Triebskorn group was able to raise artificial slugs also in two only distantly related lung snail species.

The molluscs are not genetically modified by platinum -- they are no mutants. However, the scientists expect gene activity regulation to be modified. Similar, mutation-based modifications of gene regulation may have contributed to the evolution of different mollusc body plans and, consequently, the Tübingen research group now plans to concentrate on the analysis of platinum-sensitive gene activity during the early embryogenesis of gastropods.

The biologists assume that the artificial slugs do not occur in the field, since platinum pollution in the environment does not yet reach the concentrations necessary for snail-slug conversion.

Story Source:

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

Journal Reference:

1. Raphaela Osterauer, Leonie Marschner, Oliver Betz, Matthias Gerberding, Banthita Sawasdee, Peter Cloetens, Nadine Haus, Bernd Sures, Rita Triebskorn, Heinz-R. K?hler. **Turning snails into slugs: induced body plan changes and formation of an internal shell**. *Evolution & Development*, 2010; 12 (5): 474 DOI: 10.1111/j.1525-142X.2010.00433.x

http://www.sciencedaily.com/releases/2010/10/101011090229.htm

Too Much Light at Night at Night May Lead to Obesity, Study Finds

ScienceDaily (Oct. 11, 2010) — Persistent exposure to light at night may lead to weight gain, even without changing physical activity or eating more food, according to new research in mice.

Researchers found that mice exposed to a relatively dim light at night over eight weeks had a body mass gain that was about 50 percent more than other mice that lived in a standard light-dark cycle.

"Although there were no differences in activity levels or daily consumption of food, the mice that lived with light at night were getting fatter than the others," said Laura Fonken, lead author of the study and a doctoral student in neuroscience at Ohio State University.

The study appears this week in the online early edition of the *Proceedings of the National Academy of Sciences*.

If the mice are not less active or eating more, what's causing the bigger weight gain? Results suggest that mice living with light at night eat at times they normally wouldn't.

In one study, mice exposed to light at night -- but that had food availability restricted to normal eating times -- gained no more weight than did mice in a normal light-dark cycle.

"Something about light at night was making the mice in our study want to eat at the wrong times to properly metabolize their food," said Randy Nelson, co-author of the study and professor of neuroscience and psychology at Ohio State.

If these results are confirmed in humans, it would suggest that late-night eating might be a particular risk factor for obesity, Nelson said.

In one study, mice were housed in one of three conditions: 24 hours of constant light, a standard light-dark cycle (16 hours of light at 150 lux, 8 hours of dark), or 16 hours of daylight and 8 hours of dim light (about 5 lux of light).

The researchers measured how much food the mice ate each day. They also measured how much they moved around their cages each day through an infrared beam crossing system. Body mass was calculated each week.

Results showed that, compared to mice in the standard light-dark cycle, those in dim light at night showed significantly higher increases in body mass, beginning in the first week of the study and continuing throughout.

By the end of the experiment, light-at-night mice had gained about 12 grams of body mass, compared to 8 grams for those in the standard light-dark cycle. (Mice in constant bright light also gained more than those in the standard light-dark cycle, but Nelson said the dim light-at-night mice were better comparisons to the light exposure that humans generally get.)

The dim light-at-night mice also showed higher levels of epididymal fat, and impaired glucose tolerance -- a marker of pre-diabetes.

Although the dim light-at-night mice didn't eat more than others, they did change when they ate, results showed. These mice are nocturnal, so they would normally eat substantially more food at night. However, the dim light-at-night mice ate 55 percent of their food during the daylight hours, compared to only 36 percent in the mice living in a standard light-dark cycle.

Since the timing of eating seemed significant, the researchers did a second study, similar to the first, with one important difference: instead of having food freely available at all times, food availability was restricted to either the times when mice would normally be active or when they would normally be at rest.

In this experiment, mice exposed to the dim light at night did not have a greater gain in body mass than did the others when their food was restricted to times when they normally would be active.

"When we restricted their food intake to times when they would normally eat, we didn't see the weight gain," Fonken said. "This further adds to the evidence that the timing of eating is critical to weight gain."

The findings showed that levels of corticosterone, a stress hormone, were not significantly different in dim light-at-night mice compared to those living in a standard light-dark cycle.

That's important because corticosterone has been linked to changes in metabolism, Fonken said. This shows there doesn't have to be changes in corticosterone levels to have changes in metabolism in the mice.

So how does light at night lead to changes in metabolism? The researchers believe the light could disrupt levels of the hormone melatonin, which is involved in metabolism. In addition, it may disrupt the expression of clock genes, which help control when animals feed and when they are active.

Overall, the findings show another possible reason for the obesity epidemic in Western countries.

"Light at night is an environmental factor that may be contributing to the obesity epidemic in ways that people don't expect," Nelson said. "Societal obesity is correlated with a number of factors including the extent of light exposure at night."

For example, researchers have identified prolonged computer use and television viewing as obesity risk factors, but have focused on how they are associated with a lack of physical activity.

"It may be that people who use the computer and watch the TV a lot at night may be eating at the wrong times, disrupting their metabolism," Nelson said. "Clearly, maintaining body weight requires keeping caloric intake low and physical activity high, but this environmental factor may explain why some people who maintain good energy balance still gain weight."

Other co-authors were Joanna Workman, James Walton, Zachary Weil, and John Morris, all of Ohio State; and Abraham Haim, of the University of Haifa, Mount Carmel, in Israel.

The research was supported by the National Science Foundation and the U.S.-Israel Binational Science Foundation.

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

Story Source:

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

Journal Reference:

1. L. K. Fonken, J. L. Workman, J. C. Walton, Z. M. Weil, J. S. Morris, A. Haim, R. J. Nelson. **Light at night increases body mass by shifting the time of food intake**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.1008734107

http://www.sciencedaily.com/releases/2010/10/101011173249.htm

Better Way Developed to See Molecules at Work in Living Brain Cells

ScienceDaily (Oct. 7, 2010) — By creating a better way to see molecules at work in living brain cells, researchers affiliated with MIT's Picower Institute for Learning and Memory and the MIT Department of Chemistry are helping elucidate molecular mechanisms of synapse formation. These studies could also help further understanding of how synapses go awry in developmental diseases such as autism and Fragile X syndrome. The study will appear in the Oct. 7 issue of *Cell*.

Using the new technique, which is more accurate and sensitive than existing methods, the researchers found that certain protein-protein interactions can affect early phases of synapse maturation. Their work will help scientists understand exactly how two adjacent neurons form a synapse -- the meeting point where information transfer among brain cells occurs. This method provides information on the dynamics of proteins in synapses on a minute-by-minute time scale, the researchers said.

"How nascent contacts mature into excitatory or inhibitory synapses is an area of intense interest," said Amar Thyagarajan, Autism Speaks Postdoctoral Fellow in the laboratory of Alice Y. Ting, associate professor of chemistry. "Trans-synaptic signaling complexes seem like a good place to start looking for clues to this process since they mediate signaling into the pre- and post-synaptic cells during this process."

Study co-authors Thyagarajan and Ting are Picower Institute affiliates.

The researchers studied the interaction of the proteins neurexin and neuroligin on the surface of neurons. These adhesion molecules--two of many in the brain that regulate synapse formation, maturation, function and plasticity--not only function as the "glue" that hold neurons together but also mediate signaling so that the appropriate molecular components are recruited for the pre- and postsynaptic cells.

Neurexins and neuroligins can be thought of as a chemical bridge and communication network that spans the synaptic cleft.

Called BLINC (Biotin Labeling of Intercellular Contacts), the new technique creates a fluorescent signal only when neurexin and neuroligin interact. "The only way for a BLINC signal to occur is when two neurons contact each other," Thyagarajan said.

For a long time, it had been known that neurexins and neuroligins are important for synapse maturation. However, their exact function was unclear since most previous studies used indirect methods such as manipulating gene expression to infer function.

"Our motivation was that if we could come up with a way to directly observe this complex, then maybe we could better understand its function in synapse maturation," Thyagarajan said.

"We developed BLINC to visualize this complex in live synapses in culture. We then used BLINC in different modalities to discover that synaptic activity causes the neurexin-neuroligin complex to grow in size," he said. "This growth is necessary for the recruitment of AMPA receptors to young synapses.

"AMPA receptor recruitment is a hallmark of excitatory synapse maturation, so our study demonstrated how a trans-synaptic complex can affect early phases of synapse maturation," Thyagarajan said.

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

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Massachusetts Institute of Technology**. The original article was written by Deborah Halber, MIT's Picower Institute for Learning and Memory.

Journal Reference:

1. Amar Thyagarajan and Alice Y. Ting. **Imaging Activity-Dependent Regulation of Neurexin-Neuroligin Interactions Using trans-Synaptic Enzymatic Biotinylation**. *Cell*, 7 October, 2010 DOI: 10.1016/j.cell.2010.09.025

http://www.sciencedaily.com/releases/2010/10/101007151212.htm

Natural Nano Particles En Route to 'Sick Cells'

ScienceDaily (Oct. 11, 2010) — Wouter Roos and Gijs Wuite, respectively FOM researcher and FOM workgroup leader at VU University Amsterdam, discuss recent developments in the area of 'physical virology' in the journal *Nature Physics*. This new and rapidly growing discipline studies viruses, which can be viewed as 'natural nanoparticles', from a physics perspective. Roos and Wuite provide an overview of the latest fundamental insights and sketch a picture of the possible medicinal applications, such as viral transport of specific substances to cells.

In the review article, the researchers discuss how viruses can spontaneously form a protein sphere around their own DNA. This process occurs without an external energy source and provides new insights into how nanostructures can be made with as little energy as possible. Roos and Wuite also discuss the mechanical structure of viruses using, for example, the experiments that are being carried out in their own lab at VU University Amsterdam.

Tactile microscope

Viruses are too small to observe with a light microscope, but with the help of a tactile microscope the particles can still be rendered visible. Such a microscope feels the surface just like the needle of a record player gliding over the surface of a record. This technology not only makes it possible to 'see' viruses but also to study the material properties of the particles. The particles are literally squeezed until they break open. These measurements provide insight into the exact mechanical properties of the particles.

Nanocontainers

Besides increasing our fundamental knowledge about the physics of natural nanoparticles such as viruses, these experiments also provide opportunities for the development of artificial nanocontainers for the transport of specific substances to cells. This could be used in medicine to specifically manipulate certain cells in order to cure diseases.

Story Source:

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

Journal Reference:

1. W. H. Roos, R. Bruinsma, G. J. L. Wuite. **Physical virology**. *Nature Physics*, 2010; 6 (10): 733 DOI: 10.1038/nphys1797

http://www.sciencedaily.com/releases/2010/10/101011130001.htm

Population Change: Another Big Influence on Climate Change

Changes in population, including aging and urbanization, could significantly affect global emissions of carbon dioxide over the next 40 years, according to a new study. (Credit: iStockphoto)

ScienceDaily (Oct. 11, 2010) — Changes in population, including aging and urbanization, could significantly affect global emissions of carbon dioxide over the next 40 years, according to a new study.

