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Hubble Spots First Potential Asteroid Collision

- By Alexis Madrigal
- February 2, 2010 |

The X marks the spot of a suspected head-on collision between two asteroids imaged by the Hubble Space Telescope's new-and-improved Wide Field Camera.If it's confirmed by further observations, it would be the first time that scientists have detected the interplanetary collision between objects in the asteroid belt, though they believe that such occurrences are common.The complex structure of the debris is what makes astronomers think they may be seeing something new around the sun. The main nucleus of the object, P/2010 A2, is actually located outside its dust halo, something that's never been seen in a comet-like object before.

"The filamentary appearance of P/2010 A2 is different from anything seen in Hubble images of normal comets, consistent with the action of a different process," said David Jewitt, an astronomer at the University of California Los Angeles, in a press release.They hypothesize that the filaments are made up of dust and gravel created by a high speed impact that could have occurred at 11,000 miles per hour."If this interpretation is correct, two small and previously unknown asteroids recently collided, creating a shower of debris that is being swept back into a tail from the collision site by the pressure of sunlight," Jewitt said.

Image: NASA, ESA, and D. Jewitt

Read More http://www.wired.com/wiredscience/2010/02/hubble-asteroid-crash/#ixzz0ePRnZBYm

http://www.wired.com/wiredscience/2010/02/hubble-asteroid-crash/

Tree by Tree: Reforesting Haiti

By: Erik Hayden | January 27, 2010 | 16:15 PM (PDT) |

Reforesting efforts in Haiti may not provide immediate relief, but could create a renewable and sustainable supply of food and fuel for desperate villages.

The Marines, the Red Cross and countless other charity organizations are getting their boots on the ground to offer tangible, immediate aid to quake-stricken Haitians. Relief may come as simple as a dry biscuit and water delivered by the U.N. World Food Program or as complicated as surgery performed by Doctors Without Borders.

Amid the tremendous effort to stave off hunger and slowly repair the tattered nation, another nonprofit, Trees for the Future, is continuing to do what it has done in the country for eight years: plant trees that produce much-needed fuel and food for rural villages.

The organization, founded by Grace and Dave Deppner in 1989, has offered rural populations worldwide the opportunity to receive training in sustainable farming and provided the seeds and assistance to reforest these areas. In outposts ranging from Burkina Faso, the Philippines, Honduras and others, the nonprofit has earned its name (and a four-star rating from Charity Navigator, the highest available) by assisting in reintroducing precious — and often depleted — resources to villages.

“People in these villages are motivated,” explained African and Caribbean program officer Ethan Budiansky. “They understand they need to plant trees, but they don’t have the resources. They don’t have a wheelbarrow, shovel or training to do it.” The organization provides the materials and agroforestry training to enable farmers to build sustainable food crops and fuel resources.

Prior to the earthquake in Haiti, the nonprofit had worked with 13 villages north of Port-au-Prince in 2009 to provide nurseries that harvested relatively fast-growing multipurpose trees (for fuel) and mango, avocado, citrus and guava fruit trees, among others.

The help couldn't have come at a better time: Over decades, Haitian forests have been decimated by a population desperate for food and fuel, depleting resources and creating a stark border between the country and its neighbor, the Dominican Republic. Last year, Trees for the Future helped plant more than 1 million trees on this battered landscape — a number they plan to top this year. "We're aiming to plant 1.2 million trees and assist 15 communities in 2010," said Budiansky.

After being rocked by the 7.0 earthquake, the resource center in Leveque, a small town north of Port-au-Prince, has been acting as a middleman between the villages and the eager charity groups looking to give immediate supplies. A small, full-time staff of four delivers "needs assessment" for villages that contact the outreach center, helping and advising in any way they can before planning a potential tree-nursery project.

The greatest need at present is for food. Beans, yams, eggplant and peppers are being disseminated — the types of crops that can provide some relatively immediate, and hopefully sustainable, relief.

"Especially now after the earthquake, we've been providing resources and training to grow food crops," said Budiansky. "[The goal] is for an individual to farm that same piece of land and benefit from it."

http://www.miller-mccune.com/science-environment/tree-by-tree-reforesting-haiti-7682/

My Brain on My Mind

By Priscilla Long

Walter Long was a writer and he was my grandfather. He was courteous, charming, chivalrous, handsome, well-spoken, well-shaven, well-dressed, and completely senile. His mental decline began when I was a girl. In the end he didn't know me, and he didn't know his own son, my father. He was born in 1884. He wrote for four or five decades until, starting sometime in the 1950s, dementia destroyed his writing process. We have a photo of Granddad writing with a dip pen at a slant-top writing table. He was a tall, thin man with a high forehead and a classic, almost Grecian, nose. He was a metropolitan reporter for Philadelphia's leading newspaper, *The Philadelphia Bulletin*, before the era of regular bylines. What remains of his five decades of reportage? Nothing. His words have been obliterated, eradicated, annihilated. And what do we know about his brain? About his neurons, or ex-neurons? Almost nothing. Before me, my grandfather was the writer in the family. This abecedarium is dedicated to him. To his memory.

—A—

Alphabets are an awe-inspiring invention of the *Homo sapiens* brain. Consider these sound symbols lining up before your eyes. Our 26 letters can create in English one to two million words. (The range has to do with what you consider a word. Are *brain* and *brainy* the same word?) Where in our brain do we keep our ABCs? How does our brain provide us with the use of alphabetic characters without thought? I am handwriting this sentence in my writer's notebook. The letters flow out of my pen as if they were a fluid flowing from my fingertips rather like sweat. Nothing for which I really have to use my brain.

—B—

My brain boggles my mind. Its mystery. Its moody monologue.

I walk down Bagley Avenue this fine April day. The Seattle sky is blue. The Brain, wrote Emily Dickinson, is wider than the Sky, since it contains both Sky and You. My own brain contains this blue sky plus six cherry trees in full bloom. Plus the memory of my granddad's face. Plus bungalow yards and rock gardens bright with tulips, violets, camellias, and azaleas. The passing scene enters my eyes in the form of light waves. Neurons in my retina convert these light waves into electrical impulses that travel farther back into my brain. Our brain contains 100 billion neurons (nerve cells). Our gray matter. Each neuron has an axon—a little arm—that transmits information in the form of electrical impulses to the dendrites—receivers—of nearby neurons. Dendrites branch twig-like from each neuron. Between axon and dendrite, the synapse is the point of connection. Axons commune with dendrites across the synaptic gap.

When neurons "fire," they emit a rat-a-tat-tat of electrical pulses that travel down the axon and arrive at its terminal endings, which secrete from tiny pockets a neurotransmitter (dopamine, say, or serotonin). The neurotransmitter ferries the message across the synaptic abyss and binds to the synapse, whereupon the synapse converts it back into an electrical pulse . . . What blows my mind is this: a single neuron can make between 1,000 and 10,000 connections. At this moment our neurons are making, it could be, a million billion connections.

What this electrical/chemical transaction gives us is culture: nail polish, Poland, comic books. Otis Redding belting out "Try a Little Tenderness" at the 1967 Monterey International Pop Music Festival, along with its memory, its YouTube reenactment, its recordings and coverings and remixings, its moment in history.

The geography of the brain ought to be taught in school, like the countries of the world. The deeply folded cortex forms the outer layer. There are the twin hemispheres, right brain and left brain. (We may

be of two minds.) There are the four lobes: frontal in front, occipital (visual cortex) in back, parietal (motor cortex) on top, and temporal behind the ears. There's the limbic system (seat of emotion and memory) at the center. There's the brain stem, whose structures keep us awake (required for consciousness) or put us to sleep (required for regeneration of neurotransmitters).

The brain also has glial cells, white matter. Glial cells surround and support neurons, carry nutrients to neurons, and eat dead neurons. Some glial cells regulate transmission and pulverize post-transmission neurotransmitters. Others produce myelin, which surrounds and protects axons. Glial cells are no longer thought to be mere glue. When stimulated, they make, not electricity as neurons do, but waves of calcium atoms. They also produce neurotransmitters—glutamate (excitatory) and adenosine (inhibitory). We may not know what they are up to, but we know they're up to *something*.

So there you have the brain: a three-pound bagful of neurons, electrical pulses, chemical messengers, glial cells. There, too, you have the biological basis of the mind. "Anything can happen," says the poet C. D. Wright, "in the strange cities of the mind." And whatever does happen—any thought, mood, song, perception, delusion—is provided to us by this throbbing sack of cells and cerebral substances.

But what, then, is consciousness?

—C—

Consciousness, according to neuroscientists Francis Crick and Christof Koch, is "attention times working memory." "Working memory" being the type of memory that holds online whatever you are attending to right now. Add to "attention times working memory" a third element of consciousness—the sense of self, the sense of "I" as distinct from the object of perception. If I am conscious of something, I "know" it. I am "aware" of it. As neurobiologist António Damásio puts it in *The Feeling of What Happens*, "Consciousness goes beyond being awake and attentive: it requires an inner sense of the self in the act of knowing." (It also requires the neurotransmitter acetylcholine.)

There is another theory of consciousness, the quantum physics theory of consciousness, in which quarks, a fundamental particle, have protoconsciousness. This theory is said to have an aggregation problem—how would zillions of protoconscious particles make a conscious being? It puts consciousness outside life forms and into moonrocks and spoons. I will leave that theory right here.

In dreamless sleep, we are not conscious. Under anesthesia, we are not conscious. Walking down the street in a daze, we are barely conscious. Consciousness may involve what neuroscientist Jean-Pierre Changeux postulates is a "global workspace"—a metaphorical space of thought, feeling, and attention. He thinks it's created by the firing of batches of neurons originating in the brain stem whose extra-long axons fan up and down the brain and back and forth through both hemispheres, connecting reciprocally with neurons in the thalamus (sensory relay station) and in the cerebral cortex. These neurons are focusing attention, receiving sensory news and assessing it, repressing the irrelevant, reactivating long-term memory circuits, and, by comparing the new and the known, registering a felt sense of "satisfaction" or "truth," which is brought home by a surge of the reward system (mainly dopamine).

Crick and Koch propose, rather, that the part of our gray matter necessary for consciousness is the claustrum, a structure flat as a sheet located deep in the brain on both sides. Looked at face-on, it is shaped a bit like the United States. This claustrum maintains busy connections to most other parts of the brain (necessary for any conductor role). It also has a type of neuron internal to itself, able to rise up with others of its kind and fire synchronously. This may be the claustrum's way of creating coherence out of the informational cacophony passing through. For consciousness feels coherent. Never mind that your brain at this moment is processing a zillion different data bits.

Gerald Edelman's (global) theory of consciousness sees it resulting from neuronal activity all over the brain. Edelman (along with Changeux and others) applies the theory of evolution to populations of

neurons. Beginning early in an individual's development, neurons firing and connecting with other neurons form shifting populations as they interact with input from the environment. The brain's reward system mediates which populations survive as the fittest. Edelman's theory speaks to the fact that no two brains are exactly alike; even identical twins do not have identical brains.

How, in Edelman's scheme, does consciousness achieve its coherence? By the recirculation of parallel signals. If you are a neuron, you receive a signal, say from a light wave, then relay it to the next neuron via an electrical pulse. Imagine a Fourth of July fireworks, a starburst in the night sky. Different groups of neurons register the light, the shape, the boom. After receiving their respective signals, populations of neurons pass them back and forth to other populations of neurons. What emerges is one glorious starburst.

I myself do not have a theory of consciousness. Still, I am a conscious (occasionally) being. My sense of myself, my sense of an "I," has some sort of neuronal correlate. I am conscious (aware) of the fact that I am teaching a writing seminar (observed object with neuronal correlate) on the literary form known as the abecedarium (observed object with neuronal correlate). I am conscious (aware) that I will be submitting my own abecedarium—this one—to the brainy writers in the class. Because I can imagine the future, because I can plan ahead (thanks in part to my frontal lobes), I feel apprehensive. How crazy! To imagine I could comprehend the *Homo sapiens* brain, the most complex object in the known universe, within the 26 compartments of an abecedarium.

I will try. I will color the cones and rods and convoluted lobes printed in black outline in my anatomy coloring book. I will teach my neurons to know themselves. As I write this, I picture our class seated around our big table. I can picture the face of each writer at the table. To each face I can attach a name. This is proof that, as of today, I have dodged dementia.

—D—

Dementia dooms a life. It doomed my grandfather's life. Even today, when Alzheimer's disease—just one type of dementia—afflicts as many as 5.3 million Americans, including one in four of all persons age 85 or older, we know far too little about it. It's not clear what kind of dementia Walter Long had. He may not have had Alzheimer's. He may have had Lewy body dementia. He may have had small strokes. Whatever it was, it doomed his brain, it doomed his body, it doomed his body of work—including a novel, never published, which must have existed as a typescript. Upon his death following years of senility, this novel was discarded. For me, the disappearance of my grandfather's writing is a distressing enigma. Not an easy problem.

—E—

Easy Problem. Philosopher's lingo for the problem in neuroscience of comprehending the neuronal correlates of consciousness. When you see red, what exactly are your neurons doing? When you remember your grandfather's face, what are your neurons doing? It may be difficult to parse the answer but in principle we can do it. It's easy. The Hard Problem is the mystery of subjective experience. When long light waves stimulate our neural pathways, why do we experience the color red? And what survival benefit caused our brains to develop, through eons of evolution, an ability to experience a "sense of self," a self able to see itself as special or heroic or smart or not so smart—as, on occasion, a complete failure?

—F—

Failure to learn new things kills neurons. People who vegetate before the TV are killing their neurons. People who never do anything new or meet anyone new are killing their neurons. People who never read or learn a new game or build a model airplane or cook up a new recipe or learn a new language are killing their neurons. Mind you, many middle-aged professionals are killing their neurons. They're doing what they are good at, what they already know, what they learned to do years ago. They're pursuing careers, raising children, cooking dinner, returning phone calls, reading the newspaper. They are busy and

accomplished, but they are not learning anything new. If you are not learning anything new, you are killing your neurons. To keep your neurons, learn something new every day. Begin now. Doing so requires no particular genius.

—G—

Genius is nothing you can be born with. No one is born with it. Not Mozart, not Picasso, not Tolstoy. In any field, world-class achievement demands at least 10,000 hours of practice. According to Daniel J. Levitin in *This Is Your Brain on Music*, dozens of cognition studies have produced the same result: geniuses practice more. Neural pathways require repeated stimulation to attain a "genius" level of mastery. The neurons must be stimulated and restimulated, over and again. Essential to this learning process, to this process of achieving supreme mastery, is the hippocampus.

—H—

The hippocampus is at the core of what is known as declarative memory—memory of facts and events that can be recalled later for conscious reflection. Memories of what you did this morning, of which candidate you voted for, of whether you were supposed to bring home milk or eggs, all depend on the hippocampus. In Alzheimer's, the hippocampus is gradually destroyed. The sea horse–shaped structure is located above the eye, about an inch behind the forehead. It is part of the limbic system, chief purveyor of emotion.

We remember what is emotional. Fear, essential for survival, is provided to us by our almond-shaped amygdalae, also part of the limbic system. Fearful events fire up the amygdala and the amygdala sends its projections all over the brain, but especially to the hippocampus. The amygdala can smell a rat. It receives sensations directly from the nose and sets off alarms with no intervening cognition. We remember what we fear.

And we remember what we like, what we want, what we love, what triggers our reward system, dopamine, serotonin. We attend to what is meaningful, what is emotionally resonant, whether positive or negative. We remember what we pay attention to.

Hippocampal activity is not essential for procedural memory—what the body knows. You don't need your hippocampi to ride a bike or get out of bed or even play the piano if you are a pianist. The hippocampus is not essential for semantic memory—facts and words. It's not even essential for working memory—remembering a phone number long enough to dial it. But it's the brain's transformer of short-term memory into long-term memory. What you lose when you lose your hippocampi is your ability to make new long-term memories.

Such was the fate of the much-studied "HM," Henry Gustav Molaison (1926–2008). His tragic case gave us much of what we know about memory. In 1953 a neurosurgeon, attempting to halt the young man's frequent epileptic seizures, removed most of Henry's hippocampi, his amygdalae, and some surrounding tissue of the temporal lobe. The seizures stopped. And HM could still speak and make perfect sense (semantic memory). He could remember his old skills and even learn new skills (though he couldn't remember learning them). He retained long-term memories, including vivid childhood scenes. He retained his high IQ. What he lost—in terms of a life, almost everything—was the capacity to turn new short-term memories into long-term memories. He could not remember what happened yesterday. He could not remember what happened this morning. He could not remember the scientists who studied him for 40 years; he met them anew at each encounter. After the surgery he could no longer care for himself and lived in a nursing home. "HM's case," writes neurologist Oliver Sacks in *Musicophilia: Tales of Music and the Brain*, "made it clear that two very different sorts of memory could exist: a conscious memory of events (episodic memory) and an unconscious memory for procedures—and that such procedural memory is unimpaired in amnesia."

The conscious memory of events: How we take it for granted! It enables us to plan, to pursue a goal, to work, to cook, to read. It enables us to enjoy long talks and lazy days and nights out on the town. It enables storytelling, art, imagination.

—I—

Imagination depends on the conscious memory of events. How could I imagine a purple cow if I could not remember the cows of my childhood switching their tails against the horseflies? How could I imagine a purple cow if I could not remember purple crayons, purple potatoes, purple grape juice? Persons with impaired memories have impaired imaginations. Amnesiacs, writes science reporter Benedict Carey, "live in a mental universe at least as strange as fiction: new research suggests that they are marooned in the present, as helpless at imagining future experiences as they are at retrieving old ones." Images made by functional magnetic resonance imaging (fMRI) technology show that remembering and imagining send blood to identical parts of the brain.

What does this say about the goal of living in the present?

But for most of us, the phenomena of the present (just now Miles Davis playing "Red China Blues" on YouTube) connect in our mind with previous analogous experiences. Recognition involves memory: comparing what is seen with what was seen.

My grandfather had, I think, anterograde amnesia: He couldn't form new memories. He could remember the long ago but not yesterday. He would get dressed in his suit and tie, don his fedora, dapper as ever, and head out the door.

"Walter! Where are you going?" Gran would ask.

"I'm going to work." Granddad would say.

"You're not going to work! You're retired!" Gran would cry out.

Granddad lived, I think, in a state of perpetual churning anxiety. He felt it was time to go to work. He felt lost. He wondered out loud who these "nice people" were, sitting in his living room. (That would be us, his family.)

In the process of losing his memory, did Major Walter Long lose his pride in being decorated for "exceptional bravery under shellfire" in 1918 France during the Great War? Did he forget the trauma of war, his killed comrades? Did he forget the pleasure of composing a paragraph? Did he forget love? Did he forget joy?

—J—

Joy, happiness, contentment, the feeling of safety, the feeling of being loved, the act of loving, the feeling of respecting another and of being respected, all these feeling states are produced within the brain. The pursuit of happiness might be construed as the pursuit of more dopamine and/or serotonin flooding our synaptic clefts. Add norepinephrine to the mix—energy, the constricting of blood vessels, jumping up and down. Norepinephrine is a hormone when produced by the adrenal gland along with epinephrine (adrenaline). It's a neurotransmitter when produced by neurons in the brain. Certain racers, bikers, fistfighters, bank robbers, pickpockets, and other daring devils may be addicted to the intoxicating rush of norepinephrine-epinephrine.

Normally, these neurotransmitters spread out and do their job, after which they break down within the synaptic clefts or are returned to their home neurons by reuptake molecules. Antidepressants like Prozac

or Zoloft (SSRIs—selective serotonin reuptake inhibitors) bind to serotonin reuptake molecules, preventing them from doing their ferrying duty. This leaves serotonin flooding the synaptic gaps, free to continue stimulating the receptor molecules in the dendrites of the receiving neurons.

Cocaine binds to both serotonin and dopamine reuptake molecules, leaving the synaptic gaps awash in both. Whee! But then the crash. Receptor molecules in the dendrites are switches. When stimulated they switch on; when overstimulated they switch off. (With his or her receptors desensitized, the addict needs more and more.) And, because the neurotransmitters never get returned to their neurons, the dopaminergic and serotonergic systems get depleted, drawn down, drained out. Quite soon the system itself becomes deranged. Many addicts, whether using or recovering, have damaged brains. Tragically, lacking crack, they can feel no pleasure.

I'm no addict, but I do get migraines. This means I likely have a low supply of norepinephrine, an excitatory neurotransmitter that counterbalances dopamine. Under migrainous conditions, dopamine flooding my synaptic clefts leads not to a high but to the worst kind of low—killer headaches.

—K—

Killer headaches—including nausea, vomiting, light-stabs to the eyes, repulsive odors, excruciating head pain, a total sense of despair—are under study by me when I'm not having one. Migraine is cousin to epilepsy. It may be in part genetic, although Pamela, my monozygotic twin sister, does not get them. Migraine begins with an electrical storm in the brain stem, seat of the autonomic nervous system, controller of heartbeat and sleep, dilator of pupils, regulator of airways. This brainstorm spreads widely throughout the brain. Firing neurons require oxygen, carried by blood, and during the brainstorm, 300 times the normal amount of blood rushes to your head. Now, we migraineurs (according to researcher Stephen J. Peroutka) possess an insufficient supply of norepinephrine, not only during the dread headache but also all the time. Firing neurons secrete norepinephrine, which constricts the blood vessels in the head. So far, no pain. But, alas, our meager supply of norepinephrine gets drawn down, and dopamine (along with its rogue co-conspirators adenosine and prostaglandin), which acts oppositely and in balance with norepinephrine, runs amok. Dopamine distends cerebral blood vessels, which activates the trigeminal (cranial) nerves. Excruciating pain. Dopamine also stirs up the neurons in the stomach lining (we have 100 million of these), creating nausea leading to violent retching.

Triggers: too much sleep, too little sleep, dark microbrews (the more delicious, the more deadly), too much company throughout a long day, most red wines, MSG, air travel, dark chocolate combined with red wine (requires immediate hospitalization), too much caffeine, too little caffeine. Some women get migraines in sync with their menstrual cycle. Pickles will do it. Sulfites, sulfates, sunlight. Too much exertion. Too little exertion.