The study, published in the *Proceedings of the National Academy of Sciences* (PNAS), was conducted by researchers from the National Center for Atmospheric Research (NCAR), the International Institute for Applied Systems Analysis (IIASA), and the National Oceanographic and Atmospheric Administration. It was funded by a European Young Investigator's Award*, the Hewlett Foundation, and the US National Science Foundation.

By mid-century it is estimated that global population could rise by more than three billion people, with most of that increase occurring in urban areas. The study showed that a slowing of that population growth could contribute to significantly reducing greenhouse gas emissions. By 2050, the researchers found that if population followed one of the slower growth paths foreseen as plausible by demographers at the United Nations, it could provide 16 to 29 percent of the emission reductions thought necessary to keep global temperatures from causing serious impacts. The effect of slower population growth on greenhouse gas emissions would be even larger by the end of the century.

"If global population growth slows down, it is not going to solve the climate problem, but it can make a contribution, especially in the long term," says the study's lead author and NCAR scientist Brian O'Neill.

Study co-author and IIASA scientist Shonali Pachauri says that slower population growth will have different influences, depending on where it occurs. "A slowing of population growth in developing countries today will have a large impact on future global population size. However, slower population growth in developed countries will matter to emissions too because of higher per capita energy use," says Dr Pachauri.

Scientists have long known that changes in population will have some effect on greenhouse gas emissions, but there has been debate on how large that effect might be.

Urbanization and aging

The researchers sought to quantify how demographic changes influence emissions over time, and in which regions of the world. They also went beyond changes in population size to examine the links between aging, urbanization, and emissions.

The team found that growth in urban populations could lead to as much as a 25 percent rise in projected carbon dioxide emissions in some developing countries. The increased economic growth associated with city dwellers was directly correlated with increased emissions, largely due to the higher productivity and consumption preferences of an urban labor force.

In contrast, aging can reduce emission levels by up to 20 percent in some industrialized countries. This is because older populations are associated with lower labor force participation, and the resulting lower productivity leads to lower economic growth.

"Demography will matter to greenhouse gas emissions over the next 40 years," says O'Neill. "Urbanization will be particularly important in many developing countries, especially China and India, and aging will be important in industrialized countries."

The researchers worked with projections showing that population aging will occur in all regions of the world, a result of people living longer and declines in fertility.

Future scenarios of human behavior

The authors developed a set of economic growth, energy use, and emissions scenarios, using a new computer model (the Population-Environment-Technology model, or PET). To capture the effects of future demographic change they distinguished between household types, looking at age, size, and urban vs. rural location.

In addition, they drew on data from national surveys covering 34 countries and representative of 61 percent of the global population to estimate key economic characteristics of household types over time, including labor supply and demand for consumer goods.

"Households can affect emissions either directly, through their consumption patterns, or indirectly, through their effects on economic growth," O'Neill explains.

The authors also suggest that developers of future emissions scenarios give greater consideration to the implications of urbanization and aging, particularly in the U.S., European Union, China, and India.

"Further analysis of these trends would improve our understanding of the potential range of future energy demand and emissions," says O'Neill.

The researchers caution that their findings do not imply that policies affecting aging or urbanization should be implemented as a response to climate change, but rather that better understanding of these trends would help anticipate future changes.

Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **International Institute for Applied Systems Analysis (IIASA)**.

1. Brian C. O'Neill, Michael Dalton, Regina Fuchs, Leiwen Jiang, Shonali Pachauri, and Katarina Zigova. **Global demographic trends and future carbon emissions**. *Proceedings of the National Academy of Sciences*, October 11, 2010

http://www.sciencedaily.com/releases/2010/10/101011150354.htm

Physical Symptoms Prevalent No Matter What Stage of Cancer Including Remission

ScienceDaily (Oct. 11, 2010) — Twenty-two physical symptoms associated with cancer -- symptoms often unrecognized and undertreated -- are prevalent in all types of cancers regardless of whether the patient is newly diagnosed, undergoing treatment or is a cancer survivor, according to researchers from the Regenstrief Institute and the Indiana University schools of medicine and nursing.

Common symptoms include fatigue, pain, weakness, appetite loss, dry mouth, constipation, insomnia and nausea. These physical symptoms are associated with substantial functional impairment, disability and diminished quality of life.

The study of 405 patients was reported in the Oct. 11, 2010, issue of the *Archives of Internal Medicine*. Numerous physical symptoms, rather than just a few, were prevalent in patients with cancer and this prevalence did not diminish after completion of therapy.

"We found that regardless of where they are in the course of their diseases, many individuals with cancer have a high symptom burden," said Kurt Kroenke, M.D., the study's principal investigator and first author. Dr. Kroenke is a Regenstrief Institute investigator and a Chancellor's Professor of Medicine in the IU School of Medicine.

"These symptoms impact them at home and at work throughout their lives," he said.

Study participants, all of whom had pain, depression or both, experienced substantial disability, reporting on average 17 of the past 28 days as either bed days or days in which they had to cut down on activities by at least 50%. Almost all patients reported feeling tired (97.5%) and most (78.8%) were bothered "a lot" by this symptom. Of the 22 symptoms studied, 15 were reported by more than half of the study participants.

In spite of high symptom prevalence, the researchers did not uncover greater use of the health care system. There may be several explanations for this including patients' inclinations to focus on cancer treatment while with their physicians or to accept the symptoms as an inevitable result of the disease or its treatment. Alternatively, the explanation may lie with the fact that those in the study, as cancer patients or former patients, were already frequently interacting with many parts of the health care system.

"Patients and their families should be encouraged to bring up symptoms like pain or insomnia with physicians. But because oncologists are necessarily focused on treatment of the cancer itself, they often have insufficient time to optimally evaluate and manage symptoms and other factors impacting quality of life. We have shown in an earlier study that one effective solution might be a partnership between a telephone-based symptom management team and community-based oncology practices,," said Dr. Kroenke, who is a research scientist with the Center for Implementing Evidence-Based Practice at the Richard Roudebush VA Medical Center and an Indiana University Melvin and Bren Simon Cancer Center member.

The previous study, published earlier in 2010 in the Journal of the American Medical Association, reported that an economical, centralized approach is feasible to conduct and significantly improved symptoms of pain and depression in patients in any phase of cancer. That approach gave patients, many of whom lived in underserved rural areas, one-stop assistance they probably wouldn't have had access to unless they went to a major cancer center, Kroenke said.

Recognizing and managing physical symptoms such as fatigue, pain, nausea, and insomnia may make a significant difference regardless of type or phase of cancer. The researchers plan to investigate medical and behavioral strategies and combinations of both approaches to control these symptoms.

In addition to Dr. Kroenke, co-authors of "Somatic Symptoms in Patients with Cancer Experiencing Pain or Depression" are "Xin Zhong, R.N. and Janet Carpenter, Ph.D., R.N., of the IU School of Nursing; Dale Theobald, M.D., Ph.D. of Community Home Health Hospice and Symptom Management Group; Jingwei Wu, M.S., of the IU School of Medicine; and Wanzhu Tu, Ph.D., of the Regenstrief Institute and the IU School of Medicine.

The study was supported by a grant from the National Cancer Institute.

The Regenstrief Institute, IU schools of medicine and nursing and the IU Simon Cancer Center are located on the campus of Indiana University-Purdue University Indianapolis.

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

Story Source:

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

Journal Reference:

1. K. Kroenke, X. Zhong, D. Theobald, J. Wu, W. Tu, J. S. Carpenter. **Somatic Symptoms in Patients With Cancer Experiencing Pain or Depression: Prevalence, Disability, and Health Care Use**. *Archives of Internal Medicine*, 2010; 170 (18): 1686 DOI: 10.1001/archinternmed.2010.337

http://www.sciencedaily.com/releases/2010/10/101011173500.htm

How Serotonin Works: Findings Point to New Treatments for Schizophrenia and Depression

ScienceDaily (Oct. 5, 2010) — Scripps Research Institute scientists have shown for the first time that the neurotransmitter serotonin uses a specialized signaling pathway to mediate biological functions that are distinct from the signaling pathways used by hallucinogenic substances. The new findings could have a profound effect on the development of new therapies for a number of disorders, including schizophrenia and depression.

The study was published in the October 6, 2010 issue of the *Journal of Neuroscience*.

Serotonin has tremendous influence over several brain functions, including the control of perception, cognition, sleep, appetite, pain, and mood and mediates these effects through interactions with receptors located throughout the central and peripheral nervous systems.

"Our study shows that while both serotonin and hallucinogens act at the serotonin 2A receptor, serotonin utilizes a very specific pathway and its actions are independent of those produced by hallucinogens," said Laura Bohn, an associate professor on the Florida campus of The Scripps Research Institute. "Future drug discovery efforts to identify lead compounds for treatment of depression may consider focusing upon those that only engage that pathway. This work may also lend insight into the mechanisms that underlie the hallucinations that occur in schizophrenia."

This may be particularly important, Bohn said, for the treatment of depression because traditional therapies, which focus on elevating serotonin levels, can sometimes produce serious side effects such as a serotonin syndrome. This syndrome is often accompanied by hallucinations, and is especially serious when antidepressant treatments such as selective serotonin reuptake inhibitors (SSRIs) are mixed with monoamine oxidase inhibitors (MAOIs).

The scientists' current study supports a long-standing hypothesis that hallucinations may arise from the metabolites formed from elevated serotonin levels. Since there is a difference in the way the two neurotransmitters signal, this may represent a means to preserve the effects of serotonin while preventing the adverse side effects caused by the metabolites.

Serotonin Versus Hallucinogens

The study, coauthored by Cullen Schmid, a graduate student in the lab, showed that serotonin signals through the serotonin 2A receptor by recruiting a regulatory protein called β-arrestin2, and that the actions of serotonin at the receptor are far different than those produced by hallucinogenic N-methyltryptamines, a class of naturally occurring substances found in several plants and in minute amounts in the human body and which includes the abused drug, DMT. The study found that the N-methyltryptamines activate the serotonin 2A receptor independently of β-arrestin2.

Both serotonin and the N-methyltryptamines produce what is known as a head twitch response in animal models, which indicates that the serotonin 2A receptor has been activated. Any interruption in the exclusive serotonin pathway prevents that behavioral response to serotonin, but has no effect on N-methyltryptamine-induced head twitches, indicating a distinct divergence in the signaling pathways utilized by these two neurotransmitters.

"Despite the fact that they activate the same receptor, serotonin leads to the assembly of a number of proteins associated with the receptor that the metabolites of serotonin do not produce," Bohn said. "But whether the lack of this complex formation is why compounds like DMT lead to hallucinations is not clear."

Bohn continues to investigate these and other questions.

In addition to Bohn, the study, "Serotonin, But Not N-Methyltryptamines, Activates the Serotonin 2A Receptor via an β-Arrestin2/Src/Akt Signaling Complex in Vivo," was authored by Cullen L. Schmid of The Ohio State University Neuroscience Graduate Studies Program and Scripps Research.