Mostly I adore Oliver Sacks's disquisitions on the brain, but I ingested his tome *Migraine* with flutters of anxiety. Might *Migraine* trigger a migraine?

Sacks inquires: What is the usefulness of the migraine to the migraineur?

Well!

There's the alleged migraine personality. Migraineur Joan Didion speaks (in "In Bed") of the compulsive worker, the perfectionist writer. This is the type who slaves over sentences that nonetheless ooze mediocrity like a bad odor. That would be me.

A migraine forces you to stop. Your day ends—bam! A migraine performs approximately the same service as being run over by a train.

Sacks thinks the profound despair brought on by a migraine is part of the migraine, the result of neurons firing out of control throughout the limbic system.

But what sets off the brainstorm? Why do triggers differ from one person to the next? Why do migraines occur on only one side of the head? And why does my personal miracle drug, Maxalt (rizatriptan benzoate)—which binds to serotonin receptors, which then release serotonin, which constricts blood vessels—cost $70 per headache?

And why me, Lord?

Is my brain sending my body some sort of sick, twisted message, some sort of poison-pen letter?

—L—

Letters—our ABCs—are meaningless squiggles until we learn our alphabet. Here's a letter I remember. I am 4 or 5 years old. I'm sitting on the davenport in the living room. I'm holding this letter in my hands. Pale blue letter paper. Blue ink. Gran, my Scottish grandmother, has written this letter to Mummy. I turn it over. I turn it around. I turn it every which way. I put it close to my face. I hold it far from my face. I turn it upside down. I'm filled with longing. I long to know its secrets. I long to read this letter. But I cannot read. Mummy comes into the living room and takes the letter from me. Foiled! And with the letter she takes the letter's letters. I am completely exasperated!

What part of the brain does this desperate desire to read come from? And where does the brain keep it—the long-since-satisfied longing to learn to read retained as a memory?

—M—

Memory is nothing like a scrapbook, a photo album, an attic, or a movie. Think of a broom. Remember *broom*. Different bits of the brain's broom are stored in different parts of the brain. The hickory broomstick. The weight of the broom in the hand. The straw head. The color of straw. The sound of sweeping. The purpose of sweeping. The sound of the word *broom*. The shape of the word *broom*. The fact that a broom is a cleaning tool and not a glass of wine or a plate of spaghetti. (Thoughts of sweeping, for those who sweep, activate a pre-motor area, ready to lift the hand.) Memory brings all these disparate bits together, makes them cohere. The puzzle of how the brain achieves coherent perceptions out of its widespread data bits is known as the binding problem.

Memory is a mental event, this we know. Mental events work by the transmission of neural impulses at different rates. Memory is stored not in one place but all over the place, as data bits. Memory, says António Damásio, likely involves "retro-activation"—the refiring of neurons activated during an original perception or experience. An association, either external or from within, may stir up a memory.

Types of memory: procedural (how to sweep the floor); semantic (facts, words, the word *broom* and what it refers to); working (being used at this moment to consider the concept of a broom); episodic (personal memories, the time you swept up your diamond with the dirt); declarative (remembering facts and events that become available for later conscious reflection).

Lost to everyone's declarative memory is the name of Walter Long's first wife, a girl he married in 1914. This girl died of tuberculosis a year or two after she married the young man who would become my grandfather. After her death, Walter went off to fight in the Great War. He was proud of his service (my father said). He received the Croix de Guerre. Toward the end of the war, he got the mumps, requiring nursing. In 1919 he married his nurse, a young Scottish war widow with a small child. This young mother, Annie McIlwrick Humphrey, became my Gran.

But Granddad's first wife, the girl he married in 1914 when he was 31—who was she? When I asked around a few years ago, no one in the family could remember her name, if they ever knew her name. She had gone from this world, gone from memory, gone from history. This girl, whoever she was, went from being somebody—with her looks, her likes and dislikes, with her passion for Walter Long, with a favorite pair of boots perhaps, or a love of pickles—to being nobody. Her dreams died along with her name along with her neurons.

—N—

Neurons commune with other neurons. But keep this in mind: a straightforward algorithmic connection from A to B to C is not enough for the brains of human beings or other beings to learn from experience. Rather, neurons act in assemblies that have subsets which act like cliques. Shifting perceptions are made by shifting transitory assemblies of neurons. In one type of assembly, various neurons receive input at the same time and send their output to the same place. In another type, neurons in different locations fire simultaneously. Assemblies often stack up in columns, with a single column containing perhaps 100,000 neurons.

Cliques compete with other cliques, recruiting neurons and losing them to the competition. Let's say you are trying to remember a name, but the wrong name comes to mind. The rogue clique, the clique pulsing the memory of that wrong name, is in competition with the clique you want-want-want-want. Eventually you dredge up the right name from the mind's murky sea. Attention is the net. Attention may be a function of feedback loops ("reentrant connections"), neurons firing from the frontal cortex *back* to the sensory relay station, the thalamus, to *suppress* irrelevant stimuli.

Certain neurons work as feature detectors. Neuroscientist Joe Tsien and his team subjected a mouse to an earthquake while recording the activity of some 200 hippocampal neurons. (Their ingenious lab inventions enable them to observe very few neurons at a time.) The earthquake caused the rodent's neurons to fire in a particular pattern, with different cliques reacting to different aspects. There was a startle clique, a motion-disturbance clique, a clique that reacted to *where* this event took place (a black box). With the mouse in the same black box, when a different event (an elevator fall) occurred, the startle clique and the motion-disturbance clique both fired again. The cliques of firing neurons were organized in a hierarchy from abstract to specific. (*Startle* is abstract: any number of different events could fire this clique. *Where* is more specific: a red box will not excite black-box neurons.) Memory occurs when, after the event, the same assembly of neurons refires, although less strongly.

The mystery is this: Where does the sense of mystery come from? What about tranquility or annoyance or curiosity or philosophy? Which neurons project ambition or fascination or frustration? Where does the sense of awe come from? What about the sense of the sacred, the sense of God or of *deus in res*? Are these states of being a matter of brain chemistry? Are they nothing more than electrical charges pulsing, thrumming, oscillating?

—O—

Oscillating is what the living brain does. It emits brain waves. Neurons emit electrical charges in a rhythmic pattern; they fire even with no stimulation from the outside world. The brain puts out its own energy. I think of this-this-this-this as a kind of humming. Hooked up to the electroencephalograph, the sleeping person's brain discharges mainly high-amplitude, low-frequency oscillations in the delta band (0.5 to 3 cycles per second). The barely awake or deeply meditating person's neurons tend to discharge theta waves (4 to 7 cycles per second). The awake but resting or meditating person's neurons tend to discharge alpha waves (8 to 12 cycles per second). Beta waves (15 to 25 cycles per second) begin when initiating purposeful activity. The gamma band (30 or more cycles per second) is linked to cognitive activity. But, like a great many statements about how the brain works, this one is oversimplified. In actuality, different brain areas are thrumming at different rates simultaneously. In actuality, the brains of some meditating persons are not in theta or in alpha. In actuality, the brains of persons in a TV-watching stupor *are* in alpha. In actuality, the electroencephalograph gets a lot of interference: with its electrodes

stuck not on the brain but on the scalp, it may be a dull instrument. A thick, delicious book, James H. Austin's *Zen and the Brain*, states that more important than the alpha state is synchronicity. Different parts of the brain begin oscillating in unison like the Rockettes at Radio City Music Hall. Bliss may result. But how little we know: our brain has barely begun to comprehend itself. And how wrong it can be. Until the late 1990s the dogma prevailed that neurons do not regenerate, that brain injuries are more or less permanent, that a devastating stroke represents irreparable loss. Then a new insight hit neuroscience like a tsunami—the brain's plasticity.

—P—

Plasticity brings hope to the stroke victim, the brain-injured, the autistic, the amputee in phantom pain, the palsied, the deranged, the old. The brain is plastic, not fixed. Brain structures do not have rigid job descriptions. Brain maps—those synaptically interconnected networks of neurons whose pulses produce a function or a memory—have shifting borders. Also, stem cells exist within the brain, particularly within the hippocampus. Brain stem cells can generate new brain cells, perhaps maintaining a balance with dying cells. Plasticity has exploded our notions of how to rehabilitate a stroke victim. Edward Taub, working on macaques, discovered that when one hand is disabled, say by stroke, the brain map for the good hand begins to expand. It is precisely this—the brain's compensatory ability to remap itself—that dooms the paralyzed hand. Taub's strategy is to render the good hand moot by confining it to a sling, and then to force the paralyzed hand to practice—to pick up and drop, pick up and drop, pick up and drop—beginning at the baby stage, putting square pegs into square holes eight hours a day. In this way, new brain maps form in remaining healthy tissue to work the limp hand. Taub's results, according to Norman Doidge in *The Brain That Changes Itself*, have ranged from good to spectacular. Plasticity means that old people can learn, that slow people can raise their IQ, that memory loss can be prevented or reversed.

Learning changes the brain. Gary Wayman and his team discovered that dendrites contain a growth-inhibiting protein. Synaptic activity (learning) moves that protein out of the way. Synaptic activity (learning) also makes the neuron manufacture an RNA molecule (micro RNA 132) that suppresses the manufacture of more inhibitor, allowing the dendrite to grow. Learning changes the brain by making new pathways and by growing new dendrites. And cognitive activity, according to psychopharmacologist Stephen Stahl, is the only intervention known to *consistently* diminish the risk of Mild Cognitive Impairment or Alzheimer's or to slow their terrible progression.

Then again, the propensity to develop late-onset Alzheimer's has a powerful genetic component. On chromosome 19 there's a gene (the E gene) that codes for a glycoprotein (a protein containing a carbohydrate) whose work involves cholesterol transport and metabolism. When it works, it cleans out those waxy amyloid plaques that otherwise clog thoughts and kill neurons. Persons born without a certain allele (alternative form) of this gene (the allele termed ApoE4) are in little danger of developing Alzheimer's. Persons born with one copy of this awful allele are four times as likely to get Alzheimer's as compared to the general population. Persons born with two copies of ApoE4 are eight times more likely to develop Alzheimer's. Very well, but here's the question: What is different about persons who carry two copies of ApoE4 (the worst case) who do *not* develop Alzheimer's? And there are other questions.

—Q—

Questions. What is it about our brain that makes us human? What is it that makes us different? Is it self-knowledge? Is it, as neuroscientist V. S. Ramachandran puts it, that we have a self that is self-reflexive, a self aware of itself? Is it knowing who we are? Is it our ability to explore our past and to imagine our future? Is it our spirituality, our brain's ability to imagine a soul, a higher being? Is it our propensity to make music, to make poetry? And what if we lose all of it, as Walter Long did? What if we lose all that seems intrinsic to our human nature, to our own selves? Who are we then? Who are we if we can't remember?

—R—

Remember as you would be remembered. In 2007 my father, Winslow Long, in the process of moving to Seattle, passes on to me a box of old letters and documents. In this battered cardboard carton I discover a booklet titled *The Family Records of Winslows and Their Descendants in America*. We Longs descend from the Winslows. The yellowed, shiny pages of this booklet reveal that my grandfather Walter Long (son of Clara Winslow Long) married Lillian Gorsuch, of Baltimore, on June 10, 1914. I hereby restore to everyone's neurons the name of Granddad's first wife. Did Lillian have tuberculosis at the time of their courtship? Did they know it? Did the start of the war in Europe during the 1914 summer of their wedding cause them to feel anxiety? Distress?

—S—

Stress shrinks the brain. Not normal stress or necessary stress, but chronic stress—chronic anxiety or clinical depression. The view that chronic stress destroys dendrites, neural pathways, and even entire neurons, especially in the hippocampus, is gaining acceptance as studies go forward.

Stress revs up the adrenal gland to pump glucocorticoids such as cortisol. Cortisol sparks the production of epinephrine (adrenaline), which tenses muscles, narrows blood vessels, and prepares you to kick butt or run for your life. But then the emergency ends and cortisol subsides. All is well. But in chronic stress, the emergency never ends. Cortisol bathes the hippocampus continuously, killing its neurons.

And there's more. The brain produces a protein known as brain-derived neurotrophic factor (BDNF), which protects neurons. Chronic stress may repress the gene that expresses BDNF. After which hippocampal neurons, which thirst for BDNF, which require BDNF, which can't go on without BDNF, shrink or balk or die.

Experimental animals subjected to stress, according to *Stahl's Essential Psychopharmacology*, turn off their genes for BDNF and as a result lose synapses as well as whole neurons.

On the other hand, exercise stimulates the growth of BDNF. So insists molecular biologist John Medina in *Brain Rules*.

So get out and walk. And stop your constant worrying. Stop stressing out over every little thing. Stop imagining the worst. Dementia begins there.

—T—

"There is no need for temples, no need for complicated philosophy. Our own brain, our own heart is our temple; the philosophy is kindness." So says the Dalai Lama. But in our world, violence, murder, war, and torture may be as common as kindness. Perhaps we have a deep inner need to kill, a devil in our unconscious.

—U—

Unconscious memories, unconscious wishes, unconscious fears, hates, loves. The very notion is strange. Strange to think that we have memories we can't remember, wishes we don't wish for, desires we don't feel. But that we *have* an unconscious is told by our brain's brilliance at doing things with no help from our conscious mind. We walk, chat, purchase potatoes, sweep, drive, read, talk on the phone, all without "thinking." We just do it. Our brain directs the process, whatever the process is. We have reactions to people and events—a sudden mistrust or a sudden affection—that may be based on implicit, that is non-conscious, memories of something similar. The admonition "trust your gut" translates "trust your brain, trust its implicit memories."

Blindsight also argues for the existence of the unconscious. Blindsight proves that we do not necessarily know what the brain knows. A blindsighted person is a brain-injured person. This person's visual cortex

has been damaged. He is blind, in his own opinion. Yet ask him to take a guess as to where some particular object is—say a pencil held up—and he will point right to it. The brain sees it. The brain knows where it is. But to the conscious mind, it is unknown. What is broken is the wiring that connects the part of the brain that sees to the part that *knows* it is seeing. To the person, the world has gone dark. To his brain, the world remains a carnival of shape and color—visual.

—V—

Visual arts are unique to our species. By means of culture we have created an external visual cortex—paintings, sculptures, billboards. We have created an external long-term memory—writing. We have created external dreams—films, plays, TV dramas. We tell stories to recall the past and we look through telescopes to see the past. We write in part to stop time, to hold onto the present as it becomes the past as we grow into the future.

I can picture my grandfather's face. I can remember, just barely, a time when he could still be counted among the cognoscenti. He had retired with our Scottish grandmother to a Bucks County, Pennsylvania, farm, the old farmhouse built of whitewashed brick. Granddad used to take us small children out to the barn to show us a sleek black buggy, polished but parked in desuetude. I can see in my mind's eye the barn, the buggy, the big doll I was allowed to play with. I see Walter Long's life as a tragedy, but maybe he didn't see it that way. He had good work while he could do it, and he had love and ambition, and at least some of his dreams came true. He reportedly reported on the sinking of the luxury ocean liner *Morro Castle* in 1934 and on the Lindbergh kidnapping trial of 1935. I once spent three days searching *The Philadelphia Bulletin* amid the massive coverage of the Lindbergh tragedy for any sign of my grandfather's hand. No luck. But some years later he himself was featured in the paper, in a sidebar, with his picture, here quoted in full (the ellipses appear in the original):

Walter Long . . . The Zoning Board of Adjustment goes into session . . . hearing pro and con on whether a new apartment site shall be approved . . . News is being made . . . and Walter Long's there . . . accurately recording the builders' arguments, the opponents' vigorous stand . . . For 15 years Walter Long has been one of The Bulletin's experts in municipal affairs . . . He roams the City Hall annex . . . drops in daily on the Board of Health . . . keeps tab on the Department of Supplies and Purchases . . . and distinguishes himself with his detailed reporting of the City Housing Rent Commission Hearings.

There he is. My grandfather. Not in his own words but in someone's words. Kind reader, if you were to utter the name of Walter Long, it would stay longer in this world. It would enter into your Wernicke's area.

—W—

Wernicke's area is where the brain comprehends and interprets language. Persons with damage to their Wernicke's area (who have Wernicke's aphasia) can speak, but their words pouring out make no sense. Neither do these persons comprehend a single word spoken to them. Broca's area produces spoken speech. Persons with Broca's aphasia may be able to speak within their own minds, but when they attempt to voice their thoughts, they fail to produce normal speech. Wernicke's area is associated with hearing, whereas Broca's area is associated with the neurons that activate the muscles of the larynx. Relations between Wernicke's and Broca's areas are intensely xenial.

—X—

Xenial (pronounced ZEE-nial) relations, friendly communicating relations, transpire among many neurons throughout many parts of the brain. Consider the binding problem, worked on most brilliantly by psychologist Anne Treisman. As we know, different aspects of the scene before us are carried into our brain by different neurons. Some neurons signal red; others black or yellow; others the news that what is before us is vertical or horizontal; others that an object is located in our upper-right quadrant or our

lower-left quadrant. How then do we reconstruct a coherent picture? How come, when we see a black-and-white cow with a red ribbon around its neck, the cow doesn't come out red, the ribbon black and white, since separate neurons have projected separate features of this beribboned bovine into our brain? The answer comes from the observation that persons with stroke-injured parietal lobes may indeed *see* the cow as red, the ribbon as Holstein. Think of it this way: it's *spatial* attention that puts the red on the red ribbon (both originate from the same point in space). Spatial attention emanates, it seems, from the parietal lobes. Red-perceiving neurons and ribbon-perceiving neurons are getting together, communing, enjoying xenial relations, rather like people at a cocktail party going yackety-yak.

—Y—

Yackety-yak. We are a yackety-yak people. We are quidnuncs, busybodies. Who did what to whom, who went out with whom, who slept with another's whom, who won the lottery, who won the game, who lost his shirt. Gossip, it turns out, takes up more than half of all human discourse. We concern ourselves with the business of others, and others concern themselves with our business, and all this sordid business is aired on reality TV, not to mention in cafés and over dinner and upon falling asleep and during morning coffee and later at the bar. Yackety-yak. We social primates evolved within an increasingly elaborate social framework, much dependent on our frontal-lobe-located mirror neurons. When you smile, I want to smile. When you cry, I want to cry. When you laugh, you activate my funny bone. We are inherently at home in social interaction. We can gossip for hours, even if doing so reduces the items crossed off our To Do list to zero.

—Z—

Zero is an awe-inspiring invention of the *Homo sapiens* brain. Zero is intrinsic to our human society, though we seldom give it a thought. All by itself, zero is nothing. So when does nothing become something? Nothing becomes something when you put it next to a 1, as in 10. Now this nothing is *holding a place for nothing in the units place*. Then if you put two nothings together with a 1 to make a 100, your little nothings are suddenly holding two places: a place for nothing in the units place and a place for nothing in the tens place. The zeros make the 1 mean not 1 but *one hundred ones*. Think about it. That little nothing, zero, put with only 9 other numerals, makes possible any number of numbers. The story of zero is a *Homo sapiens* story, invented by the Sumerians in ancient Babylonia and again by the Mayans in ancient Mexico.

Now, we also have other sorts of zeros. We have Ground Zero. We have zero population growth. We have the number of extant sentences written by Walter Long. Zero. No paper with Granddad's handwriting on it. No paper typed by him. No article bylined by him (at least none that I've found). So here was a writer, my grandfather, who wrote for five decades, who lost his memory, who lost, with his memory, his entire output.

How could this have happened? It's a mystery I ponder even as I hoard every word I write, even as I donate my own scribblings—60 boxes so far—to a university archives, even as I try to write more and more each day, as if that would overcome the oblivion that for certain lies in the future. Considering everything—wars and famines, families, feasts, births and deaths, the great loves and the great losses, considering the miracle of natural selection that evolved our brains—the loss of my grandfather's writing is a small thing. But for me it's a big thing. I can't get it out of my mind. It leaves me speechless, notwithstanding the two-million-word capacity of our alphabet.

Strange Matter

By John Olson I don't remember a time of greater insecurity. University of Massachusetts economics professor Richard Wolff argues that government bailouts and stimulus packages will not be enough to address the real causes of the economic crisis or to mend the "seismic failures within the structures of American-style capitalism itself." While Wall Street has been re-floated with staggering amounts of capital, the rest of the country remains floundering on a dry, mud-caked riverbed. "The bailout package," observed Joseph Stiglitz in a January 2009 *Vanity Fair* essay appropriately titled "Capitalist Fools," "was like a massive transfusion to a patient suffering from internal bleeding—and nothing was being done about the source of the problem, namely all those foreclosures." Climate change is wreaking havoc on the world's population; Australia, Argentina, India, Kenya, and war-torn Afghanistan are suffering unprecedented droughts; polar ice caps are melting at a much faster rate than scientists predicted; typhoons, hurricanes, tornadoes, and floods have increased in fury and devastation; the UN Food and Agriculture Organization predicts that 370 million people could be facing famine by 2050 if food production doesn't rise by at least 70 percent; and a series of wildfires has left California, which is drought stricken and near bankruptcy, as black as a handful of charcoal briquettes. Violence seems to be on the rise across the globe, from militants in Afghanistan spraying acid on the faces of girls walking to school, to the Mumbai attacks, to burning cars in France, to drug-related killings in Mexico, to an increase in domestic violence in the United States.

Planet Earth is in a traumatic turmoil. The combined services of Superman, Batman, Spiderman, and the Incredible Hulk could not put a dent in the problem. Anything added to this hellishness would seem to be lost in redundancy, but not so: one more item of astonishing freakishness is causing anxiety from a complex in Switzerland known as CERN, the European Organization for Nuclear Research, where something called the Large Hadron Collider (LHC) has been sputtering into operation. Its purpose is to discover whether a hypothetical particle called the Higgs boson (or the God particle) actually exists. There is a far-fetched yet widespread apprehension that a black hole created there could swallow the planet. Indeed, the entire universe.

At present, the world, including Switzerland, is still here. But that's because the $9 billion machine located outside Geneva has been riddled with problems and delays. In September 2008, a beam of protons was successfully circulated in stages through the vast ring of superconducting magnets housed in the collider's 17-mile-long tunnel, three kilometers at a time. A few days later, a quench (an abnormal termination of magnet operation) occurred, causing a loss of approximately six tons of the liquid helium needed to keep the collider cooled. Later analysis revealed the problem to be bad electrical connections. A total of 53 magnets were damaged in the incident. The machine has been beset by problems of a less technical nature as well. In October, in a scenario more redolent of a James Bond spy adventure, French investigators charged a physicist working at the LHC with having links to al-Qaeda. One begins to wonder if all these delays and complications aren't owing to a more preordained cause. A pair of CERN physicists have somewhat whimsically suggested that the reason for building the collider might be so abhorrent to nature that its creation would ripple backward through time and stop the collider before it could make a Higgs boson. In late October, BBC News announced that engineers working on the LHC had successfully injected beams of particles into two sections of the vast machine. The experiment itself, which will involve a collision of two beams, one running in a clockwise direction, the other running counterclockwise, is scheduled for December 2009. If you happen to be reading this article past that date, it would be safe to assume that a particle with less mass than a second-generation quark has not swallowed our planet.

Not yet, anyway.

So what exactly is all this apprehension about, and how real is it? Predictions that the collision of subatomic particles at the LHC might create a black hole and consume our planet, if not the entire universe, owe more to hysteria than to science. Black holes are created by the gravitational collapse of supermassive stars, which are rare and trillions of times the mass of Earth. If a black hole were created at CERN, it would be so tiny that it would eradicate itself instantly.

Thus, fears of creating a black hole are easily dismissed. But fear has a way of expanding and exacerbating worst-case scenarios. Anxiety is exponential. Problems interact to compound into an ever-broadening chain of unlooked-for consequences. There has also been some speculation that a peculiar set of entities called strangelets could turn our world inside out and make it look like a fun house gone completely mad. A strangelet is a hypothetical object composed of a finite number of roughly equal "up, down, and strange quarks." This anxiety, however improbable, is not entirely void of validity or charm. A strangelet, coming into contact with the familiar world, could convert ordinary matter into strange matter. As much as the current political milieu feels like some form of bizarre, parallel dimension where very little makes sense, the familiar world of nasturtiums, yo-yos, and lifeguards is still emphatically present. What would a world composed of "up, down, and strange quarks" gone awry be like? Would everything be neatly reversed? Would up be down and down be up? Would backward go forward and forward go backward? Would tomorrow happen yesterday and yesterday happen tomorrow?

This is heady stuff. My understanding of quarks and relativity is pretty limited. My preferred domain is that of poetry, not physics. Physicists tend to get irritated when poets attempt to turn mathematical formulations into metaphors. Nevertheless, the two domains share a similar appetite for knowledge: Why are we here? How does something come from nothing? How did the universe begin? Is there a supreme intelligence behind creation?

Physicists may be ill at ease when writers distort their precise mathematical constructions to illustrate a facet of metaphysical thought, but physicists themselves borrow heavily from literature. Murray Gell-Mann borrowed the word *quark* from James Joyce to name an elementary particle (the quark is one of two basic constituents of matter, the other being the lepton). But the poetry doesn't stop there. There are six different types of quarks, and physicists have chosen to describe them as *flavors*: up, down, charm, strange, top, and bottom. This isn't just poetry; this is enchantment.

What intrigues me the most about the current state of physics isn't this strange sortie into the realm of literature to find language for its formulations, but the quest itself for the fundamental nature of reality. How does one go about finding a solution to a metaphysical problem using empirical methods and expensive machinery? Wouldn't such methods be inherently flawed, doomed to flail about in blind alleys and dead ends, another huge waste of public funds and other resources? Did the universe pop out of a proton? Can God be discovered in a quark?

The Large Hadron Collider consists of 38,000 tons of equipment located approximately 300 feet below the earth. The complex lies about 10 miles west of Geneva. Portions of the tunnel pass under the Jura Mountains of France. This is some of the most beautiful country in the world, filled with luxurious wildflower meadows, craggy cascades, pine forests, and mossy rock walls dripping with delicate ferns. It was near here in the rainy summer of 1816 that Percy Bysshe Shelley and Lord Byron watched electric storms rage above the rocky summits and discussed Erasmus Darwin's galvanism experiments. Mary Shelley participated in these discussions, and she was especially intrigued by the prospect of reanimation. "Darwin . . . preserved a piece of vermicelli in a glass case," she wrote, "till by some extraordinary means it began to move with voluntary motion. . . . Perhaps a corpse would be re-animated; galvanism had given token of such things: perhaps the component parts of a creature might be manufactured, brought together, and endued with vital warmth." These speculations, of course, culminated in her novel *Frankenstein, or, the Modern Prometheus*, one of the world's first cautionary tales about the dangers of science unchecked by judicious or ethical concerns.

The goal of the Large Hadron Collider is no less Promethean than the ambitions of Victor Frankenstein: to find the God particle, a "massive scalar elementary particle" predicted to exist by the Standard Model of particle physics. Its discovery would help to explain how otherwise massless elementary particles cause matter to have mass. That is to say, the Higgs boson is a noun with a long string of adjectives. Adjectives, it must be said, that contradict one another. How can a particle be massive? If a particle is elementary, how can it also be hypothetical? One feels as disoriented as if one were in the realm of surrealist poetry or the Zen koan.

Mass is not what it seems. This is because we inhabit a world of weight, density, texture, and tangibility. The realities produced by calculus and differential equations make no sense to us, literally. Our perceptions are keyed to specific sensations. Roughness, weightiness, smoothness, sharpness, dullness. Foods are sweet or bitter or a combination of the two. Some things are warm and dry, others cold and wet. We cannot conceive of a reality not immersed in such responses. Not without faith in numbers. Trajectories and orbital mechanics. Energy and force. Momentum and inertia. Some of these are available to our senses. We all know what velocity feels like. But when someone tells us that there is more space in an ingot of steel than there is steel, we balk at the truthfulness of such a statement. We might readily agree, based on what we have learned in science. But it still seems beyond the reach of imagining. Because if there is more space than steel in an ingot of steel, what does that say about us? Are we ghosts? Clouds of atoms? Symphonies of molecules? Waves of light and radiant heat? All improbable, all incredible revelations. But the fact remains: a three-ton ingot of steel is mostly space. If an atom were the size of a 14-story building, the nucleus would be a grain of salt in the middle of the seventh floor.

Two instances come to mind: Dr. Samuel Johnson dismissing George Berkeley's ideas of immaterialism with his famous "I refute Berkeley thus," and then kicking a rock; and Jack Kerouac's address to an audience at the Hunter College Playhouse on November 6, 1958, during a symposium titled "Is There a Beat Generation?" It was there that Kerouac said, "We should be wondering tonight, 'Is there a world?' But I could go and talk on 5, 10, 20 minutes about is there a world, because there is really no world, cause sometimes I'm walkin' on the ground and I see right through the ground. And there is no world. And you'll find out."

Kerouac and Berkeley were right. Johnson's rock was essentially phantasmal, a cloud of subatomic particles. He was kicking a dream.

Quarks and leptons are considered to be the fundamental particles that constitute all matter. A quark is an elementary fermion particle that interacts via the strong force. Leptons are a family of fundamental subatomic particles, comprised of the electron, the muon, and the tauon (or tau particle), as well as their associated neutrinos (electron neutrino, muon neutrino, and tau neutrino). Leptons are spin-½ particles, and as such are fermions. In contrast to quarks, Leptons do not strongly interact.

The problem with these definitions, which I wicked from Wikipedia, is their circularity: one definition leads to another question and then to another definition. It is good that Wikipedia's definitions are hyperlinked, because the process of discovering what goes on in high-energy particle physics is unending. The result of these quests is a little knowledge, a tiny bit of insight, and a whole lot of dizziness and confusion.

All this becomes even more intriguing when one begins to question what is meant by *particle*. It is apparent that physicists are not referring to dust motes or grains of sand. Dust motes and sand do not have spin, probability waves, or flavors like up and down.

Or do they?

In the realm of particle physics, the word *particle* is a misnomer. What is actually being referred to is a probability pattern, an abstract mathematical quantity that is related to the probabilities of finding particles in various places and with various properties. A particle is never present at a definite place, nor is it absent. It occupies a realm of transcended opposites mathematically sandwiched between existence and nonexistence. One must learn to think outside the framework of classical logic.

Poets do this all the time. Charles Olson once referred to the poem as a "high energy construct." Words, feathered and smashed together, produce piquant contradictions: black light, civil disobedience, urban cowboy, act naturally, crash landing, jumbo shrimp, hollow point. One can easily imagine a poem as a word accelerator. A broth of verbal hardware bouncing through metaphysical problems like thunderous hues of afternoon reverie.

However charming this tangent might be, the fact is the Large Hadron Collider is neither a quatrain nor a sonnet. It is 38,000 tons of superconducting dipole magnets, blow valves, sleeper screws, bellow chambers, control racks, helium pipes, gauges, bus bars, flow meters, pumps, storage tanks, electrical sensors, and cryogenic fluids. All to answer the question: How does energy acquire mass?

Physicists hope that this perplexing problem will be answered by the Higgs boson—by smashing protons together at a velocity within a millionth of a percent of the speed of light. In essence, they will be re-creating conditions as they existed at the beginning of time, when the universe was an undifferentiated soup of matter and radiation, particles colliding rapidly with one another in a temperature of inconceivable strength, 100,000 million degrees Kelvin, too hot to sip from a tablespoon. Which doesn't really matter, as you would not be able to lift the spoon to your mouth: the mass density of the universe would be in the neighborhood of 3.8 thousand million kilograms per liter, or 3.8 thousand million times the density of water under normal terrestrial conditions.

If it exists, the Higgs boson will prove itself to be an essential and universal component of the material world. Hence, its nickname, God particle. The Higgs boson gives mass to other particles by causing them to cluster around it in much the same way a group of people may cluster around one another to hear a rumor or a bit of important news. Peter Higgs, for whom the particle is named, created a model in which particle masses arise from "fields" spread over space and time. In order to give particles mass, a background field (a Higgs field) is invented; it becomes locally distorted whenever a particle moves through it. The distortion—the clustering of the field around the particle—generates the particle's mass. Once the particle has mass, it interacts with other elementary particles, slowing them down and giving them mass as well. On the other hand, the Higgs boson may turn out to be a neat mathematical trick, a form of quantum legerdemain, in which the rabbit and hat are nothing more than a vertiginous mass of numbers, much like the numbers that appear in the movie *The Matrix* when Neo finally penetrates the illusory nature of his world.

But what about that black hole? When the LHC does fire up again, is there still a chance we may all disappear into a black hole? Will a diluted public healthcare option and a hyperinflated American dollar really matter? The answer may not be a flat-out absolute no (nothing in this universe is ever that certain), but it is extremely unlikely. For an LHC-style black hole, estimated to be only a billionth of a billionth of a meter across, the black hole would exist for a bit more than a few billion-billion-billionths of a second. I think I'd rather be witness to those strangelets, rogue fragments of strange matter converting Earth to miracles of gold and beatitude, the dream of the alchemists proclaimed in ingots of joy. But this isn't physics. It's just simple effervescence.

If the Higgs boson is confirmed, it will explain *how*, but not *why*, things exist. What is left out is our creative response to the things of this world, this universe, this dimension. Aristotle referred to matter as "stuff." Potential without actuality. It is *essence* that gives the potentiality of matter its ultimate design and purpose, its declamation and aspiration. Its character and value. Its genius, its gesture. The agitations that give it life. The intention behind it. Chopin, after all, is not just notes. Chopin is the glamour of yearning.

Each creative act we perform is a God particle. We are complicit in the creation of the universe. Matter without consciousness is raw ore. It is consciousness that smelts that ore into beams and bridges, enduring alloys that shine with an inner light.

What sort of laboratory would we need to fathom the mysteries of consciousness? How do we make sense of sense? Matter without thought is random matter, but thought without matter is as empty as a parking lot on Christmas Day. Our perceptions and memories give meaning to words, but the words themselves are representative of a higher order of being. They are the strange quarks of a giant quirk called Being.

Essence is an indissoluble kernel of inner principle, an inner grammar that gives shape and meaning to things. Anything in general, anything material, anything spiritual, anything living, is the product of a creative act on our part, our participation in its being. The discovery of a particle that allows energy to

acquire mass is intrinsically exciting, but what it implies is staggering. What it implies is process. What it implies is a universe that is in a continuous state of becoming. Not just expanding, but flowering, blossoming, revealing its mysteries to the pollination of our curiosity. Our involvement with it is immense; we stand at the end of a wharf gazing at the immensity of the horizon, knowing, in our deepest self, that the horizon is within as well as without.

It is more than a little coincidental that the fall of our financial institutions and the illusory nature of our wealth were revealed at approximately the same time as the Large Hadron Collider came online. Money, like language, like up, down, top, bottom, strange, and charmed flavors of quark, is a result of interactions, not fully realized realities. As long as we deepen and honor our experiences in this world with an audacious creativity and push our language to its utmost limits of possibility, we will keep those black holes and bankruptcies at bay. Language extends our ability to exist not merely because it envelops us, but because it is always in a state of potentiality. Reality may prove to be a probability pattern, but without anyone to perceive and give it value, it remains a pattern. It does not become a ship, an avocado, or a hand. It does not awaken. It does not shine.

An object that is visible to us is there with or without us. It does not require our eyes and ears, the touch of our hands, the warmth of our bodies. But without these things, without this involvement, it remains what it is in its barest sense: space, time, and probability patterns. A tendency to exist. It isn't so much that our involvement completes or fulfills its existence, but that we reciprocate its tendencies and so become more fully alive ourselves. And if that isn't a particle of godliness, I don't know what is.

Shylock, My Students, and Me

By Paula Marantz Cohen

I have been teaching literature for 30 years, and the longer I teach, the more I enjoy teaching Shakespeare. As I grow older and wearier, his plays seem to deliver greater matter and art in a more condensed and lively way than any other text I could choose. To be clichéd about it: Shakespeare offers more bang for the buck.

While Shakespeare now draws me more than ever before, one work in particular draws me most. This is *The Merchant of Venice*. For me, this extraordinary play grows increasingly subtle and supple with time. It continues to excite me with its language, its depth of character, and its philosophical, political, spiritual, and pedagogical implications. Looking back over my years of teaching the play, I see that the way it has been received by my students is an index to how our society has changed. I also see how much the play continues to push against established readings and to challenge even the most seemingly enlightened perspectives. *The Merchant of Venice* is both a mirror of our times and a means of transcending the bias of our times. It teaches how to teach.

My response to the play may be connected to the nature of my career in literature. I was exposed to highbrow literary criticism in the 1970s at elite undergraduate and graduate institutions. This was a time when multiculturalism was making inroads in academia but when progressive thinking coexisted with an ingrained snobbism regarding how literature should be taught and who should teach it.

This climate of snobbish virtue that I associate with my education came into direct conflict with the hardscrabble atmosphere of my first and only major teaching job. Drexel University in Philadelphia, where I was fortunate to be hired in a shrinking job market, was primarily a commuter school with a student body of first-generation college students when I began teaching there in 1982. It had, only a few years before, been an institute of technology, and it still focused its resources on its engineering students, mostly Italian, Irish, and Polish Americans from the area's parochial schools. (At the time, it was rumored that the university's president would play golf with the local archbishop whenever he wanted to increase enrollment.)

Teaching English at Drexel in the 1980s was a far cry from teaching it as a graduate student at Columbia. But still there were some strict requirements built into the curriculum—the sort of thing, ironically enough, that had begun to go by the wayside at more elite institutions. One of these was that we teach a Shakespeare play in our freshman writing course each year. Initially, I chose one of the "big" plays: *Hamlet*, *Othello*, *Macbeth*, or *King Lear*. But I soon realized that students had been exposed to these blockbusters, if only in cursory fashion, in high school, and thus brought preconceptions to their reading that were hard to shake. As a result, I started to choose plays that would be new to them: *Henry IV, Part I* and *The Winter's Tale* were especially successful, for reasons that would require another essay to explore. But *The Merchant of Venice* yielded the most interesting results.

Teaching the play during these early years was daunting. I was faced with students who had had years of Catholic school training, for whom Shylock was a familiar stereotype. It did not help that I was almost invariably the only Jewish person in the classroom and, as an inexperienced teacher, uncomfortable with how much or how little I should expose about myself and my background.

But for all its challenges, teaching the play was exciting. My students were responding to it in the way that Shakespeare's audience probably did: Shylock was the villain; Portia and Bassanio the romantic leads; Antonio (the merchant of the title) the noble, long-suffering friend. My students were quick to support the plea by Portia urging Shylock to embrace mercy over justice and give up his legal right to a pound of Antonio's flesh. It made complete sense to them: Shylock's malevolence was un-Christian; his

stubborn refusal to be moved by Portia's speech proof that he was incorrigible. In an effort to soften their feelings toward Shylock, I pointed them to the famous lines in Act III: "Hath not a Jew eyes? Hath not a Jew hands, organs, dimensions, senses, affections, passions?" They acknowledged the point: Shylock was, admittedly, a human being. And they were susceptible to the argument that followed:

. . . if you wrong us [Jews], shall we not revenge? If we are like you in the rest, we will resemble you in that. If a Jew wrong a Christian, what is his humility? Revenge. If a Christian wrong a Jew, what should his sufferance be by Christian example? Why, revenge. The villainy you teach me, I will execute; and it shall go hard but I will better the instruction.

But this passage, which helped them to a better understanding of Shylock's behavior, made me uneasy. It suggested that Jews need to take their cue from "Christian example." My students found that this conformed to the maxim of their religious education: "Whatsoever a man soweth, that shall he also reap" (a principle, some of them explained, that Paul preaches in Galatians), while for me it was an argument that obliquely diminished the autonomous humanity of the Jewish character and thus fed latent anti-Semitism.

In short, for my students at the time, Shylock was unsavory, brutal, and ultimately inhumane. They could comprehend him up to a point, but they continued to insist that he was the villain, and that to say otherwise would be to twist Shakespeare's intention. I knew they were not entirely wrong—but also that their response was, in part, a cover for prejudice. I came away from teaching the play with a sense of incompleteness and unease. In the best instances, my students seemed to feel the same way, which meant that they were potentially open to seeing the world differently, if not then, at some point in the future.

That future came about 15 years later. The change was partially the result of changing demographics in my classroom. Drexel had hired a visionary new president, and the school had expanded its mission, recruiting "better" students—meaning students with higher SAT scores, which translated into students from more affluent socioeconomic backgrounds. As a corollary to this, the university extended its reach. We now began to enroll students from all over the country and even the world, and the result was more diversity: Indians, Chinese, and Russians, as well as people from other ethnicities, including a good share of African Americans and Jews. The university looked different, and the viewpoints in the classroom reflected this.

But if Drexel had changed, so had the society around it. The students who had attended parochial schools were now versed in multiculturalism. They'd celebrated Martin Luther King Day, gone to the Holocaust Museum in Washington, and considered the plight of Native Americans on Columbus Day. The trials and tribulations of otherness had filtered down to them through movies, television, and music. They'd also become sensitized to otherness in themselves, whether in the form of a learning disability, a drug problem, or some more ineffable issue that made them feel different.

In this new, more diverse and introspective atmosphere, the discussion of *The Merchant of Venice* began to take an entirely different turn. Before, I had had to force myself to teach the play, knowing that it would involve struggling with my students' prejudices. Now, my students began to make my job easy, saving me from apologizing for Shylock by immediately siding with him. They seemed to understand how Shylock felt. The passage that had been so central to my teaching of the play before—"Hath not a Jew eyes?"—hardly needed to be discussed. It seemed a truism.

These students were now put off rather than convinced by Portia's speech calling for mercy. There was invariably a hoot of disbelief when she ended her plea with the conclusion: "Therefore, Jew, / Though justice be thy plea, consider this, / That, in the course of justice, none of us / Should see salvation." They were outraged by the lack of respect expressed in her generic reference to "Jew" and her assumption that Shylock shared her belief system, her idea of "salvation."

The lines that particularly inspired my students' sympathy for Shylock now were those in Act I, when he is asked to lend money to the merchant Antonio. This is where he spells out his resentment for the treatment he has suffered in the past:

Signior Antonio, many a time and oft
In the Rialto you have rated me
About my moneys and my usances.
Still have I borne it with a patient shrug;
For sufferance is the badge of all our tribe.
You call me misbeliever, cut-throat dog,
And spit upon my Jewish garberdine,
And all for use of that which is mine own.
Well then, it now appears you need my help:
Go to, then, you come to me, and you say
"Shylock, we would have moneys." You say so,
You, that did void your rheum upon my beard,
And foot me as you spurn a stranger cur
Over your threshold. Moneys is your suit.
What should I say to you? Should I not say
"Hath a dog money? Is it possible
A cur can lend three thousand ducats"? or
Shall I bend low, and in a bondman's key,
With bated breath and whispering humbleness,
Say this:
"Fair sir, you spit on me on Wednesday last;
You spurned me such a day; another time
You called me dog; and for these courtesies
I'll lend you thus much moneys"?

It is difficult for me to relay the sort of response this speech now evoked from my students. They heard Shylock's voice in these lines—and it was their own. I was shocked to see the number of students who claimed to have been treated like a "stranger cur"—-a dog. The well of resentment here, often going back to grade-school bullying, was deep and abiding for these 18- and 19-year-olds. I was initially mystified by their reaction. Why, as schools had become more adept at teaching cultural sensitivity, did students still manage not only to suffer ostracism but also to feel its effects so palpably? This might lead to the conclusion that teaching sensitivity is not useful, that it may, indeed, be harmful. My eventual view, however, was different. I concluded that in the past the pain of ostracism and alienation went unacknowledged; people pretended they didn't feel hurt because they didn't want to show weakness. Now, they had gained a voice and a vocabulary with which to express their feelings.

What was clear was that these students felt sympathy for Shylock—and more than that, they identified with him to the point that they supported his case. And here is where things began to get complicated. Because now the most powerful speech in the play, according to my students, was Shylock's in Act IV, scene I, that deals first with the hypocrisy of his antagonists and then with the justice of his claim:

What judgement shall I dread, doing no wrong?
You have among you many a purchased slave,
Which, like your asses and your dogs and mules
You use in abject and in slavish parts,
Because you bought them. Shall I say to you,
Let them be free, marry them to your heirs?
Why sweat they under burthens? Let their beds
Be made as soft as yours, and let their palates
Be seasoned with such viands? You will answer
"The slaves are ours": so do I answer you:

The pound of flesh, which I demand of him,
Is dearly bought. 'Tis mine and I will have it.
If you deny me, fie upon your law!