The work was supported by the National Institute on Drug Abuse of the National Institutes of Health.

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

Story Source:

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

Journal Reference:

1. C. L. Schmid, L. M. Bohn. **Serotonin, But Not N-Methyltryptamines, Activates the Serotonin 2A Receptor Via a β-Arrestin2/Src/Akt Signaling Complex In Vivo**. *Journal of Neuroscience*, 2010; 30 (40): 13513 DOI: 10.1523/JNEUROSCI.1665-10.2010

http://www.sciencedaily.com/releases/2010/10/101005171034.htm

Ibuprofen Offers Relief for Many With Migraine Headaches

ScienceDaily (Oct. 6, 2010) — For many people suffering from migraine headaches, over-the-counter ibuprofen -- Advil and Motrin are well-known brands -- might be enough to relieve the pain.

A new Cochrane review finds that about half of those with migraine headaches will have pain relief within two hours after taking ibuprofen.

"We knew that many migraineurs rely on over-the-counter medication to treat attacks and surveys show that while some find them helpful, many are dissatisfied," said review co-author Sheena Derry of the Pain Research and Nuffield Department of Anaesthetics at the University of Oxford.

Migraine headache is intense throbbing pain on one side of the head, and an attack can last anywhere between four and 72 hours. Symptoms such as nausea, vomiting, aura and increased sensitivity to light and sound often accompany migraines.

The systematic review was published by The Cochrane Collaboration, an international organization that evaluates medical research. Systematic reviews draw evidence-based conclusions about medical practice after considering both the content and quality of existing medical trials on a topic.

According to the Migraine Research Foundation, migraine ranks in the top 20 of the world's most disabling medical illnesses with more than 10 percent of the population, including children, suffering from the condition.

Migraine also causes less productivity at work and school. Less than 10 percent of sufferers are able to work or function normally during their migraine attacks, and American employers lose more than $13 billion each year as a result of 113 million lost work days, says the Migraine Research Foundation.

To relieve their headache pain, almost half (49 percent) of migraine sufferers use over-the-counter medication only, 20 percent use prescription medication and 29 percent use both, according to the Cochrane review.

Derry said she and her fellow reviewers conducted the Cochrane review to help provide a more definitive answer on whether ibuprofen is effective for migraine pain. They also wondered whether also taking an antiemetic to relieve nausea was better than taking an ibuprofen alone.

"We knew that there were a number of published trials using ibuprofen for acute treatment of attacks," she said. "Individual trials, however, can be misleading for a number of reasons, and generally it is recognized that using systematic review and meta-analysis is likely to provide a more accurate estimate of the effects of any intervention."

The reviewers evaluated nine studies with 4,373 adult participants who had a diagnosis of migraine headache. The average age of the participants was 30 to 40 years and all had a history of migraine for at least 12 months before entering the studies.

In total, 414 people with migraines underwent treatment with 200 milligrams of ibuprofen, 1,615 received a dose of 400 milligrams, 208 received a 600-milligram dose and 1,127 received a placebo.

Twenty-six percent of patients taking the 400-milligram dose were pain free within two hours, compared with 20 percent who took the smaller dose and 11 percent who received a placebo. In the same period, 57 percent who took 400 milligrams of ibuprofen had their pain reduced from moderate or severe to "no worse than mild," compared with 25 percent taking a placebo.

"For those who experience these outcomes, ibuprofen is a useful, inexpensive and readily available treatment," Derry said. "Those who don't experience good outcomes will need to look at alternative treatments."

Roger Chou, M.D., associate professor of medicine at Oregon Health & Science University and the director of clinical guidelines development at the American Pain Society, said that it is common to use OTC medications such as ibuprofen to treat migraines.

"Migraine sufferers really vary in what they do, in part because the severity and frequency varies so much," said Chou. "People with relatively mild migraines probably do use over-the-counter medications and so do people who find that they work."

He added, "Those with more severe migraines, or who don't get relief with over-the-counter medications, or who have very frequent migraines, often end up in the doctor's office and are given various prescriptions."

Derry and her colleagues also found that the nausea and other symptoms that usually accompany migraines decreased within two hours and fewer participants used rescue medications with ibuprofen compared with placebo. Only mild side effects occurred with the ibuprofen.

The reviewers found little information comparing ibuprofen with other medications and no information comparing the effectiveness of ibuprofen combined with an antiemetic.

Two of the four reviewers disclosed previous consulting work with various pharmaceutical companies.

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

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Center for Advancing Health**. The original article was written by Glenda Fauntleroy.

Journal Reference:

1. Roy Rabbie, Sheena Derry, R Andrew Moore, Henry J McQuay. **Ibuprofen with or without an antiemetic for acute migraine headaches in adults**. *Cochrane Database of Systematic Reviews*, 2010 (10): CD008039 DOI: 10.1002/14651858.CD008039.pub2

http://www.sciencedaily.com/releases/2010/10/101006114003.htm

In California, Pot Is Now an Art Patron

By RANDY KENNEDY

SANTA ROSA, Calif. — Nonprofit arts groups tend to spend much of their time scrounging for grants and praying for corporate largesse. But one art foundation taking shape on 120 acres in the high oak chaparral of Sonoma County has different kinds of worries these days: spider mites, bud rot and the occasional low-flying surveillance visit from the local Sheriff's Office.

This is because the foundation, called Life Is Art, recently began to reap a new kind of financing, in the form of tall, happy-looking marijuana plants. Late this month, with some help from the sale of its first small crop, grown under California's liberal medical marijuana laws, the group plans to present an inaugural exhibition on its land, of sculpture and installation work by more than 20 visiting artists — some of whom will have helped bring in the harvest. The foundation's hope is that income from succeeding crops will fully support such projects, in perpetuity, creating a kind of Marfa-meets-ganja art retreat north of San Francisco and a new economic engine for art philanthropy.

At a going wholesale rate of $200 or more an ounce in the Bay Area for high-quality medical marijuana, it's a lot simpler than raising money the traditional way, the project's organizers point out. And — except for the nagging fact that selling marijuana remains a crime under federal law — it even feels more honest to the people behind Life Is Art. They see it as a way of supporting the cause with physical labor and the fruits of the land instead of the wheedling of donors, an especially appealing prospect in an economy where raising money has become more difficult than ever.

"The whole game of finding support just started to seem so childish," said Kirsha Kaechele, the foundation's director, as she hauled a plastic tub of freshly harvested cannabis hybrid branches up a hill one morning recently on her rolling land just outside of Santa Rosa. "So I decided to grow up and became a marijuana farmer."

In California, where voters will consider a ballot initiative in November that would make theirs the first state to legalize marijuana for recreational use — and where some growers are already donating portions of their

proceeds to nonprofit causes like AIDS charities — the idea of putting pot to work for the arts seems to be spreading.

Artists Collective, a two-year-old medical marijuana service in Los Angeles formed with the idea of directing a large share of its income to the creative world, gave away its first chunk of money in August, to the winner of a national short-story contest it sponsored, judged by the novelist Neal Pollack. The initial prize was just $1,000, but Dann Halem, the collective's founder and director, said the goal of the nonprofit organization was to become as effective and well known as Newman's Own, Paul Newman's food-based charity, which he cited as an inspiration.

"Hopefully in the long run this is something that will be able to give millions and millions to the arts," he said.

Ms. Kaechele (pronounced KEH-shell-uh), 34, has spent the last decade directing public art projects in New Orleans. But after Hurricane Katrina and the recession, her operation was on the brink of collapse. That is when she started to think about the money-making possibilities of the rural land in Sonoma that she and her business partner, Jaohn Orgon, had bought six years earlier.

"Everyone who knew that I had land in California just assumed I was growing pot on it," she said, "which is kind of funny, and I'd tell them I wasn't."

But after a conversation with the Brooklyn artist Fred Tomaselli, whose psychedelic art is sometimes made with marijuana leaves, she started to think seriously about the idea. She formed a California nonprofit called American Medicinals. (Growers in the state tend to operate as nonprofit or not-for-profit organizations.) Through Craigslist she found a veteran California growing expert whose long involvement in marijuana cultivation during the years when it was completely illegal had left him perpetually wary, prompting a strange series of initial e-mails in which he referred only to his expertise in growing goji berries.

Now, six months after planting the crop from seed — a mix of two varieties, O.G. Kush and Cherry Pie, grown in two small outdoor plots and one indoor space — she and a handful of artists who will be making work for the show have been harvesting the plants and hanging them upside down on wires to dry in the barn that serves as the group's headquarters and makeshift studio space. They sold their first dried and cured buds to medical users in the first week of October.

They are loath to provide details about how much marijuana they hope to produce with the first harvest — plant limits vary from county to county, and they worry about how the Sonoma County Sheriff's Office, which made an unannounced visit by helicopter in September, interprets the limits there. But their goal for next year's crop is to generate $1 million after expenses to be used for art projects on the farm and to send back to support their programs in New Orleans, which they hope will ultimately be financed entirely by the farm.

"We think it's a completely realistic number," Ms. Kaechele said.

For the moment, though, the Sonoma wing of the foundation is still in its infancy and feels like a combination of Yaddo, a hip organic farm and a very laid-back commune (but with little smoking of the funds going on, at least in a reporter's presence). Ms. Kaechele eventually wants to be able to set up artists' residencies, to commission pieces from emerging and established artists and to pay for works that would remain permanently on the land, as Donald Judd's do in Marfa, Tex., at the Chinati Foundation.

While the debate about marijuana legalization has focused on its potential dangers, its mainstream benefits are starting to get more attention: higher tax income, struggling newspapers buoyed by marijuana ads. In California the potential for recreational legalization in November worries many medical growers like Mr. Halem of Artists Collective, who fear that the change would bring in corporate interests, cause prices to fall and push out growers with charitable aims.

Ms. Kaechele and the young artists whose work will appear in the first exhibition, opening to the public on Oct. 22, seem overjoyed with the way things are working out so far, but not everyone shares the sentiment. A couple who live on a property adjacent to the farm, Steve and Catherine Matuszak, only recently learned of the growing operation nearby and said they were worried about increased traffic up the winding mountain roads and even more about the potential for thieves.

“We don’t have concerns with them as individuals, really,” Ms. Matuszak, a dental hygienist, said of the new art-farm neighbors. “It’s just the situation that’s developing that worries us.”

Ms. Kaechele said she wanted to work hard to win her neighbors over, and she even has an idea for dealing with the drug-crime concerns (another completely new kind of worry for a public-art organizer): She will ask artists to come up with proposals for alarms and security devices that will double as art installations on the land.