The realization by my students that this was a slave-owning society opened the play to another level of dismay. They now began to look upon the so-called heroes—Bassanio, Portia, and Antonio—as world-class hypocrites. How dare these characters accuse Shylock of inhumanity when they owned slaves? Even as they expressed outrage at this, they also embraced the other aspect of Shylock's argument here: his right to his pound of flesh. In short, they argued for his right to kill Antonio as a matter of simple justice.

It became clear to me that my current students were hardening into positions in reverse of what my former students had felt, and that, in some ways, their views were equally limited—and maybe even scarier. For all their sensitivity, these students missed what the earlier students, despite their ingrained prejudices, had grasped: that justice according to the law is a human construction and thus subject to human manipulation. One need not be Christian or even a believer to see this. The play demonstrates that justice is manipulable when Portia uses the very law that Shylock has invoked on his own behalf to strip him of his wealth and his religion. Trusting to legal justice, the play teaches, can only take one so far, and may very well result in flagrant injustice.

Moreover, the tendency of my current students to reverse the judgment of earlier readers and viewers of the play struck me as disturbing. Now, Shylock became the heroic central figure, and the other characters became villains: Bassanio weak and opportunistic; Antonio passive and creepy; Portia mean.

The initial notion that my job had become easy, since I no longer had to defend Shylock, began to change as I realized that the all-encompassing, reflexive sympathy my students felt for him was perhaps even more insidiously wrong than the earlier prejudice toward him. In an odd reversal, I, the Jewish teacher, now became the only person in the classroom to argue that Shylock was still a villain, despite the abuse he had suffered, and that his stubborn call for a pound of flesh was the emblem of his villainy.

Teaching the play in recent years, I also began concentrating discussion on Portia and Antonio. Was Portia's subjection to her dead father's will and her need to dress as a man in order to argue the case connected to her "meanness"—her stripping Shylock of his money and forcing him to convert? As for Antonio, what was to be construed from his confused feelings at the beginning of the play?

In sooth, I know not why I am so sad:
It wearies me; you say it wearies you;
But how I caught it, found it, or came by it,
What stuff 'tis made of, whereof it is born,
I am to learn;
And such a want-wit sadness makes of me,
That I have much ado to know myself.

My students generally deduced that Antonio was "in love" with Bassanio. But what to make of the fact that he was no more able to acknowledge his homosexuality as a character than Shakespeare could spell out his problem in writing the play? What kind of alienation and loneliness, what kind of morbid depression, might ensue from this sort of profound silencing? Like my earlier students, who drew a line regarding their sympathy for Shylock, my students now did the same with regard to these characters. They could see my argument only up to a point. They refused to equate the difficulties facing people of wealth and position with the hardships facing a social pariah like Shylock. But wasn't the silencing of Portia and Antonio as likely to result in their "acting out" and behaving cruelly to people who existed more explicitly on the margins than themselves? (These characters resembled, it occurred to me, my students from years before, who had shown no sympathy for Shylock in part because they were not prepared—or allowed—to acknowledge their own weakness or alienation.) As I saw it, Portia had diagnosed her own condition in Act I: "It is a good divine that follows his own instructions: I can easier teach twenty what were good to be done, than to be one of the twenty to follow mine own teaching." But

my students found this statement lame and disingenuous. They couldn't excuse her intolerance, and believed they would never be so blind—even as their intolerance toward her belied this.

Nonetheless, the question of how those who have been abused can become abusers themselves sparked animated discussion. Students were able to discern the repetition of destructive behavior in families, and some students also proceeded to draw parallels between Shylock and the government of Israel—the children of persecution becoming persecutors in their own right. The latter comparison—that struck me as both upsetting and insightful—never occurred to my students 25 years ago, both because their view of Shylock was too uninflected to permit it and because the political situation in the Middle East had not developed (or been explored) to a point where that reading was possible.

In the end, I found myself urging students to consider the play's concluding structure. Bassanio and Portia are united happily; Shylock has been purged; Antonio, spared death, remains on the margins. Are we to ignore this ending and replace it with our own psychologically enlightened viewpoint? Is it valid to read beyond the text and project, for example, an unhappy marriage for Bassanio and Portia, a suicide for Antonio, and a new plot for revenge from the even more wronged Shylock—a terrorist in the making, if there ever was one?

Some students were adamant in saying that such speculation is encouraged in the text. Others, that the ending simply reflects Shakespeare's need to pander to his audience and their prejudices. My own position is that, if we want a happy ending, at some point we must draw a line and close our eyes to the injustices that it entails. We must accept accommodation to oppression and, in some cases, to evil itself. A happy ending is only an approximate good, pointing beyond itself to a time when happy endings will be happy for all the deserving, and evil will be fully recognized and purged. My students in the old days would have called this The Last Judgment. My students today are likely to call it wishful thinking.

Exolanguage: do you speak alien?

- 20 January 2010 by **Stephen Battersby**

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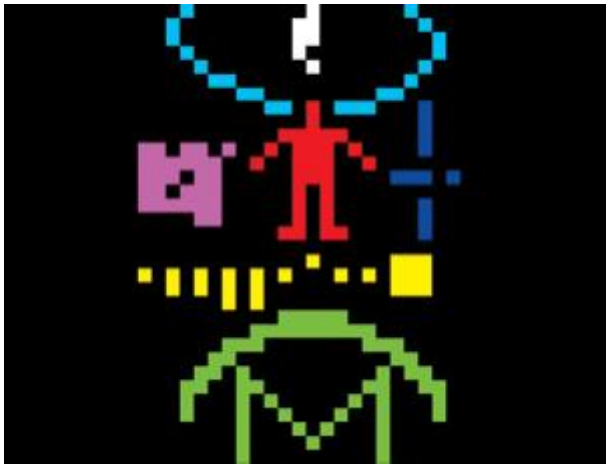

It's hard enough for a human to decipher, let alone an alien (Image: SPL)

THE cosmos is quiet. Eerily quiet. After decades of straining our radio ears for a whisper of civilisations beyond Earth, we have heard nothing. No reassuring message of universal peace. No helpful recipe for building faster-than-light spacecraft or for averting global catastrophes. Not even a stray interstellar advertisement.

Perhaps there's nobody out there after all. Or perhaps it's just early days in the search for extraterrestrial intelligence (SETI), and we're listening to the wrong star systems or at the wrong wavelengths.

There is another possibility, says Douglas Vakoch, head of the Interstellar Message Composition programme at the SETI Institute in Mountain View, California, which ponders the question of how we should communicate with aliens. "Maybe everyone's listening but no one is transmitting. Maybe it takes an audacious young civilisation like ours to do that."

So should we start sending messages into the void? And if so, how can we make ourselves understood to beings we know nothing about?

One astronomer has already stepped up to the challenge. Alexander Zaitsev at the Russian Academy of Science's Institute of Radio Engineering and Electronics in Moscow has sent four interstellar messages since 1999, each beamed to no more than a handful of nearby sun-like stars. Zaitsev's efforts are pretty small scale, however, and so far his group is more or less alone except for some low-power operations offering to send your message to the stars for a fee.

That could be about to change. Perhaps bored with spending so long hearing nothing, the wider SETI community is starting to consider a more active approach. They will get together to discuss whether to go for it at a meeting in April in League City, Texas. Vakoch, who will chair these sessions, is all in favour. "I have long held the position that after broad-based international consultation, we should be doing active SETI," he says.

It's an approach that worries ex-astronomer and science fiction author David Brin, who was a member of the International Academy of Astronautics SETI panel until 2006. He resigned when the committee backtracked on the wording of a protocol that called for discussion before deliberately broadcasting into

space. "I dislike seeing my children's destiny being gambled with by a couple of dozen arrogant people who cling to one image of the alien," says Brin. Since then three other members have quit for similar reasons. Vakoch has some sympathy with Brin's point of view. "These issues are much too important and too complex to be resolved after only a few days of discussion."

If the enthusiasts for active SETI get their way and there is a real effort to send a message, the next question is: what should we say?

Some early attempts to communicate with aliens - including the plaques attached to NASA's Pioneer 10 and 11 spacecraft, and the phonograph records on the Voyager probes - were really only symbolic efforts. More likely to be received one day is the powerful radio broadcast devised by SETI pioneer Frank Drake and sent from the Arecibo telescope in Puerto Rico in 1974. We have a long wait for contact if we rely on this, though: the message won't reach the distant star cluster it was aimed at, M13, for 25,000 years. It was also a very brief message, containing only 210 bytes of information.

"These are greeting cards," says Seth Shostak, who is a senior astronomer at the SETI Institute. "It is nice to get a greeting card, but hard to decipher if it's in a language you don't understand, because the amount of material is so limited."

Interstellar geek speak

Although the Arecibo message is cunningly constructed, it is difficult even for a human to understand. The signal contains a series of 1679 bits, a number chosen as it is equal to the product of two prime numbers - 23 and 73. The hope is this will prompt an acute alien recipient to arrange the 1s and 0s into a 23-by-73 rectangle. Doing so reveals a rather complicated picture, which is supposed to give some basic information about our chemical and biological make-up, our civilisation and the solar system (see illustration).

To me it looks a bit like a small person with a big head, four eyes and eight bushy eyebrows. So the only bit I've got right is the "person", and there I had a big advantage. "It is much worse if you don't have lot of context, if you don't even know about *Homo sapiens*," says Shostak.

So where might we find some common ground with ET? Perhaps in mathematics. This idea goes back about three centuries, when it was suggested that we could hail beings on the moon by cutting a diagram of Pythagoras's theorem into the forests of Siberia.

In 1960, Dutch mathematician Hans Freudenthal proposed an interspecies language called Lincos that starts with simple mathematical statements - a series of beeps to represent 1 + 1 = 2 for example. It then uses these to define logical relationships, eventually building up to more complex concepts of time and space.

More recently in the 1990s, mathematician Carl DeVito and linguist Robert Oehrle, both then at the University of Arizona in Tucson, made an attempt to speed up this process by assuming that respondents have some knowledge of physical concepts. In DeVito's scheme, once some mathematical and logical symbols have been defined, we would launch into a description of the periodic table, and then discuss energy in terms of specific heats of the elements and so on. They argue that any civilisation capable of receiving our radio signals must have some knowledge of physics to build radio receivers.

While interstellar geek-speak might be fine for sending details of your solar system and the latest technology, it's not so easy to move on to more abstract ideas, such as human nature and culture. How would you convey a simple sentiment like "we come in peace"?

How do you convey a simple sentiment like 'we come in peace' to an alien species?

"It seems that sooner or later one must fall back on pictures," says DeVito. Images might be the only way to convey to an alien what we're talking about, and to show them what our world is like. They wouldn't need to have vision like ours, merely some way to understand spatial patterns in at least two dimensions. Then they could attach symbols to meanings, like a child with a picture book.

And we can do better than "cows go moo". Paolo Musso, a philosopher at the Pontifical Urbaniana University in Rome, Italy, has outlined one way to combine mathematics and images to tell a moral tale using the process of analogy. First, arithmetic is used to establish signals that mean right and wrong, defined by sums that are right and wrong. These can then be applied to cartoons showing what we consider to be good and bad actions.

Many of these approaches start with counting, but what if the slimy ones don't have our concept of arithmetic? "There is no guarantee that if ETs have mathematics it will be commensurable with ours," says Vakoch. He and others have instead suggested a more creative channel of communication: sending examples of our culture. It is possible, Vakoch says, that aliens will develop a taste for Toulouse-Lautrec paintings or Meade Lux Lewis boogie-woogie numbers, and then we will have done something worthwhile. In 2008 NASA transmitted a song by The Beatles at the star Polaris, while artist Joe Davis has aimed other sounds and messages at two nearby stars.

Zaitsev's longer messages - Cosmic Call 1 and 2, and Teen Age Message - combine several of these ideas. Each message consists of a beam of radio waves sent from the Evpatoria radio telescope in southern Ukraine, which encoded each bit of information by shifting the transmission frequency slightly up or down. A bit can represent a black or white square, and a number of them can be built up pixel by pixel into a series of pictures like the original Arecibo message. Some of them form a rather sketchy "bilingual image glossary" - a dozen hand drawings meant to show concepts including people, family, nature and games, with English and Russian words attached. Zaitsev has also included an excerpt of theremin music to soothe, or perhaps irritate, alien listeners.

Give them porn

But the main content was a series of 127-by-127 pixel images forming the "interstellar Rosetta Stone", developed by astronomers Yvan Dutil and Stephane Dumas from Defence Research and Development Canada in Valcartier, Quebec. Like Freudenthal's and DeVito's approaches, the images start with arithmetic and build from there. They also include graphs to illustrate physics, as well as sketches of the solar system, Earth's topography and the man and woman from the Pioneer plaque.

As well as these complex signals, Zaitsev has transmitted a more lightweight message. In "A message from Earth", sent in 2008, contributions from users of social networking site Bebo were directed at a single planetary system around the star Gliese 581. If anyone there is listening, they can expect to receive it in 2029 - followed by 26,000 unsolicited text messages collected by *Cosmos* magazine and transmitted last year. At 50 to 60 kilobytes, there is more information in the Cosmic Calls than in the Arecibo message, giving alien cryptologists and linguists something to work with. To give them a helping hand, a lot of what has been sent is redundant.

"Redundancy really helps," says Shostak, as it allows a recipient to make a guess about the meaning and then check it, like in a crossword. He suspects that all the polite efforts to be understood might be unnecessary. "A lot of people wonder what we should send. Music, mathematics or pictures? My first thought is it probably doesn't matter," he says.

Instead, Shostak suggests that we just gabble. "My conclusion is that you would just send them the Google servers. That's an enormous amount of information, much of it redundant and pictographic. Much of it is pornographic too, but I expect they could handle that." (Although it raises questions like, can Earth handle a trillion orders for Viagra?)

According to Shostak's calculations, sending so much stuff becomes practical if we assume that ET is very good at listening and has the technology to pick up a faint, rapidly changing signal against the background noise of the galaxy. If they have truly vast radio dishes, then we can send them encyclopedias and even libraries in a sensible amount of time.

Shostak also points out that an interstellar message is quite likely to be a one-way deal: it may not even reach its destination until long after our civilisation has ended. So as this is probably the only chance of telling an alien world about humanity, we might as well say as much as we can.

Of course, it would be much better if we could actually chat, as this would allow us to gradually teach each other our languages and histories. But interstellar distances make that nigh on impossible unless we can somehow send a representative.

Sociologist William Bainbridge of George Mason University in Fairfax, Virginia, is trying to develop avatars, human personalities encoded in software. If he succeeds, we could send one into deep space, perhaps programmed into an interstellar probe. Or if we can find a way to tell receivers how our software works, we could even send avatars to them via a radio beam.

Whatever we decide, the next problem is where to aim our message. Broadcasting loudly to the whole sky would use ludicrous amounts of power, far beyond our capabilities today. Instead, active SETI would target promising star systems. A sun-like star is a start; planets are better. Space telescopes such as Kepler should be able to detect planets that are Earth-size, and future telescopes should eventually be able to pick out those with liquid water on the surface and oxygen in their atmospheres.

This still might not be a well-targeted address list, however, because civilisations may be very thinly spread. "Even if you found a list of 10,000 Earth-like worlds, that might not be good enough," says Shostak. "We've had biology for 4 billion years, and radio telescopes for 40 years; that's 1 in 100 million." If the technological window for aliens is as short as ours then we might have to transmit to 100 million Earths before anyone hears us.

For practical reasons, Shostak thinks we should wait and listen. "The bottom line is that for the foreseeable future, the only decent targets are people that have contacted you. Let them do the heavy lifting."

In the meantime, planning our own message could help to focus the minds of SETI experts on what kind of communication we should be looking out for. If Earth's efforts are anything to go by, we can expect a basic maths lesson and some pictures of naked aliens.

http://www.newscientist.com/article/mg20527441.300-exolanguage-do-you-speak-alien.html?DCMP=NLC-nletter&nsref=mg20527441.300

The face of first contact: What aliens look like

- 20 January 2010 by **Stephen Battersby**
- Magazine issue 2744

TENTACLED monsters, pale skinny humanoids, shimmery beings of pure energy... When it comes to the question of what alien life forms might look like, we are free to let our imagination roam. The science-in-waiting of extraterrestrial anatomy has yet to acquire its first piece of data, so nobody knows what features we will behold if and when humans and aliens come face-to-face. Or face to squirmy something.

Despite this lack of hard evidence, a blend of astronomy and earthly biology offers some clues to what is out there. A few bold scientists are even willing to make an educated guess at the nature of aliens that might exist on faraway worlds.

What these extraterrestrials will be like depends on where and how we expect to meet them. Barring the appearance of flying saucers, there are two broad possibilities: either we have a close encounter with our neighbours by visiting the planets and moons next door; or we make an interstellar phone call to creatures inhabiting much more distant planets that circle alien suns. These two options have different implications for the shape of what we find living there.

What extraterrestrials will look like depends on where and how we meet them

If first contact turns out to be within our solar system, then at least we have some prior knowledge about the available habitats. Several spots might be suitable for Earth-like life based on carbon biochemistry and using water as a solvent. The subsoil of Mars may be warm enough to host microbes akin to Earth's bacteria, for example, and there could be larger beasts swimming in the watery oceans of some outer moons of the solar system - especially Jupiter's moon Europa. There's every chance that a deep aquatic ocean lies beneath Europa's ice, stretching right down to the moon's rock core, where volcanic vents pump out hot, nutrient-rich water.

Astrobiologist Dirk Schulze-Makuch of Washington State University in Pullman calculates that the energy supplied by these vents could feed a large population of microbes, which in turn could support a pyramid of predators. Europa's top predator, the equivalent of our great white shark, would be a fearsome creature with a mass of - wait for it - about 1 gram. "Europa could support a shrimp-sized organism," he says. There would not be enough prey to feed a viable population of predators bigger than that.

Shrimp-sized doesn't have to mean shrimp-shaped, of course. "It is kind of difficult to say anything about how it would look," says Schulze-Makuch. Even on Earth animals have evolved an astonishing diversity of shapes and body plans, but Schulze-Makuch is nevertheless prepared to speculate. "I would make a guess at something worm-like," he says. "That is a pretty successful kind of organism on Earth."

While the hypothetical ice worm of Europa would be swimming about in boring old water, a few astrobiologists are pushing the boat out and pondering the possibility of life that is not water-based. Most places in the solar system are too hot or too cold for liquid water to exist, but there are several other liquids that might host some kind of biochemistry, says Steven Benner of the Foundation for Applied Molecular Evolution in Gainesville, Florida.

The clouds of Venus hold droplets of sulphuric acid, and billions of years ago there may have been pools of the stuff on the planet's surface. Though pretty destructive to bags of water like ourselves, it could be a refreshing draught for beings with the right biochemistry. These acid-dwellers would have to be formed of chemically resistant materials. "Multicellular Venusians living in liquid sulphuric acid could have veins made of glass," Benner suggests, conjuring up visions of delicate, transparent glassware creatures, rolling carefully over the Venusian rocks. But glass is not the only option: more mechanically robust

materials would also fit the bill. "There are flexible polymers that are acid-stable, such as Teflon, polyethylene and silicone," Benner points out.

Elsewhere in our solar system, surface lakes and seas exist to this day - though not watery ones. On Saturn's moon Titan, they are formed from a chilled hydrocarbon cocktail of ethane and methane, and Schulze-Makuch speculates about what forms of life they might harbour. "Things might be bigger," is his unexpected conclusion. "Water has a high surface tension, which constrains the volume of single cells. That's why bacteria on Earth are so small." The surface tension in a methane-ethane blend is much lower, so single cells could be enormous, a possibility that Schulze-Makuch has explored in his novel *Voids of Eternity*. "I have boulder-sized microbes moving over the surface and guzzling up hydrocarbons," he says. "That is science fiction of course, but there may be something in it."

In our eyes, the Titanians might seem pretty laid back. At around 93 kelvin, Titan's seas are very cold and that makes chemical reactions super slow. "Things could be very slow-moving and slow-growing," says Schulze-Makuch. "The lifetime of such an organism may be 10,000 years, or perhaps as much as a million."

Who's there?

As strange and marvellous as it would be to encounter these beasts, they are probably not going to be very interesting to talk to. For aliens on our intellectual level - or indeed far above it - we will almost certainly need to look beyond the limits of our own solar system. In the search for extraterrestrial intelligence, a few astronomers have been straining Earth's radio ears for the sound of alien transmissions. SETI researchers are now debating whether to become more proactive and start sending out messages (see "We're over here!"). If we do make contact, what kind of creature is going to be on the other end of the line?

Even without knowing the details of their chemistry or habitat, it is possible to hazard a few guesses. For a start, they may have a taste for flesh. "Predators tend to be more intelligent," says evolutionary biologist Lynn Rothschild of NASA's Ames Research Center in Moffett Field, California. "They have to do more moving around to outsmart the other guy. You don't have to be terribly intelligent to grab a leaf of lettuce." If that applies to alien ecosystems, we can expect to be talking to carnivores - or at least omnivores like ourselves.

And then there is the fact that in order to contact us, ET must be able to send and receive radio waves or laser beams, or use some other medium to reach across the light years. So either they are vast creatures that have evolved natural radio-wave organs to talk and listen to each other, or they have developed technology. For that, intelligence alone is not enough. "The thing that advances us as a species is that we are social," says Schulze-Makuch. "One of us alone is not very smart - I'm so dumb I can't even build a radio. It is by working together that we got on the moon."

So message-sending aliens will probably have some form of society. It need not be anything like human societies, however. "There are meta-intelligences in the societies of bees and termites. I can imagine something like a termite or ant colony that gets really intelligent," says Schulze-Makuch. This does not tell us, however, whether they will be furry, scaly or slimy. Even on Earth, clever brains come in a wide variety of packages: dolphins and primates, parrots and crows, sea otters, honey badgers, octopuses and squid.