“We see it as a set of curatorial problems for us to respond to,” she said.

http://www.nytimes.com/2010/10/12/arts/design/12farm.html?ref=design

Silent Pictures

By STEVEN HELLER

SIX NOVELS IN WOODCUTS

By Lynd Ward

Edited by Art Spiegelman

1,526 pp. The Library of America. $70

Long before graphic novels earned a dedicated section in bookstores — indeed, before the term "graphic novel" was even coined — the American wood engraver and illustrator Lynd Ward (1905-85) created six enduring examples of the form. Ward was one of only a handful of artists in the world who bucked literary convention by eliminating all words but the title from standard narrative works. His novels often contained more than 100 pages, with one image per right-hand page. The pictures, influenced by German Expressionism, were dark and melodramatic, as though taken directly from an early film noir storyboard. Ward's thematically related sequences and cinematic pacing bridged the divide between mass comics and the more rarefied illustrated book. Now this groundbreaking work, originally published between 1929 and 1937, has been collected in "Six Novels in Woodcuts," the first graphic fiction from the Library of America.

In his enlightening introduction to this hefty two-volume collection, the editor, Art Spiegelman, notes it was only a few decades ago that extended comics, published in book format with actual spines instead of staples, started being referred to as graphic novels. "The ungainly neologism seems to have stuck since Will Eisner, creator of the voraciously inventive 'Spirit' comic book of the 1940s, first used it on the cover of his 1978 collection of comics stories for adults, 'A Contract With God,' " Spiegelman writes. "It was a way to distance himself from the popular prejudices against the medium."

Were it not for Spiegelman's own role in raising comics to a bona fide artistic and literary form, this Ward retrospective might not have been published. In large part owing to the continued success of Spiegelman's Pulitzer Prize-winning "Maus," about his parents' experiences at Auschwitz, graphic novels are now widely accepted. Perhaps calling them something other than comic books has made reading them less discomfiting for adults, as when Leonard Bernstein validated the Beatles by attesting to their classical underpinnings. Or perhaps comics simply came into their own, thanks to the earlier work of Ward and others. Spiegelman, who

has long acknowledged his debt to these pioneers (and who introduced me to their work 30 years ago), uses this opportunity to celebrate Ward while expanding the definition of what constitutes a graphic novel.

Totally wordless picture books for adults were published in the 1920s and '30s, most notably by the Belgian expressionist Frans Masereel (1889-1972) and the German engraver Otto Nückel (1888-1956). It was a time of social and political crisis in Europe. Working in the unforgiving woodcut and the slightly more fluid wood engraving mediums, theirs were complex pictorial stories of war and peace, love and hate, contentment and despair, even fame and anonymity, with leftist political undertones. Their stories examined the human comedy and were appropriately dark in texture and tone.

Nückel produced only one, "Destiny: A Novel in Pictures," a wrenching narrative about a prostitute's life and death. Masereel did about 50 so-called image novels, including "The City" and "Passionate Journey," which, Spiegelman notes, had the ability to "communicate past national and linguistic barriers." (Both artists' books have been reprinted in various editions over the last 20 or so years. And the Masereel reprints are fairly easy to find in paperback editions.)

These books had a huge impact on other popular printmakers and illustrators in the United States. The German-born wood engraver Fritz Eichenberg, among the most prolific illustrators of Russian and other classics, once told me that the absence of text demanded that the artist be extraordinarily skilled at "speaking" through graphic nuance. And Rockwell Kent, whose romantic and heroic woodcuts had an emblematic *art moderne* aesthetic typical of Depression-era American graphics, clearly drew inspiration from this form. Neither man, however, specialized in wordless books. In fact, the artist most directly influenced by Masereel and Nückel — and ultimately the most prolific American graphic storyteller — was Ward, the son of a progressive Chicago minister who was the first chairman of the American Civil Liberties Union. Ward was enamored of Gustave Doré's Bible drawings, since (as Spiegelman notes) "his father forbade anything as profane as the Sunday funnies in their home." Without comics as a model, he developed a hybrid vocabulary for visual storytelling. Although his sharp-edged faces and bodies, as well as his use of dramatic lighting, bear a strong resemblance to Eichenberg's work, Ward's images were grittier than his counterparts' and invested with subtle nuances all his own.

"Six Novels in Woodcuts" collects all of Ward's books, including his best known, the Faustian "Gods' Man," along with "Madman's Drum," "Wild Pilgrimage," "Prelude to a Million Years," "Song Without Words" and "Vertigo," a weighty look at injustice against the jobless workers in the Hooverville on Manhattan's Upper West Side. Although a few of Ward's books, including "Gods' Man" and "Wild Pilgrimage," have been republished as free-standing editions, and while a 1974 coffee-table book called "Storyteller Without Words" included all of his books as well as dozens of prints and drawings, this new edition places Ward's work firmly on the literary shelf where it belongs. Spiegelman further argues for Ward's role as a godfather of graphic novels — "It seems natural now to think of Lynd Ward as one of America's most distinguished and accomplished graphic novelists" — even though his inspirations were not comics, and the only comic he seems to have read was "Prince Valiant."

If Ward's work appears familiar to contemporary readers of comics and graphic novels, it's surely in part because his technique and style have been so influential. The artist Eric Drooker, for instance, whose current book is a graphic adaptation of Allen Ginsberg's "Howl," uses many of the same dramatic visual conceits and a similar linear quality. Spiegelman himself also looked to Ward as a role model: "When I was beginning to seriously explore the limits and possibilities of comics, I drew a four-page comics story about my mother's suicide called 'Prisoner on the Hell Planet,' " he writes in the introduction. "I was then 24 years old (the same age as Ward when he made 'Gods' Man') and the scratchboard drawings I did were very influenced by Ward's engravings."

Yet Ward is not *entirely* contemporary: while most graphic novelists today depend on a combination of words and images to tell their stories, Ward let his pictures speak for themselves. This could be challenging for the audience. “Gods’ Man” — 139 wood engravings about a destitute artist seeking fame and fortune, who accepts a magic brush from a mysterious stranger — almost demands that the reader insert imaginary dialogue between the pictures, even within each frame. Yet the brilliance of Ward’s work is that it’s not so hard to imagine what that dialogue would be. As in the best silent movies, the images really do carry the narrative.

I was a young art director for the Op-Ed page of this newspaper when I first read “Gods’ Man” and “Wild Pilgrimage.” In addition to commissioning illustrations, I sometimes used existing artwork by the likes of Francisco de Goya, Thomas Nast, George Grosz and other strong black-and-white conceptualists. Ward joined their ranks. Every image he made had its own integrity. On at least three occasions I took an engraving from the books and paired it with an Op-Ed article — a perfect marriage of text and image. But this was heresy. Ward’s images were designed to be seen in their original contexts, not forced to illuminate arguments that Ward never heard. For the experience of seeing all his wordless books as they were meant to be read, the Library of America set is essential.

Steven Heller, the former art director of the Book Review, writes the Visuals column.

http://www.nytimes.com/2010/10/10/books/review/Heller-t.html?ref=design

An Unseen Evil Still Ensnaring Countless Souls

By EDWARD ROTHSTEIN

CINCINNATI — Peer through a circular hole into one of the displays in the permanent exhibition "Invisible: Slavery Today," opening on Saturday at the National Underground Railroad Freedom Center here, and you see a tawdry room the size of a closet. On the floor a stained mattress is scrawled with the words: "At sixteen, her new 'life' had begun." The irony stings. Around the portal's opening, a seemingly handwritten account tells of Margo's abusive father, the promises of escape offered by Lenny and her delivery into sexual slavery.

A few steps away is another sparely told tale: Karin, a young mother of two in Sri Lanka, is lured by the promise of a waitress job in Singapore. Lift the heavy drapery covering an opening and you gasp at the display's brute theatricality, offering a glimpse of her fate. A light suddenly comes on, casting shadows on a hanging sheet: hands reach out to grasp a woman's silhouette.

There are no explicit images here, only the suggestion of something horrifyingly entrapping. It is a bit like the battered metallic case with a hole cut in its top, in another display. No sex, but force: Mariano is smuggled into the United States to support his Guatemalan family. Cesar promises him room and board but instead turns him into a prisoner, forcing him to pay back his increasing debts by picking tomatoes; he finally escapes by cutting through a truck's roof. (The account appeared in Gourmet magazine.)

And here too are other displays: a photograph of an Indian kiln, loose bricks lying about, where a 7-year-old, Kumar, was beaten if he tried to escape, and a fishing boat off Ghana's coast on which James Kofi Annan labored from the age of 6 with other children, force-fed amphetamines to work nonstop.

"At the end of the season," we read, "many were shot and thrown overboard."

There is no end to the audacity of human cruelty, and no political boundaries contain its gluttony. This 4,000-square-foot exhibition is modest in size, and in many ways significantly flawed, but theatricality is one of its strengths. These are true stories (some with names changed) drawn from aid organizations and an annual report released by the State Department. The Web sites of these groups, like the International Justice Mission

(www.ijm.org) and Free the Slaves (www.freetheslaves.net), all have such anecdotes, as well as stories of triumphant release.

But at first, we are submerged. We enter a dim warehouse, stacked with crates stamped "child soldier," "domestic servant," "sex slave." We pass by a line of symbolic figures, people as conglomerations of detritus and tools — bricks, mops, shovels — representing contemporary slaves. Not the human comedy, but the human commodity.

And on the walls and crates are statistics by analysts who guess at the extent of this dark underground: 12 million to 27 million slaves now being held around the globe. Yes, we recall reading about them, shut in locked cellars in New York or along our Southern border, where illegal immigrants are kept in penury, or more extensively in Southeast Asia and Eastern Europe, wherever desperation leads to hope of a better life.

This show about contemporary slavery, designed by Touch Worldwide in Seattle, is the first extended reshaping of the Freedom Center's exhibition narrative since the museum opened to a mixed reception in 2004. It is also the first one fully reflecting the approach of its young curator, Dina A. Bailey. What is strange, given that the rest of this 158,000-square-foot museum is devoted to American slavery, is that it is also among the most viscerally affecting displays here. It is meant as a kind of corrective, an attempt to shift course.

Beginning under the direction of Spencer R. Crew, this $110 million museum aimed not to dramatize the nature of African slavery, but to celebrate those who escaped and those who assisted them. The Freedom Center, its early leaders explained, would promote tolerance and encourage activism across the globe. It was meant to be inspiring and all-embracing, but its galleries were given portentous titles: "Pavilion of Perseverance," "Pavilion of Cooperation."

Its most moving object is a two-story-high log house used by a slave trader in Germantown, Ky., to store his human merchandise. It was transported here, accompanied by a detailed roster of the chattel it once held. But the museum's overall effect is uneven, uncertain. It erupts into fictionalized dramas or fanciful films, but its most substantive exhibition, an extensive history of United States slavery, anxiously crams in material as if making up for lost opportunities elsewhere in the cavernous building. And, intent on a broader political mission, that history devotes unusual attention to women's suffrage and the treatment of American Indians.

As a whole the museum seemed, when I visited it in 2004, a reflection of a pop political sensibility. Instead of using the history to strengthen a sense of shared identity or to encourage righteous anger or to illuminate principles, the museum generalized it into a kind of bland therapeutic activism, until the historical specifics dissolved. Its final exhibition space featured video screens showing examples of world hunger, illiteracy, tyranny and racism, urging political action.