The principle of convergent evolution could give us some ideas, though. "Some things have evolved many times on Earth such as hearts, eyes and jointed limbs, and the four "F"s - flight, fur, photosynthesis and sex," says Jack Cohen, a reproductive biologist who has helped science fiction authors design plausible aliens for their books. "They happened independently in different branches of the tree of life. If you ran Earth again from the start, you'd likely get these again."

So if our aliens come from a planet with a range of habitats not too different from those on Earth, they might well have some of the same characteristics. A well-lit world like ours would probably produce beings with eyes - so maybe a recognisable face after all. And our cosmic correspondents would presumably need some manipulating organs to fiddle with the nuts and bolts of their technology. They might even have hands, but then again why not a prehensile tail or a trunk instead? "Maybe it's an antenna, maybe a tentacle," says Rothschild. "Maybe an octopus would look at us and think 'How can you expect this organism to develop technology with its two clumsy front limbs?'"

Whether such creatures would be aquatic, like Earth's octopoids, is questionable, however. Much of our technological development, from curing meat to smelting metal, is based on fire, and learning to use fire is likely to prove an insurmountable obstacle even for very clever water dwellers. Far better for the talented, tentacled monsters to slither onto land before building their interplanetary empire.

Putting it all together, the daring astrobiologist might be prepared to make a very small bet that SETI-type aliens will be social multicellular predators with eyes, sexes, and sticky-out bits of some sort. Unless, of course, the aliens were usurped by smart machines or decided to modify themselves using biotechnology. In that case, we might find tentacled monsters, pale skinny humanoids, shimmery beings of pure energy...

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http://www.newscientist.com/article/mg20527441.400-the-face-of-first-contact-what-aliens-look-like.html

How the US exports its mental illnesses

- 20 January 2010 by **Ethan Watters**

Magazine issue 2744.

Psychological reactions to war trauma in Afghanistan are experienced differently to western diagnosis (Image: Paula Bronstein/Getty)

IN THIS age of globalisation, you would expect people to value and be sensitive about their local differences and diversity. And few areas could be more critical than different peoples' understanding of the human mind when it comes to mental health and illness.

For example, a Nigerian man might experience a culturally distinct form of depression by describing a "peppery" feeling in his head, while a Chinese farmer might speak only of shoulder or stomach aches. Salvadorean women refugees suffering psychological trauma after a long civil war, on the other hand, often experience something called *calorias*, a feeling of intense body heat.

For a long time, psychiatrists and medical anthropologists studying mental illness in different cultures found that mental illnesses are not evenly distributed globally, and do not take the same form from place to place. Unfortunately, mental health professionals in the US, who dominate the global discussion about how mental illnesses are categorised and treated, have often ignored or dismissed these differences.

Worse, local versions of mental illnesses are now being homogenised into American versions at an extraordinary rate. This is why I wrote *Crazy Like Us*, in which I explore the spread of four illnesses: post-traumatic stress disorder, anorexia, schizophrenia and depression. In this essay, I concentrate on two western forms of mental illness - depression and PTSD - which are spreading around the world with the speed of a contagious disease, bulldozing indigenous forms of mental illness as they go.

Two powerful but different forces are driving this. The diagnosis of PTSD is being spread by roving bands of western trauma counsellors who set up psychological first aid centres after wars and natural disasters. And our western conception of depression is being promoted by multinational drug companies who profit mightily when other cultures adopt the idea and then buy their antidepressants.

Laurence Kirmayer, director of the division of social and transcultural psychiatry at McGill University in Montreal, Canada, had a front-row seat as GlaxoSmithKline launched its antidepressant paroxetine (marketed as Paxil/Seroxat) in Japan in 2000. Kirmayer, an authority on the impact of cultural beliefs on mental illness, had been invited to a GSK-sponsored academic conference in Japan. It was only when he

arrived that he realised the true agenda: the company wanted his knowledge to help it understand how cultural beliefs about illness can be changed.

"The clinical presentation of depression and anxiety is a function not only of patients' ethnocultural backgrounds, but of the structure of the healthcare system they find themselves in and the diagnostic categories and concepts they encounter in mass media and in dialogue with family, friends and clinicians," Kirmayer wrote later in *The Journal of Clinical Psychiatry*. In a globalising world, all of these factors are in "constant transaction and transformation across boundaries of race, culture, class, and nation". In other words, cultural beliefs about depression and the self are malleable and responsive to messages exported from one culture to another.

The challenge GSK faced in the Japanese market was formidable. The nation did have a clinical diagnosis of depression - *utsubyo* - but it was nothing like the US version: it described an illness as devastating and as stigmatising as schizophrenia. Worse, at least for the sales prospects of antidepressants in Japan, it was rare. Most other states of melancholy were not considered illnesses in Japan. Indeed, the experience of prolonged, deep sadness was often considered to be a *jibyo*, a personal hardship that builds character. To make paroxetine a hit, it would not be enough to corner the small market for people diagnosed with *utsubyo*. As Kirmayer realised, GSK intended to influence the Japanese understanding of sadness and depression at the deepest level.

"What I was witnessing was a multinational pharmaceutical corporation working hard to redefine narratives about mental health," Kirmayer said. "These changes have far-reaching effects, informing the cultural conceptions of personhood and how people conduct their everyday lives. And this is happening on a global scale. These companies are upending long-held cultural beliefs about the meaning of illness and healing."

Which is exactly what GSK appears to have accomplished. Promoting depression as a *kokoro no kaze* - "a cold of the soul" - GSK managed to popularise the diagnosis. In the first year on the market, sales of paroxetine in Japan brought in $100 million. By 2005, they were approaching $350 million and rising quickly.

Giving depression stiff competition is the PTSD diagnosis. It has only been "official" since 1980, when it entered the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders*, but it has had a meteoric rise. Western counsellors now use it worldwide after natural disasters, wars and genocides. According to Allan Young, a medical anthropologist at McGill, the spread of PTSD as a diagnosis worldwide may be the "greatest success story of globalisation".

Globalisation's greatest success story may be the spread of PTSD diagnosis

In our rush to treat the psychic wounds of traumatised people, we seldom ask if PTSD can be usefully applied everywhere. "The meaning of a horrible event has a tremendous impact on the human psyche, and that meaning differs across the world. The meaning matters as much as the event," says Ken Miller, a psychologist at Pomona College, Claremont, California, who studied in Afghanistan and elsewhere the reactions to war trauma.

He found many psychological reactions that were not on any western PTSD symptom list, and a few with no ready translation into English. In Afghanistan, for example, there was *asabi*, a type of nervous anger, and *fishar-e-bala*, the sensation of agitation or pressure.

Giathra Fernando, a psychologist at California State University, Los Angeles, also found culturally distinct psychological reactions to trauma in post-tsunami Sri Lanka. By and large, Sri Lankans didn't report pathological reactions in line with the internal states making up most of the west's PTSD checklist (hyperarousal, emotional numbing and the like). Rather, they tended to see the negative consequences of tragic events in terms of damage to social relationships. Fernando's research showed the people who

continued to suffer were those who had become isolated from their social network or who were not fulfilling their role in kinship groups. Thus Sri Lankans conceived the tsunami damage as occurring not inside their minds but outside, in the social environment.

Many researchers who found culturally distinct expressions of trauma worry whether counsellors can be effective if they don't know the local idioms of distress. Arthur Kleinman, a medical anthropologist at Harvard University, says that although most disasters do not occur in the west, "we come in and pathologise their reactions. We say 'you don't know how to live with this situation'. We take their cultural narratives and impose ours. It's a terrible example of dehumanising people."

Depression and PTSD aren't just symptom lists. Just as hysteria was a quintessential disorder of the Victorian era, so PTSD and depression speak volumes about how the US and the west conceive of the self. They contain assumptions about the events that will damage the human mind and where the line lies between normal psychological states and pathological ones. They go far beyond describing disorders with a symptom cluster: with them, we are exporting a world view.

Profile

Ethan Watters is a journalist who writes on social trends for publications that include *Wired* and *The New York Times Magazine*. His books include *Urban Tribes*. This essay is based on his latest book, *Crazy Like Us: The globalization of the American psyche* (Free Press/Simon and Schuster)

http://www.newscientist.com/article/mg20527441.200-how-the-us-exports-its-mental-illnesses.html

Brain asymmetry eases hypnotic trance

- 20 January 2010 by **Linda Geddes**

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Let the artistic side take over (Image: Rick Raymond/Getty)

IF HYPNOSIS leaves you unmoved, blame the wiring in your brain. It seems those who find it easier to fall into a trance are more likely to have an imbalance in the efficiency of their brain's two hemispheres. The finding backs hotly disputed claims of a biological basis for hypnosis.

Around 15 per cent of people are thought to be extremely susceptible to hypnosis, while another 10 per cent are almost impossible to hypnotise. The rest of us fall somewhere in between.

Sceptics argue that rather than being in a genuine trance, some of us are simply more suggestible and therefore more likely to act the part. However, recent studies have hinted that during hypnosis, there is less connectivity between different regions, and less activity in the rational, left side of the brain, and more in the artistic right side. Such findings suggest hypnosis is more than acting.

To see if there are also differences between the brains of susceptible and unresponsive volunteers when they were awake, Peter Naish of the Open University in Milton Keynes, UK, used a standard test of hypnotic susceptibility, that combines motor and cognitive tasks, to identify 10 volunteers of each type. He then gave each volunteer a pair of spectacles with an LED mounted on the left and right side of the frame. The two LEDs flashed in quick succession, and the volunteers had to say which flashed first. Naish repeated the task until the gap between the flashes was so short that the volunteers could no longer judge the correct order.

Naish found that hypnotically susceptible volunteers were better at perceiving when the right LED flashed first than when the left one did. This suggested that the left hemisphere of their brain was working more efficiently (visual pathways cross over in the brain, so left controls right and vice versa). In contrast,

the non-susceptible people were just as likely to perceive the right LED flashing first as the one on the left.

These differences in the balance of brain efficiency persisted when Naish tried to hypnotise both groups. During hypnosis, the brains of those in the susceptible group seemed to switch "states", becoming faster at spotting when the left LED flashed first. Meanwhile, the efficiency of the hemispheres remained relatively even in the non-susceptible people. They didn't fall into a trance, but their performance on the task started to deteriorate (*Consciousness and Cognition*, DOI: 10.1016/j.concog.2009.10.003).

Naish suggests that successful hypnosis requires temporary domination by the brain's right side, a state that might be much easier to bring about in people who tend to have an imbalance in the efficiency of their two hemispheres, even when awake.

Hypnosis requires right side domination. People with asymmetric brains are more susceptible

"It fits in with a theory that hypnosis involves a transition from left to right hemispheric dominance," says Zoltan Dienes of the University of Sussex in Brighton, UK. He has used transcranial magnetic stimulation to temporarily reduce activity in the left hemisphere and found that this increases responsiveness to hypnosis. "It is as if people who don't have the natural ability to become right hemisphere dominant are being given a helping hand by reducing activity in their left hemisphere," says Naish.

http://www.newscientist.com/article/mg20527444.400-brain-asymmetry-eases-hypnotic-trance.html

The entropy force: a new direction for gravity

- 20 January 2010 by **Martijn van Calmthout**
- Magazine issue 2744.

Gravity keeps us tumbling back to Earth (Image: SuperStock/Getty)

WHAT exactly is gravity? Everybody experiences it, but pinning down why the universe has gravity in the first place has proved difficult.

Although gravity has been successfully described with laws devised by Isaac Newton and later Albert Einstein, we still don't know how the fundamental properties of the universe combine to create the phenomenon.

Now one theoretical physicist is proposing a radical new way to look at gravity. Erik Verlinde of the University of Amsterdam, the Netherlands, a prominent and internationally respected string theorist, argues that gravitational attraction could be the result of the way information about material objects is organised in space. If true, it could provide the fundamental explanation we have been seeking for decades.

Verlinde posted his paper to the pre-print physics archive earlier this month, and since then many physicists have greeted the proposal as promising (arxiv.org/abs/1001.0785). Nobel laureate and theoretical physicist Gerard 't Hooft of Utrecht University in the Netherlands stresses the ideas need development, but is impressed by Verlinde's approach. "[Unlike] many string theorists Erik is stressing real physical concepts like mass and force, not just fancy abstract mathematics," he says. "That's encouraging from my perspective as a physicist."

Newton first showed how gravity works on large scales by treating it as a force between objects (see "Apple for your eyes"). Einstein refined Newton's ideas with his theory of general relativity. He showed that gravity was better described by the way an object warps the fabric of the universe. We are all pulled towards the Earth because the planet's mass is curving the surrounding space-time.

Yet that is not the end of the story. Though Newton and Einstein provided profound insights, their laws are only mathematical descriptions. "They explain how gravity works, but not where it comes from," says Verlinde. Theoretical physics has had a tough time connecting gravity with the other known fundamental forces in the universe. The standard model, which has long been our best framework for describing the subatomic world, includes electromagnetism and the strong and weak nuclear forces - but not gravity.

Many physicists doubt it ever will. Gravity may turn out to be delivered via the action of hypothetical particles called gravitons, but so far there is no proof of their existence. Gravity's awkwardness has been one of the main reasons why theories like string theory and quantum loop gravity have been proposed in recent decades.

Verlinde's work offers an alternative way of looking at the problem. "I am convinced now, gravity is a phenomenon emerging from the fundamental properties of space and time," he says.

To understand what Verlinde is proposing, consider the concept of fluidity in water. Individual molecules have no fluidity, but collectively they do. Similarly, the force of gravity is not something ingrained in matter itself. It is an extra physical effect, emerging from the interplay of mass, time and space, says Verlinde. His idea of gravity as an "entropic force" is based on these first principles of thermodynamics - but works within an exotic description of space-time called holography.

Like the fluidity of water, gravity is not ingrained in matter itself. It is an extra physical effect

Holography in theoretical physics follows broadly the same principles as the holograms on a banknote, which are three-dimensional images embedded in a two-dimensional surface. The concept in physics was developed in the 1970s by Stephen Hawking at the University of Cambridge and Jacob Bekenstein at the Hebrew University of Jerusalem in Israel to describe the properties of black holes. Their work led to the insight that a hypothetical sphere could store all the necessary "bits" of information about the mass within. In the 1990s, 't Hooft and Leonard Susskind at Stanford University in California proposed that this framework might apply to the whole universe. Their "holographic principle" has proved useful in many fundamental theories.

Verlinde uses the holographic principle to consider what is happening to a small mass at a certain distance from a bigger mass, say a star or a planet. Moving the small mass a little, he shows, means changing the information content, or entropy, of a hypothetical holographic surface between both masses. This change of information is linked to a change in the energy of the system.

Then, using statistics to consider all possible movements of the small mass and the energy changes involved, Verlinde finds movements toward the bigger mass are thermodynamically more likely than others. This effect can be seen as a net force pulling both masses together. Physicists call this an entropic force, as it originates in the most likely changes in information content.

This still doesn't point directly to gravity. But plugging in the basic expressions for information content of the holographic surface, its energy content and Einstein's relation of mass to energy leads directly to Newton's law of gravity. A relativistic version is only a few steps further, but again straightforward to derive. And it seems to apply to both apples and planets. "Finding Newton's laws all over again could have been a lucky coincidence," says Verlinde. "A relativistic generalisation shows this is far deeper than a few equations turning out just right."

Verlinde's paper has prompted praise from some physicists. Robbert Dijkgraaf, a prominent mathematical physicist also at the University of Amsterdam, says he admires the elegance of Verlinde's concepts. "It is amazing no one has come up with this earlier, it looks just so simple and yet convincing," he says.

The jury is still out for many others. Some believe that Verlinde is using circular reasoning in his equations, by "starting out" with gravity. Others have expressed concern about the almost trivial

mathematics involved, leaving most of the theory based on very general concepts of space, time and information.

Stanley Deser of Brandeis University in Waltham, Massachusetts, whose work has expanded the scope of general relativity, says Verlinde's work appears to be a promising avenue but adds that it is "a bombshell that will take a lot of digesting, challenging all our dogmas from Newton and Hooke to Einstein."

Verlinde stresses his paper is only the first on the subject. "It is not even a theory yet, but a proposal for a new paradigm or framework," he says. "All the hard work comes now."

Apple for your eyes

"We went into the garden and drank thea, under some apple trees... he told me he was just in the same situation, when the notion of gravitation came into his mind. 'Why should that apple always descend perpendicularly to the ground,' thought he to himself."

So wrote archaeologist and biographer William Stukeley in 1752, recounting the famous story as told to him by a young Isaac Newton. Newton went on to show that, on a large scale, two masses are attracted in proportion to their individual mass, and the force between them falls off with the square of their distance.

Now the original manuscript featuring the story, entitled *Memoirs of Sir Isaac Newton's Life*, is available for all to read. As part of its 350th anniversary celebration, London's Royal Society has published a digital version of the document, which is tucked away in their archives. See royalsociety.org/turning-the-pages.

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http://www.newscientist.com/article/mg20527443.800-the-entropy-force-a-new-direction-for-gravity.html?DCMP=NLC-nletter&nsref=mg20527443.800

Solar system 'on fire' burned up Earth's carbon

- 19 January 2010 by **David Shiga**

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Now where did all that carbon go? (Image: Christian Miller/iStock)

FIRE sweeping through the inner solar system may have scorched away much of the carbon from Earth and the other inner planets.

Though our planet supports carbon-based life, it has a mysterious carbon deficit. The element is thousands of times more abundant in comets in the outer solar system than on Earth, relative to the amount of silicon each body contains. The sun is similarly rich in carbon. "There really wasn't that much carbon that made it onto Earth compared to what was available," says Edwin Bergin of the University of Michigan in Ann Arbor.The conventional explanation for the deficit argues that in the inner region of the dust disc where Earth formed, temperatures soared above 1800 kelvin, enough for carbon to boil away. But observations of developing solar systems suggest that at Earth's distance from the sun the temperature would be too cool to vaporise carbon dust.

Now a team of astronomers says that fire is to blame. Hot oxygen atoms in the dusty disc would have readily combined with carbon, burning it to produce carbon dioxide and other gases, say Jeong-Eun Lee of Sejong University in Seoul, South Korea, and colleagues, including Bergin, in a paper to appear in *The Astrophysical Journal Letters* (arxiv.org/abs/1001.0818). Any solid carbon in the inner solar system would have been destroyed within a few years, they calculate.

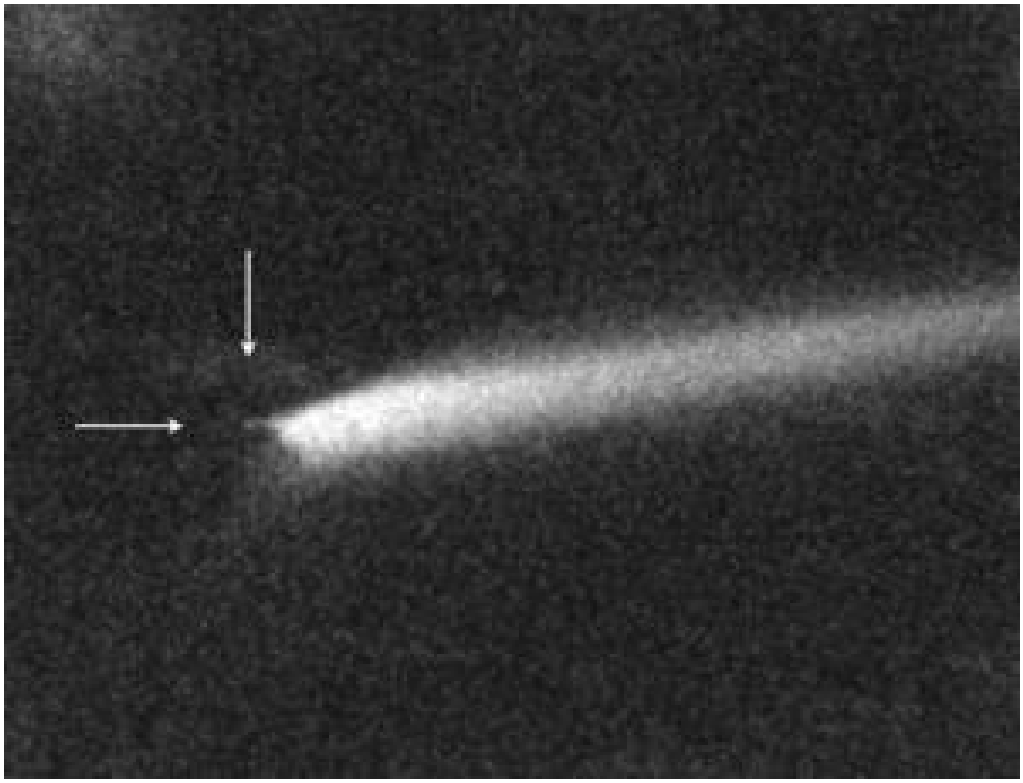
Fire would have destroyed any solid carbon in the early inner solar system within a few years Supporting the theory is the fact that carbon abundance in the asteroid belt surrounding the inner planets increases the farther away you get from the sun.

The carbon that Earth now contains must have been delivered later by asteroids and comets that formed beyond the reach of the early fire, the researchers say. This may have had a hidden benefit: chemical reactions in the outer solar system could have transformed simple carbon compounds into more complex molecules such as amino acids, which are key ingredients of life, Bergin says.

http://www.newscientist.com/article/mg20527434.400-solar-system-on-fire-burned-up-earths-carbon.html?DCMP=NLC-nletter&nsref=mg20527434.400

Trail of dust may point to fresh violence in asteroid belt

- 03:52 20 January 2010 by **David Shiga**



A pair of asteroids may have collided to produce this dust streak in the asteroid belt, seen here in an image from the WIYN telescope on Kitt Peak, Arizona. Arrows point to what may be a fragment of one of the asteroids (Image: J Annis/M Soares-Santos/D Jewitt/Fermilab/UCLA)

Enlarge image

A mysterious streak of dust in the asteroid belt might represent the first evidence of a collision between asteroids in modern times.

Using a telescope in New Mexico, an asteroid survey called LINEAR (Lincoln Near Earth Asteroid Research), spotted a long dust trail on 6 January.

The dust trail, called P/2010 A2, resembles a comet's tail, but unlike most comets, it resides in the asteroid belt between Mars and Jupiter.