This approach may have been one reason many in Cincinnati, across the political spectrum, have been dissatisfied. A 2008 editorial in The Cincinnati Enquirer said: "The Center has failed to articulate its role in the intellectual, cultural and political life of this region." Early optimism about attendance and income proved incorrect; annual visitors now number 130,000, about half of what was imagined.

The new exhibition doesn't abandon the museum's approach, but it is a vast improvement, expanding the slavery theme and pointing the way to a more modest social mission. Though much more could have been done, we get a sense of how contemporary slavery differs from what had come before. While slavery had always been about human property — whether taken in conquest or purchased in vast commercial networks — it was, until recently, out in the open, part of the social and legal structure of nearly every society. American slavery was a special case: by surviving the Enlightenment, it was exposed in all its venality.

But contemporary slavery is something else. It is hidden. And the victims are not institutionalized property but anonymous prisoners. In addition, while slaves once had significant economic value — in the mid-19th-century South, a slave could be worth the modern equivalent of $35,000 — now they are disposable, resembling, as the author Kevin Bales points out, "cheap plastic ballpoint pens."

In this subterranean realm, we are told, it is "difficult to say" how many slaves exist. But the exhibition argues that "more people are illegally trapped in various forms of slavery today than ever before." How, though, is that estimated, particularly when definitions of contemporary slavery are so porous? Dickens's novels offer scores of indentured, bent, beaten-down figures who might now be miscategorized as slaves.

"Is prostitution slavery?" the exhibition asks, for example. "One side argues that all prostitution is — or should be — treated as slavery, and that most women are coerced into prostitution through physical and psychological duress or out of desperate economic emergency." There are also, we read, widely opposing perspectives. The show, at any rate, leaves little doubt in the examples offered, but the sources seem to require careful scrutiny.

Since the museum's impulse is not merely to inform, but also to inspire action, there are times when its advocacy can seem unnecessarily forced. We are asked to accept that the danger of slavery is *personal*. "How could YOU become enslaved?" reads the bottom of what the show calls a "Wheel of Misfortune." Spin it and it might land on "fraud," "debt" or "abduction." But is it really the case that such things readily lead to enslavement? Or create a universal risk? Is this personalization even necessary?

Activist ambitions fully come into play in the final gallery, where we are urged to become "modern-day abolitionists." Each panel is filled with suggestions: become active in an organization that fights slavery; "Host a World Day of Social Justice event"; "Hold community meetings"; seek out "products that are certified as fair trade."

Is this really the contemporary Underground Railroad? Law enforcement, social reform, fighting corruption: these would seem to be the most important aspects of any contemporary abolition movement. So is the kind of attention given by the State Department and the United Nations. And biographical panels tell of the organizations that have contributed to the exhibition, whose triumphs are palpable.

Everything else seems to emphasize virtuous feelings rather than real successes, promoting activism over understanding history. That still is one of the museum's weaknesses as well, but now it can be sensed amid growing strengths.

"Invisible: Slavery Today" opens on Saturday at the National Underground Railroad Freedom Center, 50 East Freedom Way, Cincinnati; freedomcenter.org.

http://www.nytimes.com/2010/10/09/arts/design/09museum.html?ref=design

Rediscovering an Earthy Master

By ROBERTA SMITH

"Man, Myth, and Sensual Pleasures: Jan Gossart's Renaissance" at the Metropolitan Museum of Art is a big deal. It is the first survey in this country devoted to the supple, mercurial, groundbreaking art of Gossart (1478-1532), the perennially underestimated Flemish master also known as Mabuse.

A feat of curatorial intelligence, research and diplomacy, with loans from all over, the show has been organized by Maryan W. Ainsworth, a curator in the Met's department of European paintings. Hats off.

It includes 50 of Gossart's 63 surviving panel paintings — several of them freshly cleaned and given firmed-up attributions — and based on his signature, returns the spelling of his name to Gossart from Gossaert. There are mythological scenes, portraits and religious commissions, including the fantastical "St. Luke Drawing the Virgin," showing an angel with multicolored hair and wings guiding the saint's pen as he sits before a cloud-ringed vision of Mary. An early example of art about art, it has been lent by the Kunsthistorisches Museum in Vienna. There are also 35 drawings and 6 prints, as well as some 20 works whose attributions are still in flux.

The show is accompanied by a catalog of Gossart's complete oeuvre, and as if all this were not enough, the installation is peppered with 40 or so contextualizing works by his predecessors, followers and contemporaries, including Dürer, Simon Benning and Gossart's sometime collaborator, Gerard David.

In all, this is an exhibition with benefits. Arguably the most breathtaking is "Virgin and Child at the Fountain," by Jan van Eyck, Flemish art's 15th-century point of origin. Lent by the Royal Museum of Fine Arts in Antwerp, it celebrates its subjects by placing them before ornate planes of culture and nature: a floral-patterned tapestry and a flowering hedge. Exquisite and not much larger than a postcard, it is an extraordinary addition to an extraordinary show.

Mabuse is Dutch for Maubeuge, the Walloon town where Gossart was born. It provided Gossart one of the most memorably strange nicknames in the history of Western art, and has always seemed like a marvelous phonetic gift to the field. Granted, it has been enriched by its association with Dr. Mabuse, the archfiend of fiction, screen and comic books, starting with the novels of Norbert Jacques and the films of Fritz Lang.

The mouthy slide of ma-BOOZE is tellingly unlike the clipped command of go-SART. Its amorphousness suits Gossart's mutating sense of style; his fascination with the human form as breathing, dimensional flesh; and his achievement, which was in essence to introduce the sensuality of Italian Renaissance art to Northern Europe. He provided, as is often stressed, the link between van Eyck, who died in 1441, and Rubens, born in 1577.

Actually, an intermediate genius is also relevant: Pieter Bruegel the Elder, probably born in the last decade of Gossart's life, active by 1550 and dead by 1569. One of the show's most emotionally powerful works is Gossart's "Christ on the Cold Stone," an image of the Savior being taunted just after he has been stripped of his garments and crowned with thorns. A short man whose graceful body is tense with anxiety, he gazes beseechingly heavenward. His stubby, sun-coarsened features and hands make him a sensitive forerunner to a Bruegel peasant.

As is so often the case with success, Gossart was the right person in the right place at the right time with the right talent. Little is known about his origins or his artistic training, but by the 1490s he was in Antwerp, a commercial center where prosperity was giving rise to a new collecting class.

By 1503 he was a master in the Guild of St. Luke and a force in Antwerp Mannerism, the fabulously cluttered, tightly wound High Gothic style that was both a continuation and a perversion of the chaste, orderly stillness of van Eyck. By late 1508, Gossart was on his way to Rome, as part of a delegation headed by Philip of Burgundy, an illegitimate son of Philip the Good. He remained for more than a year, drawing the antique sculptures and monuments being excavated with stunning regularity — the Laocoön had surfaced two years before.

Gossart went to Rome and brought back an elaborate carnal knowledge, not just of sex, but of the body and sexuality as complexly expressive forces. In her catalog Ms. Ainsworth notes delicately that Gossart's "heightened eroticism" must have shocked and probably titillated his Lowlands patrons.

The sense of healthy corporeal attraction is strongest in a panel-painting of the seated nude figures of Hercules and his wife, Deianira, and the veritable pretzel of desire formed by their elegantly shaped, entwined legs. The tormented side of eros is evident in a large chalk drawing of Adam and Eve, which shows an anguished grapple for the apple.

This exhibition tells an intricate story in masterly fashion. Each of its eight galleries constitutes a chapter unto itself, with a distinct feel and its own play of artworks, subjects and styles. In the first, for example, you get a heady sense of Antwerp Mannerism from a small, eye-twisting altarpiece by the artist known as Master of the Antwerp Adoration. In it, lavishly decked-out Magi seem nearly to romp around the Holy Family like slightly inebriated court jesters. In Gossart's own "Holy Family" hanging nearby, a bare-headed, wispy-haired Joseph might be a sweet village fool. Both works celebrate mannered extremes of articulation, be they the extravagant filigrees of High Gothic architecture; the deep, impossibly clear vistas; or the comedic quirks of the human personality.

In the second gallery, which indicates Gossart's time in Rome, a vitrine of small Greco-Roman torsos and heads evokes some of the sensuality that so changed his art. Two ink drawings of soldiers engulfed in fantastically filigreed armor strike the eye as rote Mannerist exercises. In contrast, an intensity of attention permeates a nearby drawing that Gossart covered with closely observed sketches of Roman statuary, including a marvelously complete rendering of a seated boy pulling a thorn from his foot and a large sandaled foot. (Sculptural examples of both are also on display.)

In the third gallery you'll find the van Eyck and Gossart's collaborations with Gerard David, as well as the idiosyncratic "St. Jerome the Penitent." Attributed to Gossart, this grisaille depiction of the saint crouched in the desert before a vision of the Crucifixion might almost be chiseled stone. Its neighbor, Gossart's "Agony in the Garden of Gethsemane," continues the nocturnal mood, but is all tender softness, with gently moonstruck forms and an array of rich, modulated purples and blacks. It depicts nearly the same modest, proto-Bruegelian Christ who awaits, seated on the cold stone, a few galleries forward.

Shows as elaborate and broad of reach as this one often dwindle at the end, but not here. The last gallery is in some respects the grandest and most gripping. It is devoted entirely to portraits, most of them late commissions, from after 1520. The best works reflect Gossart's dedication to physical truth and balance, ignited in Rome but elevated to a humanist plane. But their psychological insights and uninflected realism are more Northern than Italian.

This applies whether the subjects are an old man and his wife in relatively austere clothes — bent but unbroken — or the gentleman, likely a banker, who sits at a table, his hands fastidious, his sleeves billowing red, with two sheaves of white paper hanging on the wall behind him like angel's wings. And it applies to the splendidly dressed tween, possibly a Danish princess, who leans slightly forward, in front of what appears to be the frame but is actually part of the painting.

She is yet another quietly vibrant reminder of Gossart's affinity for the human creature, alive and in motion, in space.

MAN, MYTH AND SENSUAL PLEASURES

WHEN AND WHERE Through Jan. 17. Metropolitan Museum of Art; (212) 535-7710, metmuseum.org.

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http://www.nytimes.com/2010/10/08/arts/design/08gossart.html

Growing Together

By CHRISTINE MUHLKE

When I began writing about American farmers and food artisans for this magazine's Field Report column two years ago, I set out to learn the story behind the people whose ingredients were driving chefs to create great dishes. Little did I know it would become a column about communities — of producers, of customers, of eaters and enthusiasts.

After transcribing the first five or so interviews, I adopted the shorthand "comm": "I don't think that I would exist w/o the comm of ppl that are my customers and my suppliers," I typed for Jeff Ford, a baker in Madison, Wis. "We're showing how to build a local comm, we're not showing em how to farm," I scribbled for Tim Young, a Georgia marketing-service entrepreneur turned farmer. "Another piece for me about urban homesteading is rebuilding comm — it's such a cliché — but rebuilding comm around food," said Anya Fernald, a consultant for food businesses in Oakland, Calif. In a recent interview with Evan Dayringer, a farm apprentice, there are 26 comms in the course of three hours. At this point, my computer just fills in the word after the second M.

What are they talking about when they talk about community? In their case, it's the network of people that they gradually knit around themselves based on a shared interest in food, from the grain supplier to the bakery apprentice to the farmers' marketers and restaurateurs who order the loaves. It's the schoolteacher who buys bread every week who eventually asks the baker if he'll teach her students how to make pizza dough. It's the cheese maker who trades for baguettes. It's the sous-chef who receives the daily delivery and becomes a drinking buddy.

In even simpler terms, community is built upon conversations. People like to eat, and they like to talk about it. Ask a stranger anywhere in the world what or where he likes to eat, and chances are he'll open up. (I've unexpectedly gotten out of speeding tickets because I told the officers I was hurrying to get to a local restaurant or gristmill before it closed.) Working and living around food allows you to interact mainly with people who find pleasure in similar things — which could, of course, become frustratingly limiting. But according to the men and women I've interviewed for Field Report, this sense of connection with and appreciation by the people around them makes the crushing work and razor-thin margins worth it. As Jeff Ford of Cress Spring Bakery, who sells to some of the 20,000 visitors to the Madison farmers' market every Saturday, told me, "People hand me money all day and tell me they love what we do, so it's really not work at that point, it's my social life."

Food communities take many forms. Not all of them have the righteous, rarefied aura of the Ferry Plaza Farmers Market in San Francisco or the cool graphics of the food vendors at the Brooklyn Flea. And not all of them begin with a financial transaction. There are cookie swaps, canning parties, community-supported agriculture, crop mobs, cooking clubs, cow shares and more — all of which are subject to the preciousness, insularity and childish infighting of a self-selecting group. (The politics of potlucks.) And then there is the Web, where strangers bond over their lack of conviction about a certain pizzaiolo, form underground restaurants based on a chef's disregard for the place of figs in California cooking or cheer on a home cook from Tel Aviv in an online recipe competition.

While these small-food communities are growing in pockets of America, typically around cities and universities, they have yet to become the norm. The number of farmer's markets increased to 6,132 this year from 1,755 in 1994, but fast food is still a $170 billion industry — up from $6 billion in 1970. Class issues are inevitable with a movement driven by the college educated, regardless if they can sweat $25 for the chicken they believe is the only kind of chicken people should be eating. And the fact remains that those who are growing, distributing and serving this food can't always afford to buy it. The idea of good food for all is still fairly (organic, heirloom apple) pie in the sky.

Or is it? The strongest example of a food community I've seen was in Detroit, where a vibrant farming scene has sprung up literally from the ashes. In a neighborhood that is a true food desert — there are no national chain grocery stores within city limits; more than 90 percent of food providers are places like convenience and liquor stores — I watched young men and old women socialize while picking collard greens in abandoned lots brought back to life by the Urban Farming organization. There was no fence, no supervision, no charge. Some of these people — neighbors — haven't spoken to each other since the 1967 riots, the Urban Farming organizer Michael Travis told me as we watched. But, he added, not all of the visitors know how to cook those idealized greens. That's another program they are working on.

A few miles away was a model of the new scrappiness that has taken root around food, one that relies on collaborative rather than conspicuous consumption. I visited a block where young artists and college debtors have formed a wonky farm village, a postindustrial, preapocalyptic vision, complete with pheasants running between the raised garden beds built with floorboards ripped from an abandoned factory. I was shown around by Carolyn Leadley, who grows sunflower sprouts in her attic and bikes with them to restaurants and farmers' markets for cash and trade. Why go back to the land when it's cheaper in the city?

Some people want to become their own closed-loop supply chain; others wish to cut out price-jacking middlemen. In order to do so, they are learning to raise, butcher and cure meat; to grow and preserve fruits; tend and pickle vegetables; make bakery-quality bread in a cast-iron pot; turn milk into cheese; and mill grain — the better to make your own moonshine. (One sign that those small-batch kimchis and handmade chocolates are more than a cutesy trend? The government has realized that it has to regulate them: the Michigan Cottage Food Operation bill was signed in July.) Since these skills are decreasingly passed on by

elders, Americans of all ages have been signing up for classes, apprenticing with experts, chatting up farmers and heading online to share their findings. Friendships are made, networks are formed, delicious things are shared.

The new food movement is still labeled as Do It Yourself, but it's really Do It Ourselves. As Carlo Petrini, the founder of the Slow Food organization, told attendees at Slow Food Nation in 2008, "Happiness and pleasure involve depending on others." In this case, dessert is included.

Christine Muhlke is the food editor of the magazine.

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

Free the Free Radicals

By GRETCHEN REYNOLDS

David Stewart/Getty Images

We're all used to hearing that everything we once thought was good for us is not. But even within that framework, the latest science about antioxidants, free radicals and exercise is telling. As many of us have heard, free radicals are molecules created by the breakdown of oxygen during metabolism. Each of us constantly creates free radicals simply by living and breathing. But these molecules are highly reactive and capricious, sometimes attacking other cells and damaging tissue. Wilding free radicals have been linked with a number of diseases and with aging. Exercise, because it requires increased oxygen consumption, also increases the production of free radicals. So, many experts began urging the fitness-minded to pop large doses of antioxidant vitamin supplements, like vitamins C and E, to counteract the presumed damaging effects of the free radicals. Food alone would not supply sufficient levels of the necessary antioxidants, it was thought. The exercising body needed help from vitamins.

But then a few years ago, researchers from the University of Valencia in Spain and the University of Wisconsin in Madison set out to study what would happen if you tried to prevent exercising muscles from creating free radicals. They had laboratory rats run on small treadmills until they were exhausted. Some of the rats had been injected with a powerful, pharmaceutical-grade antioxidant that works in the body to halt the production of most free radicals. After the rats ran, the researchers measured the levels of a number of substances in their leg muscles. Not surprisingly, the injected rats showed almost no free-radical activity. They were virtually immune to what scientists had considered a kind of bodily damage.

The leg muscles of the other exercised rats, though, teemed with free radicals. But at the same time, they buzzed with other, unexpected biochemical reactions. In their legs, genes were being expressed that activated growth factors that, in turn, increased levels of ''important enzymes associated with cell defense'' and ''adaptation to exercise,'' the researchers wrote. There was hardly any similar activity in the rats with low free-radical levels. Somehow, the researchers speculated, the free radicals had jump-started a process that over time would allow the rats' muscles to adapt to exercise. Suppressing the production of free radicals had, they concluded, prevented the ''activation of important signaling pathways'' and altered the muscles' ability to adapt to exercise. As a result, they wrote, ''the practice of taking antioxidants'' to ward off the presumed free-radical damage caused by exercise ''may have to be re-evaluated.''

They published their findings in 2005, and since then a number of other studies have replicated and expanded on their results, to thought-provoking effect. One of the most reverberant experiments, published last year, enrolled a group of young men in a monthlong exercise program. Some swallowed moderately high doses of the antioxidant vitamins C and E. Others did not. At the end of the month, the men not taking the vitamins showed higher-than-average activity in their bodies' innate antioxidant defense system. The men downing the vitamins did not, which makes sense; the antioxidant vitamins were mopping up the free radicals for them. But at the same time, the men not taking vitamins significantly increased their insulin sensitivity, a key measure of the health benefits of exercise, while those taking the antioxidants did not. Apparently, when the body's natural antioxidant defense system went into high gear, so did its ability to handle insulin. Removing the necessity for the body to deal, on its own, with the free radicals also prevented other adaptations that make exercise healthy.

What these findings mean for those of us who work out regularly is still being determined by scientists. But one message is clear. ''The evidence suggests that antioxidants are not needed'' by most athletes, even those training strenuously, said Li Li Ji, a professor of exercise physiology and nutritional science at the University of Wisconsin and one of the authors of the rat study. ''The body adapts,'' he said, a process that can, it seems, be altered by antioxidant supplements.

Another lesson: ''Eat well,'' he said. Although this is not yet proved, it seems likely, he continued, that antioxidants from foods, like blueberries, green tea and carrots, may work in tandem with the body's natural antioxidant defenses better than those from supplements.

But the overriding lesson of the newest science about exercise and antioxidants may be as simple as: let the body be. ''It is quite a smart machine,'' Dr. Ji said. ''It knows how to respond'' to stresses like a hard run, without the need for antioxidant pills.

http://well.blogs.nytimes.com/2010/10/06/phys-ed-free-the-free-radicals/?ref=magazine

Moonlighting as a Conjurer of Chemicals

By NATALIE ANGIER

Sir Isaac Newton was a towering genius in the history of science, he knew he was a genius, and he didn't like wasting his time. Born on Dec. 25, 1642, the great English physicist and mathematician rarely socialized or traveled far from home. He didn't play sports or a musical instrument, gamble at whist or gambol on a horse. He dismissed poetry as "a kind of ingenious nonsense," and the one time he attended an opera he fled at the third act. Newton was unmarried, had no known romantic liaisons and may well have died, at the age of 85, with his virginity intact. "I never knew him to take any recreation or pastime," said his assistant, Humphrey Newton, "thinking all hours lost that were not spent on his studies."

No, it wasn't easy being Newton. Not only did he hammer out the universal laws of motion and gravitational attraction, formulating equations that are still used today to plot the trajectories of space rovers bound for Mars; and not only did he discover the spectral properties of light and invent calculus. Sir Isaac had a whole other full-time career, a parallel intellectual passion that he kept largely hidden from view but that rivaled and sometimes surpassed in intensity his devotion to celestial mechanics. Newton was a serious alchemist, who spent night upon dawn for three decades of his life slaving over a stygian furnace in search of the power to transmute one chemical element into another.

Newton's interest in alchemy has long been known in broad outline, but the scope and details of that moonlighting enterprise are only now becoming clear, as science historians gradually analyze and publish Newton's extensive writings on alchemy — a million-plus words from the Newtonian archives that had previously been largely ignored.

Speaking last week at the Perimeter Institute for Theoretical Physics in Waterloo, Ontario, William Newman, a professor of the history and philosophy of science at Indiana University in Bloomington, described his studies of Newton's alchemical oeuvre, and offered insight into the central mystery that often baffles contemporary Newton fans. How could the man who vies in surveys with Albert Einstein for the title of

"greatest physicist ever," the man whom James Gleick has aptly designated "chief architect of the modern world," have been so swept up in what looks to modern eyes like a medieval delusion? How could the ultimate scientist have been seemingly hornswoggled by a totemic psuedoscience like alchemy, which in its commonest rendering is described as the desire to transform lead into gold? Was Newton mad — perhaps made mad by exposure to mercury, as some have proposed? Was he greedy, or gullible, or stubbornly blind to the truth?

In Dr. Newman's view, none of the above. Sir Isaac the Alchemist, he said, was no less the fierce and uncompromising scientist than was Sir Isaac, author of the magisterial Principia Mathematica. There were plenty of theoretical and empirical reasons at the time to take the principles of alchemy seriously, to believe that compounds could be broken down into their basic constituents and those constituents then reconfigured into other, more desirable substances.