Evidence that the trail might be the debris of a collision between asteroids comes from observations of a nearby object (see image). The object appears to be a 200-metre-wide asteroid that is moving across the sky with the same speed and direction as the trail, according to observations led by Javier Licandro of the Astrophysical Institute of the Canary Islands.

Real time

David Jewitt of the University of California in Los Angeles says the 200-metre object may be a large fragment of one of the colliding asteroids, which were mostly demolished in the impact. The pressure from sunlight would have blown the resulting debris cloud into a long tail.

The smashup may have occurred as recently as a few weeks ago, not long before P/2010 A2 was discovered, he says. That would be the most recent evidence of an asteroidal pileup yet. Families of asteroids – whose members all move along similar orbits today – likely formed in violent collisions, but in the much more distant past.

"We see very clear evidence for collisions in the asteroid belt [that occurred] many tens of millions of years ago," Jewitt told *New Scientist*. "The cool thing about this – if the impact interpretation is correct – is that we're seeing one basically as it happens."

Sun-warmed comet?

Alternatively, P/2010 A2 might be a 'main-belt' comet, an object in the asteroid belt that occasionally flares up and grows a tail like a comet.

Astronomers believe main-belt comets are powered by the same mechanism as regular comets – ice that gets heated by sunlight and vaporises, shedding puffs of gas and dust. A handful of these objects have been found to date, but until now, all of them have orbited in the outer, colder part of the asteroid belt. P/2010 A2 resides in the inner, warmer part, which is thought to contain less ice.

Jewitt is hoping to get approval to point the Hubble Space Telescope at P/2010 A2 to look for additional fragments from the possible collision. "If I see those fragments, I think that will be a clincher in favour of the impact argument," he says.

Window into the past

He also predicts that the distance between the 200-metre object and the tail will grow. That's because sunlight pressure can blow away dust grains in the tail but has little effect on the heftier space rock, whose inertia will keep its path relatively unchanged.

If it does turn out to be a collision, it will provide an unprecedented window into the violent events that have shaped the asteroid belt. Collisions are thought to destroy small asteroids over time, converting them into dust, Jewitt says.

It is not clear how often impacts between asteroids occur. But Bill Bottke of the Southwest Research Institute in Boulder, Colorado, agrees that P/2010 A2 might be the result of such a collision. "Asteroids do hit one another," he says. "Collisions are the fundamental geologic process taking place in the asteroid belt today."

http://www.newscientist.com/article/dn18415-trail-of-dust-may-point-to-fresh-violence-in-asteroid-belt.html?DCMP=NLC-nletter&nsref=dn18415

Innovation: The relentless rise of the digital worker

- 16:19 15 January 2010 by **Justin Mullins**

Innovation is our regular column that highlights emerging technological ideas and where they may lead

When Unilever wanted ideas for a new TV advertising campaign to sell its Peperami snack food, it decided to try something unusual. It dropped its ad agency of 15 years and turned instead to a little known internet site called IdeaBounty.com, an online marketplace trading in creative ideas. Companies or individuals post topics and then sit back and wait for surfers to send in their best shots. After the closing date, the client selects the best idea and pays the winner.

The challenge generated over 1000 replies and in November last year, Unilever paid out $15,000 for the two ideas it liked best. The new Peperami adverts are due to appear on British TV later this year.

Welcome to the world of "cloud labour" where a virtual workforce will undertake any task in the cloudlike world of cyberspace for the best possible price.

Wage cheats

Cloud labour has hit the headlines recently because of fears that unscrupulous employers could exploit disadvantaged workers, by luring them unknowingly into illegal activities or by cheating them out of their wages.

The reality appears to be somewhat different. John Horton at Harvard University asked workers at Amazon's Mechanical Turk whether they thought they were treated more fairly by online or by offline employers.

Surprisingly, the respondents said that it made little difference: they believed their chances of being treated fairly were as good or better online as they were off-line (although Horton paid his Mechanical Turk respondents a good rate to complete his survey which may have influenced their answers).

Digital artisans

The potential benefits are potentially huge: cloud labour allows anybody with a computer to work from home, or wherever their internet link is, and at the times that suit them, regardless of where they are in the world. Cloud labour could transform the lives of many people in the developing world. So what kind of work can aspiring digital artisans hope to find?

At one end of the scale are the repetitive "click working" tasks that are too complex for a computer to handle but little more than child's play for humans. The place to find these is Amazon's Mechanical Turk , where current tasks include transcribing an hour long voicemail for around $40, filtering inappropriate content from a social networking site at 2 cents a pop or drawing boxes around objects in digital images for 5 cents a go.

The Mechanical Turk, which was founded in 2005, has become such an important source of work and labour that it has begun to spawn an ecosystem of intermediaries such as Crowdflower that can manage crowd labour activities such as writing labels for images or categorising recipes for a cooking website. Crowdflower organises the crowd, helping to design the tasks and managing the quality control of the results.

Hurricane Katrina

Higher up the pay scale are sites aimed at more highly skilled workers. LiveOps sets up virtual call centres that handle and process calls over the internet using operators from all over the planet.

When Hurricane Katrina struck New Orleans in 2005, LiveOps arranged for 300 operators to handle calls on behalf of the Red Cross, whose own call centre had become swamped. It set up this virtual call centre in only three hours.

Elsewhere, Elance allows companies to outsource jobs such as graphic design, proof-reading and legal services to professional freelancers around the world. Rates vary from a few dollars to hundreds of dollars per hour.

And last year, the internet start-up Speaklike began offering translation services on the same basis. If you want your tweets retweeted in Mandarin, for example, it'll cost you 25 cents a shot.

Space food

At the top of the scale are services like IdeaBounty and InnoCentive that ask for high-level input and pay handsomely for it too. InnoCentive was set up in 2001 as marketplace where the world's brightest minds could tackle the planet's most difficult questions. NASA has its own channel on the site offering, for example, $30,000 for a way to forecast solar activity and $15,000 for a way to keep food fresh in space.

Similarly, the Rockefeller Foundation is offering $20,000 for the design of a low-cost tank to collect rainwater in the wetlands of India. And another challenge offers $20,000 for new ways to protect maize against insect damage.

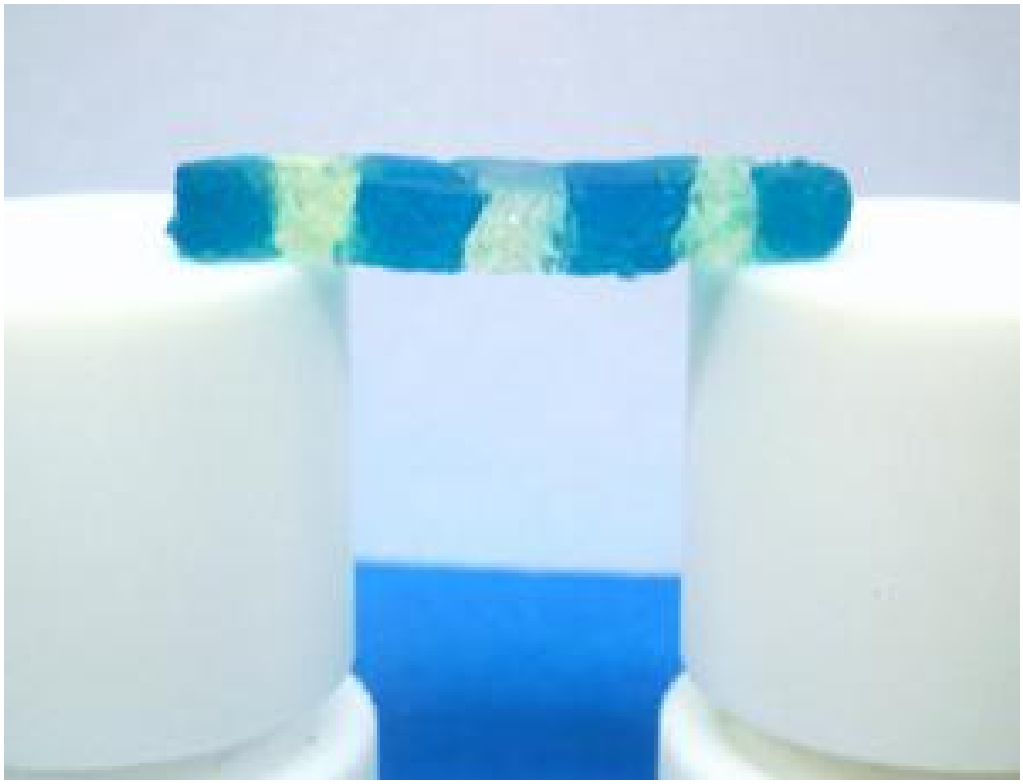
If you have answers to any of those problems or fancy chancing your arm as one of the other types of digital worker, you could have a rosy future online.

And if you don't, employers aren't fussy. They know there are millions, may be even billions, of other potential workers around the world who will happily take your place.

http://www.newscientist.com/article/dn18395-innovation-the-relentless-rise-of-the-digital-worker.html?DCMP=NLC-nletter&nsref=dn18395

Smart mud could be the new plastic

- 20 January 2010 by **Colin Barras**
- Magazine issue 2744.



A hydrogel made from water, clay and a "molecular glue" is strong enough to support its own weight. Future, stronger versions could replace plastics (Image: Takuzo Aida and Nature)

Could a mixture of water and clay replace plastics? The desire to wean the world off oil has sparked all manner of research into novel transportation fuels, but manufacturing plastics uses large amounts of oil too. Researchers at the University of Tokyo, Japan, think their material could be up to the task.

Takuzo Aida and his team mixed a few grams of clay with 100 grams of water in the presence of tiny quantities of a thickening agent called sodium polyacrylate and an organic "molecular glue". The thickening agent teases apart the clay into thin sheets, increasing its surface area and allowing the glue to get a better hold on it.

This means that, while the mixture is almost 98 per cent water, it forms a transparent and elastic hydrogel with sufficient mechanical strength to make a 3.5-centimetre-wide self-standing bridge.

Self-repairing hydrogel

The strength of the material depends on the sum of the forces acting between the molecules in the clay nanosheets and the glue, says Aida. These so-called supramolecular forces, such as hydrogen bonds, also help to trap water molecules between the clay sheets.

Some other hydrogels rely on covalent chemical bonds rather than supramolecular forces for their strength. One disadvantage of this is that when the covalent bonds break, the material irreversibly loses its

strength, says Aida. Supramolecular forces, on the other hand, can easily reform, so if the material fails under stress it can quickly regain its strength.

The gel takes just 3 minutes to form, and making it requires no understanding of the chemical process involved, Aida says, – a fact that impresses Craig Hawker at the University of California in Santa Barbara, who was not involved with the study. "One of the primary breakthroughs is the overall simplicity of the procedure coupled with the exceptional physical properties of the final assemblies," he says.

New class of materials

"Toughness, self-healing and robustness are just some of the initial physical properties that will be found for this new class of materials," Hawker says. "I predict that this approach will lead to the design of even more impressive materials in the near future."

Polymer scientist Jian Ping Gong at Hokkaido University in Sapporo, Japan, says the work is "beautiful" but points out that the material's mechanical strength falls short of what is possible for plastics and chemically cross-linked gels.

Aida says that strengthening the material is as simple as increasing the quantities of clay, sodium polyacrylate and glue, provided transparency is not important.

Journal reference: *Nature*, DOI: 10.1038/nature08693.

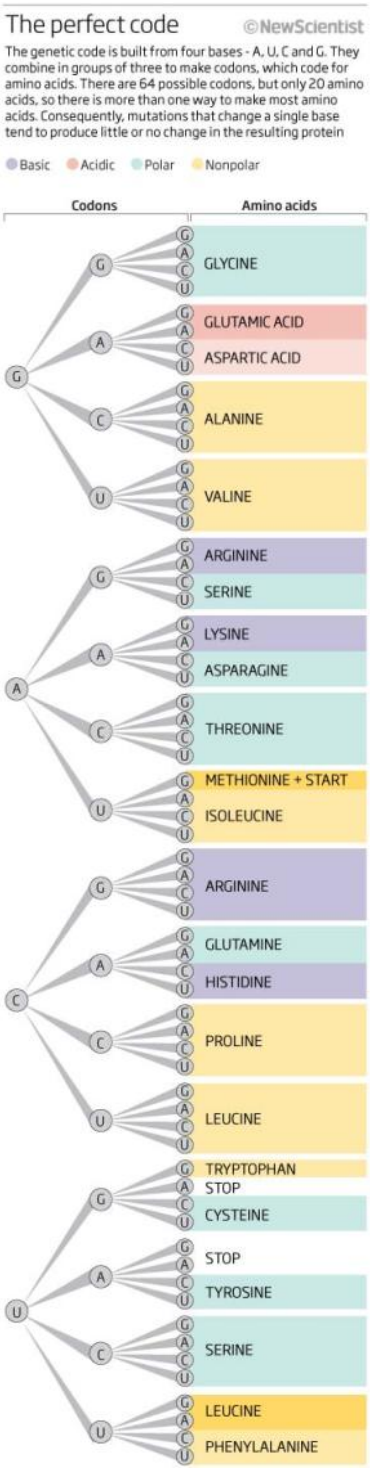
http://www.newscientist.com/article/mg20527445.600-smart-mud-could-be-the-new-plastic.html

Horizontal and vertical: The evolution of evolution

- 20 January 2010 by **Mark Buchanan**
- Magazine issue 2744.

The perfect code

JUST suppose that Darwin's ideas were only a part of the story of evolution. Suppose that a process he never wrote about, and never even imagined, has been controlling the evolution of life throughout most of the Earth's history. It may sound preposterous, but this is exactly what microbiologist Carl Woese and physicist Nigel Goldenfeld, both at the University of Illinois at Urbana-Champaign, believe. Darwin's explanation of evolution, they argue, even in its sophisticated modern form, applies only to a recent phase of life on Earth.



At the root of this idea is overwhelming recent evidence for horizontal gene transfer - in which organisms acquire genetic material "horizontally" from other organisms around them, rather than vertically from their parents or ancestors. The donor organisms may not even be the same species. This mechanism is already known to play a huge role in the evolution of microbial genomes, but its consequences have hardly been explored. According to Woese and Goldenfeld, they are profound, and horizontal gene transfer alters the evolutionary process itself. Since micro-organisms represented most of life on Earth for most of the time that life has existed - billions of years, in fact - the most ancient and prevalent form of evolution probably wasn't Darwinian at all, Woese and Goldenfeld say.

Strong claims, but others are taking them seriously. "Their arguments make sense and their conclusion is very important," says biologist Jan Sapp of York University in Toronto, Canada. "The process of evolution just isn't what most evolutionary biologists think it is."

Vertical hegemony

How could modern biology have gone so badly off track? According to Woese, it is a simple tale of scientific complacency. Evolutionary biology took its modern form in the early 20th century with the establishment of the genetic basis of inheritance: Mendel's genetics combined with Darwin's theory of evolution by natural selection. Biologists refer to this as the "modern synthesis", and it has been the basis for all subsequent developments in molecular biology and genetics. Woese believes that along the way biologists were seduced by their own success into thinking they had found the final truth about all evolution. "Biology built up a facade of mathematics around the

juxtaposition of Mendelian genetics with Darwinism," he says. "And as a result it neglected to study the most important problem in science - the nature of the evolutionary process."

In particular, he argues, nothing in the modern synthesis explains the most fundamental steps in early life: how evolution could have produced the genetic code and the basic genetic machinery used by all organisms, especially the enzymes and structures involved in translating genetic information into proteins. Most biologists, following Francis Crick, simply supposed that these were uninformative "accidents of history". That was a big mistake, says Woese, who has made his academic reputation proving the point.

In 1977, Woese stunned biologists when his analysis of the genetic machinery involved in gene expression revealed an entirely new limb of the tree of life. Biologists knew of two major domains: eukaryotes - organisms with cell nuclei, such as animals and plants - and bacteria, which lack cell nuclei. Woese documented a third major domain, the Archaea. These are microbes too, but as distinct from bacteria genetically as both Archaea and bacteria are from eukaryotes. "This was a enormous discovery," says biologist Norman Pace of the University of Colorado in Boulder. Woese himself sees it as a first step in getting evolutionary biology back on track. Coming to terms with horizontal gene transfer is the next big step.

In the past few years, a host of genome studies have demonstrated that DNA flows readily between the chromosomes of microbes and the external world. Typically around 10 per cent of the genes in many bacterial genomes seem to have been acquired from other organisms in this way, though the proportion can be several times that (*New Scientist*, 24 January 2009, p 34). So an individual microbe may have access to the genes found in the entire microbial population around it, including those of other microbe species. "It's natural to wonder if the very concept of an organism in isolation is still valid at this level," says Goldenfeld.

Lateral thinking

This is all very different from evolution as described by Darwin. Evolution will always be about change as a result of some organisms being more successful at surviving than others. In the Darwinian model, evolutionary change occurs because individuals with genes associated with successful traits are more likely to pass these on to the next generation. In horizontal gene transfer, by contrast, change is not a function of the individual or of changes from generation to generation, but of all the microbes able to share genetic material. Evolution takes place within a complex, dynamic system of many interacting parts, say Woese and Goldenfeld, and understanding it demands a detailed exploration of the self-organising potential of such a system. On the basis of their studies, they argue that horizontal gene transfer had to be a dominant factor in the original form of evolution.

Evidence for this lies in the genetic code, say Woese and Goldenfeld. Though it was discovered in the 1960s, no one had been able to explain how evolution could have made it so exquisitely tuned to resisting errors. Mutations happen in DNA coding all the time, and yet the proteins it produces often remain unaffected by these glitches. Darwinian evolution simply cannot explain how such a code could arise. But horizontal gene transfer can, say Woese and Goldenfeld.

The essence of the genetic code is that sequences of three consecutive bases, known as codons, correspond to specific amino acids (see diagram). Proteins are made of chains of amino acids, so when a gene is transcribed into a protein these codons are what determines which amino acid gets added to the chain. The codon AAU represents the amino acid asparagine, for example, and UGU represents cysteine. There are 64 codons in total and 20 amino acids, which means that the code has some redundancy, with multiple codons specifying the same amino acid.

This code is universal, shared by all organisms, and biologists have long known that it has remarkable properties. In the early 1960s, for example, Woese himself pointed out that one reason for the code's deep

tolerance for errors was that similar codons specify either the same amino acid or two with similar chemical properties. Hence, a mutation of a single base, while changing a codon, will tend to have little effect on the properties of the protein being produced.

In 1991, geneticists David Haig and Lawrence Hurst at the University of Oxford went further, showing that the code's level of error tolerance is truly remarkable. They studied the error tolerance of an enormous number of hypothetical genetic codes, all built from the same base pairs but with codons associated randomly with amino acids. They found that the actual code is around one in a million in terms of how good it is at error mitigation. "The actual genetic code," says Goldenfeld, "stands out like a sore thumb as being the best possible." That would seem to demand some evolutionary explanation. Yet, until now, no one has found one. The reason, say Woese and Goldenfeld, is that everyone has been thinking in terms of the wrong kind of evolution.

Working with Kalin Vetsigian, also at the University of Illinois at Urbana-Champaign, Woese and Goldenfeld set up a virtual world in which they could rerun history multiple times and test the evolution of the genetic code under different conditions (*Proceedings of the National Academy of Sciences*, vol 103, p 10696). Starting with a random initial population of codes being used by different organisms - all using the same DNA bases but with different associations of codons and amino acids - they first explored how the code might evolve in ordinary Darwinian evolution. While the ability of the code to withstand errors improves with time, they found that the results were inconsistent with the pattern we actually see in two ways. First, the code never became shared among all organisms - a number of distinct codes remained in use no matter how long the team ran their simulations. Second, in none of their runs did any of the codes evolve to reach the optimal structure of the actual code. "With vertical, Darwinian evolution," says Goldenfeld, "we found that the code evolution gets stuck and does not find the true optimum."

Horizontal is optimal

The results were very different when they allowed horizontal gene transfer between different organisms. Now, with advantageous genetic innovations able to flow horizontally across the entire system the code readily discovered the overall optimal structure and came to be universal among all organisms. "In some sense," says Woese, "the genetic code is a fossil or perhaps an echo of the origin of life, just as the cosmic microwave background is a sort of echo of the big bang. And its form points to a process very different from today's Darwinian evolution." For the researchers the conclusion is inescapable: the genetic code must have arisen in an earlier evolutionary phase dominated by horizontal gene transfer.

Goldenfeld admits that pinning down the details of that early process remains a difficult task. However the simulations suggest that horizontal gene transfer allowed life in general to acquire a unified genetic machinery, thereby making the sharing of innovations easier. Hence, the researchers now suspect that early evolution may have proceeded through a series of stages before the Darwinian form emerged, with the first stage leading to the emergence of a universal genetic code. "It would have acted as an innovation-sharing protocol," says Goldenfeld, "greatly enhancing the ability of organisms to share genetic innovations that were beneficial." Following this, a second stage of evolution would have involved rampant horizontal gene transfer, made possible by the shared genetic machinery, and leading to a rapid, exponential rise in the complexity of organisms. This, in turn, would eventually have given way to a third stage of evolution in which genetic transfer became mostly vertical, perhaps because the complexity of organisms reached a threshold requiring a more circumscribed flow of genes to preserve correct function. Woese can't put a date on when the transition to Darwinian evolution happened, but he suspects it occurred at different times in each of the three main branches of the tree of life, with bacteria likely to have changed first.

Early evolution may have proceeded through a series of stages before the Darwinian form emerged

Today, at least in multicellular organisms, Darwinian evolution is dominant but we may still be in for some surprises. "Most of life - the microbial world - is still strongly taking advantage of horizontal gene transfer, but we also know, from studies in the past year, that multicellular organisms do this too," says

Goldenfeld. As more genomes are sequenced, ever more incongruous sequences of DNA are turning up. Comparisons of the genomes of various species including a frog, lizard, mouse and bushbaby, for example, indicate that one particular chunk of DNA found in each must have been acquired independently by horizontal gene transfer (*Proceedings of the National Academy of Sciences*, vol 105, p 17023). "The importance of this for evolution has yet to be seriously considered."