Miners were pulling up from the ground twisted bundles of copper and silver that were shaped like the stalks of a plant, suggesting that veins of metals and minerals were proliferating underground with almost florid zeal.

Pools found around other mines seemed to have extraordinary properties. Dip an iron bar into the cerulean waters of the vitriol springs of modern-day Slovakia, for example, and the artifact will emerge agleam with copper, as though the dull, dark particles of the original had been elementally reinvented. "It was perfectly reasonable for Isaac Newton to believe in alchemy," said Dr. Newman. "Most of the experimental scientists of the 17th century did."

Moreover, while the alchemists of the day may not have mastered the art of transmuting one element into another — an ordeal that we have since learned requires serious equipment like a particle accelerator, or the belly of a star — their work yielded a bounty of valuable spinoffs, including new drugs, brighter paints, stronger soaps and better booze. "Alchemy was synonymous with chemistry," said Dr. Newman, "and chemistry was much bigger than transmutation."

For Newton, alchemy may also have proved bigger than chemistry. Dr. Newman argues that Sir Isaac's alchemical investigations helped yield one of his fundamental breakthroughs in physics: his discovery that white light is a mixture of colored rays, and that a sunbeam prismatically fractured into the familiar rainbow suite called Roy G. Biv can with a lens be resolved to tidy white sunbeam once again. "I would go so far as to say that alchemy was crucial to Newton's breakthroughs in optics," said Dr. Newman. "He's not just passing light through a prism — he's resynthesizing it." Consider this a case of "technology transfer," said Dr. Newman, "from chemistry to physics."

The conceptual underpinning to the era's alchemical fixation was the idea of matter as hierarchical and particulate — that tiny, indivisible and semipermanent particles come together to form ever more complex and increasingly porous substances, a notion not so different from the reality revealed by 20th-century molecular biology and quantum physics.

With the right solvents and the perfect reactions, the researchers thought, it should be possible to reduce a substance to its core constituents — its corpuscles, as Newton called them — and then prompt the corpuscles to adopt new configurations and programs. Newton and his peers believed it was possible to prompt metals to grow, or "vegetate," in a flask. After all, many chemical reactions were known to leave lovely dendritic residues in their wake. Dissolve a pinch of silver and mercury in a solution of nitric acid, drop in a lump of metal amalgam, and soon a spidery, glittering "Tree of Diana" will form on the glass. Or add iron to hydrochloric acid and boil the solution to dryness. Then prepare a powdery silicate mix of sand and potassium

carbonate. Put the two together, and you will have a silica garden, in which the ruddy ferric chloride rises and bifurcates, rises and bifurcates, as though it were reaching toward sunlight and bursting into bloom.

Add to this the miners' finds of tree- and rootlike veins of metals and alchemists understandably concluded that metals must be not only growing underground, but ripening. Hadn't twined ores of silver and lead been found? Might not the lead be halfway to a mature state of silverdom? Surely there was a way to keep the disinterred metal root balls sprouting in the lab, coaxing their fruit to full succulent ripeness as the noblest of metals — lead into silver, copper to gold?

Well, no. If mineral veins sometimes resemble botanical illustrations, blame it on Earth's molten nature and fluid mechanics: when seen from above, a branching river also looks like a tree.

Yet the alchemists had their triumphs, inventing brilliant new pigments, perfecting the old — red lead oxide, yellow arsenic sulfide, a little copper and vinegar and you've got bright green verdigris. Artists were advised, forget about mixing your own colors: you can get the best from an alchemist. The chemistry lab replaced the monastery garden as a source of new medicines. "If you go to the U.K. today and use the word 'chemist,' the assumption is that you're talking about the pharmacist," said Dr. Newman. "That tradition goes back to the 17th century."

Alchemists also became expert at spotting cases of fraud. It was a renowned alchemist who proved that the "miraculous" properties of vitriol springs had nothing to do with true transmutation. Instead, the water's vitriol, or copper sulfate, would cause iron atoms on the surface of a submerged iron rod to leach into the water, leaving pores that were quickly occupied by copper atoms from the spring.

"There were a lot of charlatans, especially in the noble courts of Europe," said Dr. Newman. Should an alchemist be found guilty of attempting to deceive the king, the penalty was execution, and in high gilded style. The alchemist would be dressed in a tinsel suit and hanged from a gallows covered in gold-colored foil.

Newton proved himself equally intolerant of chicanery, when, in his waning years, he took a position as Master of the Mint. "In pursuing clippers and counterfeiters, he called on long-nurtured reserves of Puritan anger and righteousness," writes James Gleick in his biography of Newton.

"He was brutal," said Mark Ratner, a materials chemist at Northwestern University. "He sentenced people to death for trying to scrape the gold off of coins." Newton may have been a Merlin, a Zeus, the finest scientist of all time. But make no mistake about it, said Dr. Ratner. "He was not a nice guy."

http://www.nytimes.com/2010/10/12/science/12newton.html?ref=science

Hunting One Language, Stumbling Upon Another

By JOHN NOBLE WILFORD

Two years ago, a team of linguists plunged into the remote hill country of northeastern India to study little-known languages, many of them unwritten and in danger of falling out of use.

On average, every two weeks one of the world's recorded 7,000 languages becomes extinct, and the expedition was seeking to document and help preserve the endangered ones in these isolated villages.

At a rushing mountain river, the linguists crossed on a bamboo raft and entered the tiny village of Kichang. They expected to hear the people speaking Aka, a fairly common tongue in that district. Instead, they heard a language, the linguists said, that sounded as different from Aka as English does from Japanese.

After further investigation, leaders of the research announced last week the discovery of a "hidden" language, known locally as Koro, completely new to the world outside these rural communities. While the number of spoken languages continues to decline, at least one new one has been added to the inventory, though Koro too is on the brink of extinction.

"We noticed it instantly" as a distinct and unfamiliar language, said Gregory Anderson, director of the Living Tongues Institute for Endangered Languages in Salem, Ore.

Dr. Anderson and K. David Harrison, a linguist at Swarthmore College, were leaders of the expedition, part of the Enduring Voices Project of the National Geographic Society. Another member of the group was Ganash Murmu, a linguist at Ranchi University in India. A scientific paper will be published by the journal Indian Linguistics.

When the three researchers reached Kichang, they went door to door asking people to speak their native tongue — not a strenuous undertaking in a village of only four bamboo houses set on stilts. The people live by raising pigs and growing oranges, rice and barley. They share a subsistence economy and a culture with others in the region who speak Aka, or Miji, another somewhat common language.

On the veranda at one house, the linguists heard a young woman named Kachim telling her life story in Koro. She was sold as a child bride, was unhappy in her adopted village and had to overcome hardships before eventually making peace with her new life.

Listening, the researchers at first suspected Koro to be a dialect of Aka, but its words, syntax and sounds were entirely different. Few words in Koro were the same as in Aka: mountain in Aka is "phu," but "nggo" in Koro; pig in Aka is "vo," but in Koro "lele." The two languages share only 9 percent of their vocabulary.

The linguists recorded Kachim's narrative in Koro, and an Indian television crew had her repeat it in Hindi. This not only enabled the researchers to understand her story and her language, but called attention to the cultural pressures threatening the survival of such languages, up against national languages dominant in schools, commerce and mass media.

In "The Last Speakers: The Quest to Save the World's Most Endangered Languages," published last month by National Geographic Books, Dr. Harrison noted that Koro speakers "are thoroughly mixed in with other local peoples and number perhaps no more than 800."

Moreover, linguists are not sure how Koro has survived this long as a viable language. Dr. Harrison wrote: "The Koro do not dominate a single village or even an extended family. This leads to curious speech patterns not commonly found in a stable state elsewhere."

By contrast, the Aka people number about 10,000 living in close relations with Koro speakers in a district of the state of Arunachal Pradesh, where at least 120 languages are spoken. Dr. Anderson said the coexistence of separate languages between two integrated groups that do not acknowledge an ethnic difference between them is highly unusual.

As Dr. Harrison and Dr. Anderson expanded their research, comparing Koro with several hundred languages, they determined that it belonged to the Tibeto-Burman language family, which includes 400 tongues related to widely used Tibetan and Burmese. But Koro had never been recognized in any surveys of the approximately 150 languages spoken in India.

The effort to identify "hot spots of threatened languages," the linguists said, is critical in making decisions to preserve and enlarge the use of such tongues, which are repositories of a people's history and culture.

In the case of Koro speakers, Dr. Harrison wrote in his book, "even though they seem to be gradually giving up their language, it remains the most powerful trait that identifies them as a distinct people."

http://www.nytimes.com/2010/10/12/science/12language.html?ref=science

Child Abuse Investigations Didn't Reduce Risk, a Study Finds

By NICHOLAS BAKALAR

Child Protective Services investigated more than three million cases of suspected child abuse in 2007, but a new study suggests that the investigations did little or nothing to improve the lives of those children.

In 1973, Congress passed the Child Protective Services Act, designed to encourage more thorough and accurate reporting and record-keeping in child abuse cases. In New York, for example, there are now Child Protective Services offices in every county, paid for in part with federal funds.

Researchers examined the records of 595 children nationwide, all at similar high risk for maltreatment, tracking them from ages 4 to 8. During those years, Child Protective Services investigated the families of 164 of these children for suspected abuse or neglect. The scientists then interviewed all the families four years later, comparing the investigated families with the 431 families that had not been investigated.

The scientists looked at several factors: social support, family functioning, poverty, caregiver education and depressive symptoms, and child anxiety, depression and aggressive behavior — all known to increase the risk for abuse or neglect. But they were unable to find any differences in the investigated families compared with the uninvestigated in any of these dimensions, except that maternal depressive symptoms were worse in households that had been visited.

One possible interpretation of this result would be that the investigated families were at greater risk to begin with, and that the investigation helped them to recover to the expected level of risk. But if this were so, the authors write, households with recent investigations would have greater risk than households with more distant investigations. Statistical analysis found no such association. They concluded that Child Protective Services investigations had little or no effect.

The researchers were in some ways unsurprised by their findings. Even when services are offered, they usually take aim at immediate risks — substance abuse, for example, or domestic violence — not abiding problems like poverty or poor social support. Whatever interventions were offered apparently failed to reduce the risk for future child abuse.

Dr. Kristine A. Campbell, the lead author of the study, said that it may be too easy to blame Child Protective Services. "I believe that C.P.S. has a critical role," she said. "As a pediatrician, when I'm there in the middle of the night with a child who has been beaten up, I need them. But we have to look at other systems that can really create a safety net for these children."

Other experts agreed. "I don't see investigation as an intervention. I see it as an activity to gather information," said Jill Duerr Berrick, a professor of social welfare at the University of California, Berkeley. "While we might all hope that C.P.S. could do more, in the current context it doesn't. This is an important study that will get people talking again." Dr. Berrick was not involved in the work.

The authors acknowledge that the study, which appears in the October issue of The Archives of Pediatrics & Adolescent Medicine, has certain weaknesses: some potentially modifiable risk factors — intimate partner violence and substance abuse, for example — were not included in the data they used. And not all of the five different geographical sites systematically collected information on all risk factors.

In an editorial published with the study, starkly titled "Child Protective Services Has Outlived Its Usefulness," Dr. Abraham B. Bergman suggests some essential changes: child abuse, because it is a crime, should be investigated by the police; public health nursing services should be the first to respond to concerns of child neglect; social workers should assess appropriate living situations and work with families to obtain services, and not be engaged in law enforcement. But Dr. Bergman, who is a pediatrician at the Harborview Medical Center in Seattle, expressed considerable skepticism that such changes would happen.

Dr. Campbell, an assistant professor of pediatrics at the University of Utah, is more optimistic. "I don't believe that C.P.S. has outlived its usefulness," she said. "The problem is that someone needs to continue working with these families — those risk factors don't go away, and I'm not sure we should expect C.P.S. to deal with them. C.P.S. deals with acute issues. We don't know how to deal with what remains."

http://www.nytimes.com/2010/10/12/science/12child.html?ref=science

Physician Revives a Dying Art: The Physical

By DENISE GRADY

STANFORD, Calif. — For a 55-year-old man with a bad back and a bum knee from too much tennis, Dr. Abraham Verghese was amazingly limber as he showed a roomful of doctors-in-training a twisting, dancelike walk he had spied in the hospital corridor the day before.

He challenged them to diagnose it. Hemiplegia? Sensory ataxia? Chorea? Spastic diplegia?

"It would be a shame to have someone with a gait that's diagnostic, and yet we can't recognize it," he said.

It was their introduction to a rollicking workshop on abnormal gaits that soon had them shuffling, staggering and thrashing about, challenging one another. Parkinson's? Neuropathy? Stroke?

Dr. Verghese (ver-GEESE) is the senior associate chairman for the theory and practice of medicine at Stanford University. He is also the author of two highly acclaimed memoirs, "My Own Country" and "The Tennis Partner," and a novel, "Cutting for Stone," which is now a best seller.

At Stanford, he is on a mission to bring back something he considers a lost art: the physical exam. The old-fashioned touching, looking and listening — the once prized, almost magical skills of the doctor who missed nothing and could swiftly diagnose a peculiar walk, sluggish thyroid or leaky heart valve using just keen eyes, practiced hands and a stethoscope.

Art and medicine may seem disparate worlds, but Dr. Verghese insists that for him they are one. Doctors and writers are both collectors of stories, and he says his two careers have the same joy and the same prerequisite: "infinite curiosity about other people." He cannot help secretly diagnosing ailments in strangers, or wondering about the lives his patients lead outside the hospital.

"People are endlessly mysterious," he said in an interview in his office at the medical school, where volumes of poetry share the bookshelves with medical texts, family photos and a collection of reflex hammers.

His sources of inspiration include W. Somerset Maugham and Harrison's Principles of Internal Medicine. In addition to his medical degree, he has one from the writing workshop at the University of Iowa.

He is out to save the physical exam because it seems to be wasting away, he says, in an era of CT, ultrasound, M.R.I., countless lab tests and doctor visits that whip by like speed dates. Who has not felt slighted by a stethoscope applied through the shirt, or a millisecond peek into the throat?

Some doctors would gladly let the exam go, claiming that much of it has been rendered obsolete by technology and that there are better ways to spend their time with patients. Some admit they do the exam almost as a token gesture, only because patients expect it.

Medical schools in the United States have let the exam slide, Dr. Verghese says, noting that over time he has encountered more and more interns and residents who do not know how to test a patient's reflexes or palpate a spleen. He likes to joke that a person could show up at the hospital with a finger missing, and doctors would insist on an M.R.I., a CT scan and an orthopedic consult to confirm it.

Dr. Verghese trained before M.R.I. or CT existed, in Ethiopia and India, where fancy equipment was scarce and good examination skills were a matter of necessity and pride. He still believes a thorough exam can yield vital information and help doctors figure out which tests to order and which to skip — surely a worthwhile goal as the United States struggles to control health care costs, he said.

A proper exam also earns trust, he said, and serves as a ritual that transforms two strangers into doctor and patient.

"Patients know in a heartbeat if they're getting a clumsy exam," he said.

He has lectured and written about the erosion of examination skills, and his ideas have resonated with many doctors.

Stanford recruited him in 2007, in large part because of his enthusiasm for teaching the exam. He seized the bully pulpit.

"Coming from here, it's taken more seriously," he said.

With colleagues, he developed the Stanford 25, a list of techniques that every doctor should know, like how to listen to the heart or look at blood vessels at the back of the eye. The 25 are not the only exams or even the most important ones, he emphasizes — just a place to start.

Medical School, Interrupted

At times, Dr. Verghese said, he feels almost embarrassed by all the interest in his work, because the exam techniques he is teaching are nothing more than the same ones he learned in Ethiopia and India decades ago.

Two days a week he hides out to write, in a secret office that was part of the deal he made when Stanford recruited him. His name is not even on the door; he left the names of the previous occupants. There is no land line.

Like Dr. Marion Stone, the main character in "Cutting for Stone," Dr. Verghese was born in Ethiopia. His parents were teachers from Kerala, a Christian region in southern India. His mother had newspaper articles published there about life in Ethiopia. The family's expectations were high.

"You were a doctor, engineer, lawyer or a failure," Dr. Verghese said. He was always drawn to literature, but never imagined he could make living at it.

He left Ethiopia at 15 for two years of premedical studies in Madras, India, and then returned to Addis Ababa for medical school. By then his parents, worried about Ethiopia's stability, had moved to the United States. But he had no desire to leave.

"I loved that land," he recalled.

The medical training was rigorous. Students spent a year dissecting a cadaver, and then had to pass grueling essay exams.

"It was almost brutal," he said. "But it left us changed in some fundamental way, like formatting a disk."

Medical students in the United States today spend far less time studying anatomy — too little to learn it well, he said, shaking his head.

Civil war broke out in Ethiopia in 1974. Emperor Haile Selassie was deposed, and the military took over. During Dr. Verghese's third year of medical school, the university was shut down. Soldiers were everywhere. A curfew was imposed, and troops patrolled at night in jeeps with mounted machine guns. Corpses lay in the streets. As a citizen of India, he was a foreigner, and it was time to get out. He joined his parents in Westfield, N.J.

America excited him. But he was a young man used to being on his own, thrust back into a small house with his parents, who urged him to finish his medical studies. He would have to start from scratch, earning a bachelor's degree and then applying to medical schools, even though he already had more than two years of medical training.

He took a night job as a hospital orderly. He liked earning a paycheck, and he bought a used car, hung out with nurses and orderlies, and dated an American girl.

"I could see my blue-collar life starting to unfold," he said. "I'd marry a Jersey girl, we'd live in an apartment someplace and take vacations in the Poconos when we could afford it."

He lost his way during that period, he says, and it made him the black sheep of the family.

A Passionate Return to Training

Then one night at work he had an epiphany. He picked up a book that a medical student had left behind, the Harrison textbook. It's a medical school classic, the same book he had studied in Ethiopia. He realized how much he had already invested in medicine, and what he would be throwing away if he did not resume his training. He finished medical school in India, and then did his residency in the United States, specializing in internal medicine and infectious disease.

He worked in Tennessee during the early days of the AIDS epidemic, before there were any effective treatments. Before AIDS, he said: "I must have been a conceited ass, full of knowledge. AIDS humbled a whole generation."

He came to know many of his patients and their families. He visited their homes, attended their deaths and their funerals. One patient, near death, awoke when Dr. Verghese arrived, and opened his shirt to be examined one last time.

"It was like an offering," Dr. Verghese said, with tears in his eyes. "To preside over the bed of a dying man in his last few hours. I listen, I thump, I don't even know what I'm listening for. But doing it says: 'I will never leave you. I will not let you die in pain or alone.' There's not a test you can offer that does that."

His long hours and intense involvement with his patients led to his first book, "My Own Country," but also drained him and contributed to the failure of his first marriage. Still, it was not a mistake to get so close, he insists.

"I've never bought this idea of taking a therapeutic distance," he said. "If I see a student or house staff cry, I take great faith in that. That's a great person, they're going to be a great doctor."

He met his present wife, Sylvia, in El Paso, where she had started a ministry to help people with AIDS. Their son, Tristan, is 12. Dr. Verghese also has two grown sons, Jacob and Steven, from his first marriage.

The Next Generation

Making hospital rounds with students, Dr. Verghese is in his element. He is impeccably dressed under the white coat, in a crisp dress shirt, pale silk tie and sharply pressed pants. His hair has made its retreat, and what remains is trimmed too close to hide the hearing aids that he has reluctantly begun to wear. He loves being in the wards, he says. It is the only place where his back does not ache.

On a morning in August, he peppered four students with rapid-fire questions, mini-lectures on science and the history of medicine, pointers on presenting cases, and jokes that made them roll their eyes or laugh, or both.

"What can alcohol do to the nervous system?" he asked. Damage the cerebellum, said one. Cause seizures, said another. "Come on, I want 10," Dr. Verghese said, insistent but not bullying.

"What's the most important part of the stethoscope?" They stared at him. "The part between the earpieces." They moaned.

Striding down the corridor, he told them about an unusual condition that produces silver-colored stools.

"You'll be so impressed you'll want to take them home," he said.

With a group of third-year medical students, he waited until they had taken their places around a patient's bed, then asked them to turn their backs and look away.

What had they noticed on the bedside table? A lunch tray? A book? Clues to whether the patient could eat, whether he was alert? Did he look comfortable? Or did he seem to be in pain?

"What if the patient says, 'Whatever you do, Doc, don't bump the bed'?" Dr. Verghese asked, bumping the bed with his hip. "Consider peritonitis."

The patient, a man in his 80s, grinned, enjoying the show, and seemed pleased to let the students practice palpating his spleen and percussing his lungs.

"Name five things that are better outside the body than in," he asked, not mentioning that the answer appears in his novel: fluids, fetuses, foreign bodies, feces and flatus.

As they headed to the next room, Dr. Verghese told the students: "We're going to walk these corridors and I'm going to ask you if you notice anything unusual. I'm going to ask you about someone I see along the way. Peek into patients' rooms as you go by."

They gathered around the next patient, leaning in close as Dr. Verghese pointed out signs of facial weakness — inability to raise the eyebrows, a lip that rose more on one side than the other when Dr. Verghese asked to see the patient's teeth, one eye that blinked more often than the other.

In the corridor, he said, "Here's your question: What about the lady in the next bed?"

As she had watched them walk by, only one of her eyes had moved. Just a few of the students had noticed.

"You can't show up at the bedside and then turn on your skills," he said. "You have to keep your game sharp all the time."

Outside another patient's room, he had a group of interns and residents palpating their own thighs as he showed them a technique for finding the right place to stick the needle when culturing an abscess.

"Wow!" said one of the group, whose needle had recently missed its mark. "Amazing. This is great."

Dr. Verghese smiled. "I am here to astound you," he said.

http://www.nytimes.com/2010/10/12/health/12profile.html?ref=scien