No doubt there will be resistance in some quarters, yet many biologists recognise that there must be a change in thinking if evolution is finally to be understood in a deep way. "The microbial world holds the greatest biomass on Earth," says Sapp, "but for most evolutionists it's a case of 'out of sight, out of mind'. They tend to focus on visible plants and animals."

If a paradigm shift is pending, Pace says it will be in good hands. "I think Woese has done more for biology writ large than any biologist in history, including Darwin," he says. "There's a lot more to learn, and he's been interpreting the emerging story brilliantly."

Mark Buchanan is a writer based in Oxford, UK

http://www.newscientist.com/article/mg20527441.500-horizontal-and-vertical-the-evolution-of-evolution.html?DCMP=NLC-nletter&nsref=mg20527441.500

Spasers set to sum: A new dawn for optical computing

- 20 January 2010 by **Justin Mullins**
- Magazine issue 2744.

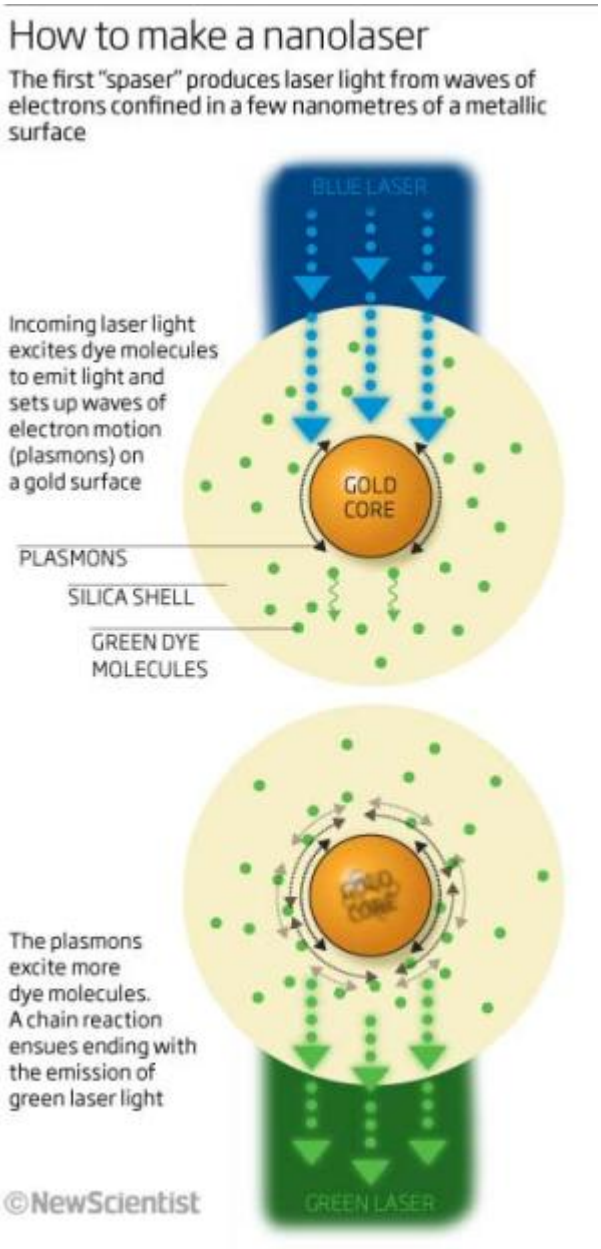
How to make a nanolaser

IT'S a laser, but not as we know it. For a start, you need a microscope to see it. Gleaming eerily green, it is a single spherical particle just a few tens of nanometres across.

Gleaming eerily green, this laser is a single spherical particle just tens of nanometres across

Tiny it might be, but its creators have big plans for it. With further advances, it could help to fulfil a long-held dream: to build a super-fast computer that computes with light.

Dubbed a "spaser", this minuscule lasing object is the latest by-product of a buzzing field known as nanoplasmonics. Just as microelectronics exploits the behaviour of electrons in metals and semiconductors on micrometre scales, so nanoplasmonics is concerned with the nanoscale comings and goings of entities known as plasmons that lurk on and below the surfaces of metals.



To envisage what as plasmon is, imagine a metal as a great sea of freely moving electrons. When light of the right frequency strikes the surface of the metal, it can set up a wavelike oscillation in this electron sea, just as the wind whips up waves on the ocean. These collective electron waves - plasmons - act to all intents and purposes as light waves trapped in the metal's surface. Their wavelengths depend on the metal, but are generally measured in nanometres. Their frequencies span the terahertz range - equivalent to the frequency range of light from the ultraviolet right through the visible to the infrared.

In 2003, their studies of plasmons led theorists Mark Stockman at Georgia State University in Atlanta and David Bergman at Tel Aviv University in Israel to an unusual thought. Plasmons behaved rather like light, so could they be amplified like light, too? What the duo had in mind was a laser-like device that multiplied single plasmons to turn them into powerful arrays of plasmons all oscillating in the same way (see "From laser to spaser").

The mathematics of it seemed to work. By analogy with the acronym that produces the word laser, they dubbed their brainchild "surface plasmon amplification by the stimulated emission of radiation" - spaser - and published a paper about it (*Physical Review Letters*, vol 90, p 027402).

The spaser might have remained just a theoretical curiosity. Around the same time, however, physicists were waking up to the potential of plasmonics for everything from perfect lenses to sensitive biosensors (see "What have plasmons ever done for us?"). The spaser idea was intriguing enough that Mikhail Noginov, an electrical engineer at Norfolk State University in Virginia, and some of his colleagues set out to build one.

It was not an easy task. Light is long-lived, so it is relatively easy to bounce it around in a mirrored chamber and amplify it, as happens inside a laser. Plasmons, by contrast, are transient entities: they typically live for mere attoseconds, and cannot travel more than a few plasmon wavelengths in a metal before their energy is absorbed by the ocean of non-oscillating electrons around them. It was not at all clear how we might get enough of a handle on plasmons to amplify them at all.

In August 2009, Noginov and his colleagues showed how. Their ingenious solution takes the form of a circular particle just 44 nanometres across. It consists of a gold core contained within a shell of silica, speckled with dye molecules that, excited initially by an external laser, produce green light. Some of that light leaks out to give the nanoparticles their characteristic green glow; the rest stimulates the generation of plasmons at the surface of the gold core.

In the normal way of things, these plasmons are absorbed by the metal almost as soon as they are produced. But their tickling influence also stimulates the dye molecules in the silica shell to emit more light, which in turn generates more plasmons, which excites more light and so on. With a sufficient supply of dye, enough plasmons can exist at the same time that they start to reinforce each other. The signature of a laser-like multiplication of plasmons within the device is a dramatic increase in green laser light emitted from the nanoparticle after only a small increase in the energy supplied from the external laser - the signature Noginov and his colleagues reported last year (*Nature*, vol 460, p 1110).

And they were not the only ones. In October 2009, Xiang Zhang, a mechanical engineer at the University of California, Berkeley, and his colleagues unveiled a similarly tiny device that exploits plasmons to produce laser light (*Nature*, vol 461, p 629).

These innovations generated headlines at the time as an entirely new type of lasing device more compact than any yet seen and which, in theory, required a lot less power than a conventional device. That's an exciting development in its own right, but just one in a list of promising advances in the bustling business of laser technology.

Crucially, though, the development of spasers has sparked the hope that one of the great scientific disappointments of the past decades - the unfulfilled promise of optical computing - may yet be turned into triumph.

On the face of it, optical computers, which use light rather than currents of electrons to process information, are a great idea. Electrons are easy to manipulate and process, but they tend to get bogged down as they pass through metals and semiconductors, colliding with atoms and bouncing off them in ways that limit the speed and fidelity of information transmission. Photons, by contrast, can withstand interference, and are above all fast, in theory zipping around a chip at close to the cosmic speed limit.

In the 1990s, various groups claimed to be getting close to making the dream of optical computing a reality. That included a concerted effort at the world-famous Bell Laboratories in Murray Hill, New Jersey, where the building block of microelectronic circuits, the transistor, was invented in 1947. Researchers there and elsewhere hit a snag, however. The very fleet-footedness that made photons perfect

for high-speed communications made them almost impossible to pin down and use for sensible processing of data.

"Optical computing has a chequered history, particularly the boondoggle at Bell Labs," says Harry Atwater, a physicist at the California Institute of Technology in Pasadena. All the efforts foundered when it came to producing anything like a transistor: a tiny, low-power device that could be used to toggle light signals on and off reliably.

In theory, a controllable laser would do this trick, if not for one problem - lasers devour power. Even worse, they are huge, relatively speaking: they work by bouncing photons around a mirrored cavity, so the very smallest they can be is about half the wavelength of the light they produce. For green light, with a wavelength of 530 nanometres, that means little change from 300 nanometres. Electrical transistors, meanwhile, are approaching one-tenth that size.

You see where this is leading. Spasers are a tiny source of light that can be switched on and off at will. At a few tens of nanometres in size, they are just slightly bigger than the smallest electrical transistors. The spaser is to nanoplasmonics what the transistor is to microelectronics, says Stockman: it is the building block that should make optical information-processing possible.

The spaser is to plasmonics what the transistor is to microelectronics

Inevitably, there will be many hurdles to overcome. For a start, Noginov's prototype spaser is switched on and off using another laser, rather than being switched electrically. That is cumbersome and means it cannot capitalise on the technology's low-power potential. It is also unclear, when it comes to connecting many spasers together to make a logic gate, how input and output signals can be cleanly separated with the resonant spherical spasers that have so far been constructed.

Mutual benefit

The most intriguing aspect of spasers, however, is the one that could make or break them as the basis of a future computing technology: they are made of metal. In one sense, that is a bad thing, because making a plasmonic chip would require a wholly different infrastructure to that used to make silicon chips - an industry into which billions in research money has been poured.

Silicon's predominance has not necessarily been a bar to other technologies establishing themselves: the radio signals used for cellphone communication, for example, are of a frequency too high for silicon chips to cope with, so an entirely separate manufacturing process grew up to make the gallium arsenide chips that can. To justify the initial investment costs, another upstart chip-architecture needs a similar "killer application": something it can do that silicon cannot.

Stockman reckons the extra processing speed promised by plasmonic devices will generate such applications in areas like cryptography. "Having faster processors than everyone else will be a question of national security," he says. And he points to another reason why the spooks might be interested. One problem with semiconductors is that their delicate conduction capabilities are vulnerable to ionising radiation. Such rays can send avalanches of electrons streaming through delicate electronic components. At best, this corrupts data and halts calculations. At worst, it fries transistors, permanently disabling them.

This is where the metallic nature of a plasmonic chip would come into its own. The extra electrons that ionising radiation can produce are mere drops in the ocean of free electrons from which plasmons are generated in a metal. A plasmonic device would be able to process and store information in the harshest radioactive environments: in orbiting satellites, in nuclear reactors, during nuclear conflict.

Perhaps the most likely outcome, though, is that rather than the one superseding the other, plasmonics and electronics come to coexist to mutual advantage in a single chip. As the transistors in chips become

smaller, the wires that connect them over distances of just a few nanometres become a significant bottleneck for data. That is one reason why chips are currently spinning their wheels at speeds of about 3 gigahertz. "Wires limit the speed at which electrons can deliver information," says Atwater. "So an obvious solution is to replace them with photonic connections."

The problem with such connections to date has been converting electronic signals into photonic ones and back again with a speed and efficiency that makes it worthwhile. Plasmons, which owe their existence to the easy exchange of energy between light and electrons, could be just the things for the job, making a hybrid electrical-optical chip a genuine possibility.

As well as that, says Atwater, we should work out how to manipulate plasmons using devices that can be made in the same way, and on the same fabrication lines, as ordinary silicon chips. Early last year, he and his colleagues at Caltech revealed an electrically controlled device dubbed the plasmostor that can vary the intensity of plasmons as they pass through it, and which has an architecture very similar to that of conventional transistors (*Nano Letters*, vol 9, p 897). Just this month, a Dutch group has announced that they have produced an electrically powered source of plasmons fully compatible with existing silicon chip fabrication technology (*Nature Materials*, vol 9, p 21).

It's very early days, so such innovations have yet to match the performance of purely electronic components. The plasmostor, for instance, flips between its on and off states more slowly than a conventional transistor, and the signals have an annoying tendency to leak out of the device and get lost. There is still a long way to go to a computer that runs on anything other than electrons. But it is a start, says Atwater. "You're challenging a hugely successful technology. It's audacious to think that you can just replace it."

But if a tiny round green light isn't a signal to go ahead and give it a try, what is?

From laser to spaser

This year marks the golden jubilee of a ruby trailblazer: it was on 16 May 1960 that Theodore Maiman of Hughes Research Laboratories in Malibu, California, coaxed a synthetic ruby to produce the first ever laser light. The first laser to produce light from gas - a mixture of helium and neon - followed later that same year.

Half a century later, and there's hardly an area of human endeavour that doesn't depend on lasers in some way or another: CD and DVD players, metal cutting and welding, barcode scanners and corrective eye surgery to name but a few.

Early lasers were essentially made up of a mirrored box containing a "gain medium" such as a crystal or gas. Zapped with light or an electric current, electrons in this medium absorb energy, releasing it again as photons. These photons bounce around the box and stimulate further electrons to emit more photons. This self-reinforcing increase in light energy is "light amplification by the stimulated emission of radiation" - laser action, for short.

Spasers use the same principle, except rather than amplifying light directly, they amplify surface plasmons - the wavelike movements of free electrons on and near the surfaces of metals - using that in turn to emit light.

What have plasmons ever done for us?

Plasmons might sound esoteric, but it is not just with spasers (see main story) that they are seeing practical application.

Take molecular sensing. The amount and colour of light absorbed by a plasmonic nanoparticle is extremely sensitive to the surrounding molecular environment. This property has been exploited to build sensing devices that detect levels of anything from the protein casein, an indicator of the quality of milk products, to glucose in the blood.

What's significant about these plasmonic sensors is that they can make continuous measurements, unlike chemical tests which usually give a single snapshot. A plasmonic implant could one day help diabetics to monitor and control their blood glucose levels in real time.

Plasmons should also be useful for increasing the efficiency of certain kinds of flat-screen displays. In June 2009, Ki Youl Yang and his colleagues at the Korea Advanced Institute of Science and Technology in Daejeon showed how silver nanoparticles deposited onto organic light-emitting diodes used in some displays increases the amount of light they emit.

More impressive yet, plasmonic devices might also help to tackle cancer, if tests in mice are anything to go by. Plasmonic nanoparticles laced with antibodies can be made to latch onto tumours. When blasted with a focused beam of infrared light precisely tuned to the plasmon frequency, the nanoparticles heat up, killing the attached cancer cells while leaving the surrounding healthy tissue unharmed (*Accounts of Chemical Research*, vol 41, p 1842).

Justin Mullins is a consultant editor for New Scientist

http://www.newscientist.com/article/mg20527441.600-spasers-set-to-sum-a-new-dawn-for-optical-computing.html?DCMP=NLC-nletter&nsref=mg20527441.600

Zap that fat: Can lasers make you slimmer in minutes?

- 20 January 2010 by **Helen Thomson**
- Magazine issue 2744.

Cut the fat

I'M lying on a bed in a cosy room. Soothing music plays in the background. Four palm-sized paddles rest silent and cool across my midriff. In the time it takes to do a typical gym workout, I could be up to 7 inches thinner than I was before I lay down. No, I'm not in the middle of a daydream, I'm in a private clinic in London, and I'm about to have my fat zapped.

Half an hour ago, I walked into a plush reception lobby on Harley Street - a thoroughfare famed for its exclusive private medical practices. Business is good. Two beauty therapists sit in the reception area chatting to a customer. "You lost just 3 inches this time? Never mind, we'll see if we can get a few more next week. How does Tuesday suit?"

I am visiting Harley Fit, one of a string of new companies that promise to transform your waistline in your lunch break. My visit is the culmination of a journey that began when a press release landed on my desk boasting a treatment that could make me "7 inches thinner in 20 minutes".

It sounded too good to be true. Yet thousands of people have attended one of the hundreds of clinics around the world that offer the treatment, and scores of reviews in lifestyle magazines speak of results that are "nothing short of amazing". At around £250 per treatment it doesn't come cheap, but with the diet industry estimated to turn over tens of billions of dollars every year in the US alone, the appetite for a quick fix is clearly there.

Praise from customers is one thing, but independent scientific evidence corroborating the claims is harder to find. So while the promise of being able to lose inches in minutes is undeniably amazing, does the technique really work, or are people parting with their cash for a snake-oil treatment? And more importantly, is it safe?

After months of research, which involved reading several studies of the technology and questioning experts in the field, I am satisfied that I am not putting my life at risk, so I've come to the clinic to try the procedure for myself. To be honest, now that I'm here I'm having second thoughts. To complement "WowFatZap", the inch-loss treatment that I'm receiving, Harley Fit also offers "WowSlimChoc", a

chocolate bar that promises to help you lose weight in one week, and the rather daunting "WowWilly", a "medically proven permanent expansion device" which promises: "once stretched, is everlastingly expanded". It feels like I've walked into the real-world equivalent of a spam email.

Despite all this, curiosity has got the better of me. If nothing else, my research revealed that getting rid of fat by zapping it with lasers is based on a scientifically plausible idea. The treatment is a form of non-invasive, laser-assisted fat-removal, or lipolysis. In 2001 Rodrigo Neira, a plastic surgeon at Red Deer Regional Hospital in Alberta, Canada, shone a laser at cultured fat cells, and found that this emulsified the targeted tissue. He presented his results later that year at the second South American Congress on Plastic and Reconstructive Surgery in Lima, Peru.

Getting rid of fat by zapping it with lasers is based on a scientifically plausible idea

In later studies, he showed that shining a low-level laser for 6 minutes onto the outside of the body where liposuction was about to take place made it much easier to extract the fat (*Aesthetic Surgery Journal*, vol 22, p 451). The technique was approved by the US Food and Drug Administration in 2004.

Neira then suggested that it might be possible to dispense with the invasive, hazardous and costly surgical procedure and just use lasers on their own. He reasoned that the laser was damaging the fat cells, allowing their contents to move from inside to outside the cell. Could the body then dispose of the fat without the need for liposuction?

His idea was sound. Lasers have been used in medicine for decades, and depending on the wavelength, energy level and treatment time, can be used to cut, cauterise, destroy tissue and control pain by altering cellular function.

Using lasers to "zap" fat, however, is a relatively new concept. Paddles containing a low-level, 635-nanometre laser are placed over regions of unwanted fat. While a small amount of the light is absorbed by the skin, the majority of the energy penetrates through to adipose tissue beneath. Here, bunches of grape-like fat cells attached to the skin absorb light energy from the laser, triggering a cascade of biochemical reactions that ends up with the cells rupturing.

According to Ryan Maloney, medical director at Erchonia Medical, one of the main distributors of this technology, the energy emitted by the lasers causes holes to form in the fat cell membranes, releasing the fat into spaces between the cells. The enzyme cytochrome c oxidase, present in the fat cell membrane, may play a key role in forming these holes. Energy from the laser causes changes in the activity of this enzyme, which affect the chemical state of the cell. This in turn affects genes that control the formation and maintenance of the fat cell membrane, causing pores to appear (*Photochemical and Photobiological Sciences*, vol 1, p 547).

The proof is in the pictures. In 2002, Neira watched the process under an electron microscope to identify the formation of a pore within the membrane of a fat cell after exposure to a 635-nanometre laser. He showed that the contents of the fat cell flowed across the membrane and into the extracellular space (*Plastic and Reconstructive Surgery*, vol 110, p 912). Erchonia claims that the excess fat is then "passed through the body during its normal course of detoxification". Though how the body does this, Erchonia does not say.

In 2008, Erchonia sponsored a double-blind clinical trial of the technique to zap fat in 67 volunteers aged between 18 and 65, who were all candidates for conventional liposuction. Each volunteer received low-level laser therapy (LLLT) on their waist, hip and thighs, three times a week for two weeks. Half the participants were assigned the real treatment; the other half received a placebo from a device that looked similar to the laser but was in fact a low-power LED. No change in exercise or dietary routine was allowed during the trial, and patients were asked to keep a diary of their exercise and food regimes to ensure that these habits were kept constant.

Overall, participants in the treatment group demonstrated a total girth reduction across all four sites of 89 millimetres (3.51 inches) compared with control subjects who showed a 17-millimetre reduction. Maloney says the reduction in the placebo group is a reflection of the typical placebo response. The results were published last month in *Lasers in Surgery and Medicine* (vol 41, p 799).

So far this is the only trial of the treatment. In Europe it does not require any further testing to comply with government regulations as the European Union has already approved the laser for surgical use. The US Food and Drug Administration has recently received experimental data demonstrating that the procedure works, but as *New Scientist* went to press the FDA had yet to announce that it has approved it. Its use in the US is therefore still "off-label".

Scientific evidence doesn't seem to be necessary for some people who have used the treatment. "Curiosity got the better of me," says Jane Lewis, a sales consultant from London, who heard about the treatment when she bumped into the owner of Harley Fit at a business conference. "Forty minutes after my treatment my therapist showed me I'd lost 6 inches in total from three separate areas of my body. I wasn't that overwhelmed, until I got back into a close-fitting dress that I'd been wearing and I was in awe at the difference."

For Nigel Potter, a finance director from London, the results were even more dramatic. "I lost a total of 19.5 inches from around various areas of my body after six weeks of treatments," he says.

Generally, this slimming down does not translate into a statistically significant reduction in weight. "Customers only lose 0.5 to 1 kilogram after lipolysis," says Maloney.

So what happens to the fat once it has leaked out of the cell? "The body can't excrete fat: it doesn't come out through the urine or the stool. We need to find out where it's going before we know whether these treatments will be truly safe and effective," says Molly Wanner, a dermatologist from Massachusetts General Hospital in Boston, who uses lasers for other medical procedures.

The body can't excrete fat: it doesn't come out through urine or stool. So we need to find out where it's going

Wanner is not the only person to have raised this question. Spencer Brown, a surgeon from the University of Texas Southwestern Medical Center, who performs laser lipolysis in his clinic in California, is equally perplexed. "It doesn't seem logical, that's the puzzling part. But the clinical results show that patients are certainly losing inches, so there has to be a redistribution of fat or fluids somewhere."

Both Brown and Maloney suspect that the fat is broken down through the body's natural metabolic pathways. "The body cannot excrete triglycerides, but fat can be broken down," says Maloney. The body transports fatty acids to the liver to be broken down into products which then undergo oxidative phosphorylation - a process which produces energy. Harley Fit's customers are advised to do 60 minutes of exercise within 24 hours of each treatment to burn off the released fat. So far, no trials have been done to test whether this aids the fat loss process.

Brown suspects that some of the released fat is used to repair the fat cell's membrane. "It takes a lot of energy to repair cells so I would suspect that some of the free fatty acids would participate in this process and be transferred into that energy cycle," he says.

Zapping fat with lasers isn't the only way to target your love handles. Treatments that destroy fat cells by freezing (see "Freezing fat") or create mechanical disruption by using ultrasound are being marketed outside the US.

Brown acts as a medical adviser for UltraShape, a company which provides body contouring through the use of ultrasound. Ultrasound treatments are non-invasive: they apply high-energy ultrasound to target the

fat cells. But unlike the laser treatments, which exploit biochemical pathways to create pores in the fat cell, they generate mechanical forces that rupture these cells.

Longer-lasting effect

While Brown says that destroying fat cells in this way causes more internal damage, he reckons it could also provide a longer-lasting effect. "With LLLT the fat cells recover very quickly, but with ultrasound the cell is destroyed. Although adults can create new fat cells, this process takes much longer than fixing damaged ones," he says.

While LLLT is approved as a safe mechanism for assisting with liposuction, there are questions to be answered over what happens when it is used by itself. Fat leaking from the damaged fat cells is not removed from the body straight away, so what happens if the patient doesn't exercise to burn it up? Can the body cope with a sudden increase in cholesterol and triglycerides floating around?

In one recent small trial, Maloney looked at the cholesterol and triglyceride levels in 19 patients undergoing LLLT. The patients received laser treatment three times a week for two weeks. Cholesterol levels were taken pre-procedure and at the end of the two-week treatment where you would expect any rise in cholesterol to be at its peak. Yet there was an overall reduction in cholesterol levels in 84 per cent of participants, with 74 per cent experiencing a reduction in low-density-lipoprotein or "bad" cholesterol (which is responsible for increasing the risk of heart disease), while 58 per cent of participants either maintained or increased their levels of high-density-lipoprotein - the "good" cholesterol (which can have a protective effect). Over half of the participants showed a reduction in triglyceride levels, suggesting that the body is more than capable of coping with the increase.

While the results look promising, the test group was very small, and independent experts in the field have yet to be convinced. "I would have expected the levels to go up, and would need more data to be convinced they don't," says Neil Thomas, an obesity expert from the University of Birmingham, UK.

He also highlights other potential hazards such as pancreatitis and fat emboli, in which multiple blood vessels are plugged with fat globules that are too large to pass through the capillaries - with potentially life-threatening results. "These diseases could have significant health impacts if levels did increase as would have been expected, though this may not be an issue if the data is confirmed," says Thomas.

Michael Hamblin, a researcher at Harvard Medical School in Boston who studies LLLT treatments, says that in his opinion these hazards are extremely unlikely. "While there is some evidence that high blood triglycerides are associated with acute pancreatitis, this is only after chronically high levels for a considerable time."

Maloney says further investigation is warranted, and is conducting a placebo-controlled, randomised, double-blind, multi-centred clinical investigation to evaluate the efficacy of LLLT in lowering serum lipid levels.

"At this stage it is really not possible to judge what will happen with the technology," Thomas adds. "Its effects appear to be relatively short-lived and the big problem in obesity is fat regain, so this would likely still be an issue for anyone using it as a means to reduce weight."

According to Harley Fit I lost two-and-a-half inches (more than 60 millimetres) from around my hips and stomach after one 20-minute session. Would I go again? There are still unanswered questions over how the body deals with the released fat, and how much extra it can cope with. I would want these questions answered before returning for the treatment week after week.

"It may well be a decent alternative to liposuction which is perfectly acceptable as a cosmetic procedure, but does nothing to improve health," says David Haslam, an obesity specialist at the Centre for Obesity

Research at Luton and Dunstable Hospital, and chair of the UK National Obesity Forum. "Individuals who undergo treatment should be aware that diet and physical activity are the cornerstones, and the best way to make a long-lasting improvement in health and appearance."

It may be a decent alternative to liposuction, but it does nothing to improve health

And while questions still remain, it's certainly not a long-term option, nor, as Haslam says, is it a replacement for a gym membership and eating fewer doughnuts.

Freezing fat

Forget about a vigorous workout, or lasers to zap your fat. Could you freeze it off instead? There are hints that adipose tissue is susceptible to damage by the cold. The phenomenon has been well documented in a few rare cases of cold-induced fat necrosis in children whose fatty tissue in their cheeks became damaged by sucking for too long on frozen lollies.

Fat appears to be selectively damaged when exposed to low temperatures. If so, this might provide another way of sculpting away fatty areas of the body.

To test the theory, Dieter Manstein and colleagues from Harvard Medical School in Boston exposed anaesthetised pigs to cooling plates at temperatures between +20 °C and -7 °C for 10 minutes. Using photographs, ultrasound and histological evaluation, the researchers then examined the tissue to assess the level of fat damage, as well as any potential damage to the skin. The team found that the cooling plates caused a biological response in the adipose tissue which resulted in a decrease in the level of fat at sites exposed to cold (*Lasers in Surgery and Medicine*, vol 40, p 595).

Happily, there was no apparent discomfort to any of the animals, although there were some changes in pigmentation and superficial damage to the skin. Histological examination showed 40 per cent of the thickness of the fat layer had been removed under the exposure site. It appeared that most of the fat disappeared from the surface layer, while the deeper fat remained relatively unchanged.

Clinical trials are in progress to test whether freezing off fat is safe and effective on humans. The results are likely to be published within the next few months.

Helen Thomson is New Scientist's careers editor

http://www.newscientist.com/article/mg20527441.700-zap-that-fat-can-lasers-make-you-slimmer-in-minutes.html?DCMP=NLC-nletter&nsref=mg20527441.700

Technique 'tracks' spread of MRSA

Researchers have developed a technique for precisely tracking the spread of the superbug MRSA in hospitals.

The team from the Wellcome Trust Sanger Institute in Cambridge looked at the genomes of MRSA strains from across the globe and at one hospital in Thailand.

They were able to spot small changes that allowed them to track the strain back to an individual patient.

They say this adds to the understanding of how MRSA can spread so rapidly and should lead to better treatments.

DNA sequencing

The research, which is published in the journal Science, involved teams in the UK, in Bath, Oxford and London, and Thailand, Portugal and the United States.

Scientists used new high-throughput DNA sequencing technologies to compare MRSA samples from patients to show how they were genetically related.

" **This work is a great demonstration of new, rapid DNA sequencing that in the near future will be how important pathogens such as MRSA will be identified** "
Prof Mark Enright, Imperial College London

They were able to spot single-letter differences in the genetic code.

They looked at two different sets of samples: one set taken from people across the globe and another from a single hospital in Thailand.

They sequenced the entire genomes of each sample.

In the hospital setting it revealed single letter genetic changes in the samples showing that no two infections were caused by entirely identical bacteria.

This allowed them to discover whether one patient had infected another or whether the infection had come in from another source.

They found that the MRSA strain studied acquired about one single-letter change in its genetic code every six weeks.

Worldwide search

They also looked at samples from hospitals in several parts of the world collected over more than 20 years.

The rate of mutation apparently supports the theory that MRSA emerged in the 1960s at the time of widespread antibiotic use.

Professor Sharon Peacock, a microbiologist at the University of Cambridge said: "The implications for public health are clear. This technology represents the potential to trace transmission pathways of MRSA more definitively so that interventions or treatments can be targeted with precision and according to need."

Researchers say it would be too expensive to use the technology widely at present but the cost should fall in the next few years.

Professor Mark Enright, an expert in molecular epidemiology at Imperial College, London, said the work gave researchers "a good idea as to how this particular type of MRSA has evolved and how it behaves in and out of hospitals".

"This work is a great demonstration of new, rapid DNA sequencing that in the near future will be how important pathogens such as MRSA will be identified," he said.

"Such unambiguous identification will form the basis for rapid diagnostics of microbial infection and will tell us how they spread in hospitals identifying each human host and surface in chains of transmission between patients."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8471137.stm

Published: 2010/01/21 19:16:41 GMT

Cell 'surfing' aids virus spread

Some viruses may be able to accelerate around the body by helping each other find uninfected cells to attack, scientists say.

The mechanism, caught on camera by experts at London's Imperial College, may explain the improbable speed with which some viruses spread.

The virus detects if a cell is occupied by another virus and simply "bounces" off in search of a free one.

One expert said it was a convincing and fascinating study.

The study in the journal Science says researchers used the vaccinia virus which was used to eradicate smallpox.

When a virus meets an unoccupied cell it burrows inside leaving a protein marker on the outside membrane.

It is these "occupied" signs that actually push other viruses away towards uninfected cells.

Mechanism

Viruses multiply by entering cells and hijacking the cell machinery to start copying themselves.

" **This fundamentally changes how we think about virus dissemination and similar strategies may very well be exploited by many viruses** "
Professor Geoffrey Smith, Imperial College London

When a large number of copies are made, the cell bursts and releases the new viruses to repeat the process on nearby cells.

However, scientists have always been puzzled that some viruses appear able to spread very rapidly, even though their rate of replication does not match that speed.

The Imperial College researchers, led by Professor Geoffrey Smith, think they may have found a neat trick used by some viruses to spread more efficiently.

If more than one virus enters the cell, it would be a waste, as only one can replicate once inside, and many viruses have ways to prevent this "superinfection".

'Surfing'

However, the vaccinia poxvirus does more - on entering the cell, it leaves two viral proteins on the cell surface.

If another virus approached, these proteins would trigger it to push out snake-like projections called "actins" from its surface, actively bouncing it away to "surf" towards uninfected cells further afield.

Prof Smith said: "This effectively says to additional virus particles trying to infect the cell 'I'm infected already, there is no point coming here, you need to go elsewhere' - and remarkably the virus particles are physically repelled until they find an uninfected cell."

He said that other viruses might share this feature, and that the discovery might lead to strategies to slow the spread of viruses, limiting the ability of an infection to cause illness.

"This fundamentally changes how we think about virus dissemination and similar strategies may very well be exploited by many viruses," said Prof Smith.

Dr Stacey Efstathiou, a virologist from the University of Cambridge, said that other viruses, such as herpes viruses, also spread unusually quickly, and could well be employing a similar method.

He said: "The novelty here is the 'bounce', and this study is both very convincing, and fascinating.

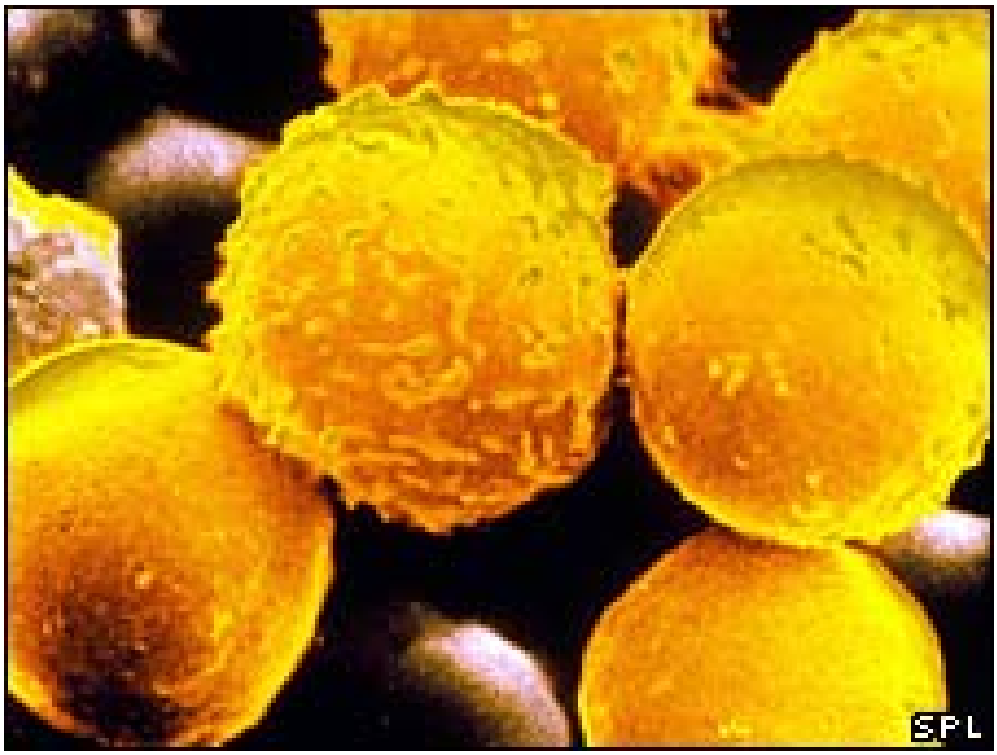
"In theory, if you could block this mechanism of onward propulsion, you could end up severely attenuating the ability of the virus to spread."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8472802.stm

Published: 2010/01/22 00:25:23 GMT

Leukaemia cell breakthrough hope

Scientists believe they have made an important breakthrough in attempts to treat a form of childhood leukaemia.



In mice tests, Australian researchers found that a cell, which plays a key role in T-cell acute lymphoblastic leukaemia, survives radiotherapy.

The Melbourne University team believes targeting this cell may help to stop this disease returning, but they warned much more research was needed.

UK experts said the findings may eventually lead to better care.

T-cell acute lymphoblastic leukaemia is a rare form of leukaemia which is most common in older children and adolescents, although adults can also be affected.

About a fifth of children suffer relapses after radiation therapy.

In the tests, the team found that 99% of cells in the thymus, a small organ in the upper chest which helps protect people from infections and as a result plays a key role in leukaemia, were killed by radiation.

Resistance

But the Lmo2 gene was able to recover because of its stem-cell like properties, suggesting it could be responsible for the disease, the Science journal reported.

Lead researcher Dr Matthew McCormack said: "The cellular origins of this leukaemia are not well understood.

"Our discovery that these cells are similar to normal stem cells explains why they are capable of surviving for long periods.

"It also explains why they are remarkably resistant to treatment."

The team is now planning to focus on novel treatment capable of killing these cells, but warns it is still many years away from clinical trials.

Ken Campbell, of Leukaemia Research, said: "This is an interesting piece of research that increases our understanding of this small sub-set of childhood leukaemia patients.

"However, while the research could reduce relapse rates in the future for this group, it is likely that current treatment regimes will continue to be used."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8472628.stm

Published: 2010/01/22 00:16:37 GMT

Springtime Ozone Increases Above Western North America Linked to Emissions from Abroad

A cadre of government and commercial aircraft helped collect data for a new study linking an increase in springtime ozone levels in western North America with pollutants drifting eastward from overseas, including Asia. (Credit: Image courtesy NOAA)

ScienceDaily (Jan. 21, 2010) — Springtime ozone levels above western North America are rising primarily due to air flowing eastward from the Pacific Ocean, a trend that is largest when the air originates in Asia.

Such increases in ozone could make it more difficult for the United States to meet Clean Air Act standards for ozone pollution at ground level, according to a new international study. Published online January 20 in the journal *Nature*, the study analyzed large sets of ozone data captured since 1984.

"In springtime, pollution from across the hemisphere, not nearby sources, contributes to the ozone increases above western North America," said lead author Owen R. Cooper, of the NOAA-funded Cooperative Institute for Research in Environmental Sciences at the University of Colorado at Boulder. "When air is transported from a broad region of south and east Asia, the trend is largest."

The study focused on springtime ozone in a slice of the atmosphere from two to five miles above the surface of western North America, far below the protective ozone layer but above ozone-related, ground-level smog that is harmful to human health and crops. Ozone in this intermediate region constitutes the northern hemisphere background, or baseline, level of ozone in the lower atmosphere. The study was the first to pull together and analyze nearly 100,000 ozone observations gathered in separate studies by instruments on aircraft, balloons and other platforms.

Combustion of fossil fuels releases pollutants like nitrogen oxides and volatile organic compounds, or VOCs, which react in the presence of sunlight to form ozone. North American emissions contribute to global ozone levels, but the researchers did not find any evidence that these local emissions are driving the increasing trend in ozone above western North America.

Cooper and colleagues from NOAA's Earth System Research Laboratory in Boulder and eight other research institutes used historical data of global atmospheric wind records and sophisticated computer modeling to match each ozone measurement with air-flow patterns for several days before it was recorded. This approach essentially let the scientists track ozone-producing emissions back to a broad region of origin.

This method is like imagining a box full of 40,000 tiny weightless balls at the exact location of each ozone measurement, said Cooper. Factoring in winds in the days prior to the measurement, the computer model estimates which winds brought the balls to that spot and where they originated.

When the dominant airflow came from south and east Asia, the scientists saw the largest increases in ozone measurements. When airflow patterns were not directly from Asia, ozone still increased but at a lower rate, indicating the possibility that emissions from other places could be contributing to the ozone increases above North America.

The study used springtime ozone measurements because previous studies have shown that air transport from Asia to North America is strongest in spring, making it easier to discern possible effects of distant pollution on the North American ozone trends.

Ozone-measuring research balloons and research aircraft collected a portion of the data. Commercial flights equipped with ozone-measuring instruments also collected a large share of the data through the MOZAIC program, initiated by European scientists in 1994. The bulk of the data was collected between 1995 and 2008, but the team also included a large ozone dataset from 1984.

The analysis shows an overall significant increase in springtime ozone of 14 percent from 1995 to 2008. When they included data from 1984, the year with the lowest average ozone level, the scientists saw a similar rate of increase from that time through 2008 and an overall increase in springtime ozone of 29 percent.

"This study did not quantify how much of the ozone increase is solely due to Asia," Cooper said. "But we can say that the background ozone entering North America increased over the past 14 years and probably over the past 25 years."

The influence of ozone from Asia and other sources on ground-level air quality is a question for further study, Cooper said. Scientists will need to routinely measure ozone levels close to the surface at several locations along the West Coast to see whether similar trends are impacting ground-level air quality.

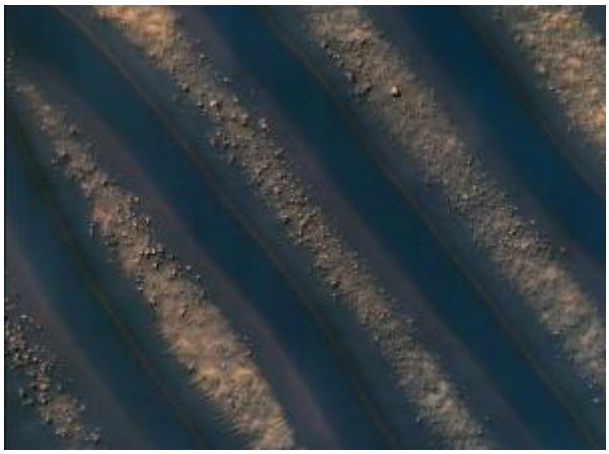
Collaborating institutions include the Norwegian Institute for Air Research, the National Center of Scientific Research Midi-Pyrenees Observatory in Toulouse, France; the Meteorological Service of Canada; NASA Jet Propulsion Laboratory and the California Institute of Technology; the University of Washington; the National Center for Atmospheric Research in Boulder; and NASA's Langley Research Center in Hampton, Va.

Story Source:

Adapted from materials provided by University of Colorado at Boulder, via EurekAlert!, a service of AAAS.

http://www.sciencedaily.com/releases/2010/01/100120131252.htm

Resumed Mars Orbiter Observations Yield Stunning Views



Dunes of sand-sized materials have been trapped on the floors of many Martian craters. This is one example, from a crater in Noachis Terra, west of the giant Hellas impact basin. (Credit: NASA/JPL-Caltech/University of Arizona)

ScienceDaily (Jan. 21, 2010) — Dunes of sand-sized materials have been trapped on the floors of many Martian craters. This view shows dunes inside a crater in Noachis Terra, west of the giant Hellas impact basin in Mars' southern hemisphere.

The High Resolution Imaging Science Experiment (HiRISE) camera on NASA's Mars Reconnaissance Orbiter captured this view on Dec. 28, 2009. The orbiter resumed making observations in mid-December following a three-month hiatus. A set of new images from the HiRISE camera is on the camera team's site, at http://hirise.lpl.arizona.edu/nea.php.

The dunes here are linear, thought to be due to shifting wind directions. In places, each dune is remarkably similar to adjacent dunes, including a reddish (or dust-colored) band on northeast-facing slopes. Large angular boulders litter the floor between dunes.

The most extensive linear dune fields known in the solar system are on Saturn's large moon Titan. Titan has a very different environment and composition, so at meter-scale resolution they probably are very different from Martian dunes.

The University of Arizona, Tucson, operates the HiRISE camera, which was built by Ball Aerospace & Technologies Corp., Boulder, Colo. NASA's Jet Propulsion Laboratory, a division of the California Institute of Technology, Pasadena, manages the Mars Reconnaissance Orbiter for the NASA Science Mission Directorate, Washington. Lockheed Martin Space Systems, Denver, is the prime contractor for the project and built the spacecraft.

Story Source:

Adapted from materials provided by NASA/Jet Propulsion Laboratory.

http://www.sciencedaily.com/releases/2010/01/100119085221.htm

Jurassic 'Burn-Down' Events and Organic Matter Richness in the Kimmeridge Clay Formation

Monika Kodrans-Nsiah inspects an exposed section of the Kimmeridge Clay Formation on Dorset's "Jurassic Coast." (Credit: Ian Harding (NOCS))

ScienceDaily (Jan. 21, 2010) — The sediments of the Kimmeridge Clay Formation were deposited during the Late Jurassic between around 160 and 145 million years ago, the age of the reptiles. They are the main oil source rock in the North Sea. However, within this unit beds rich in organic matter are interspersed with organic-poor sediments. New evidence demonstrates that organic-poor sediments were probably caused by post-depositional loss of organic matter during so-called 'burn-down' events.

The Kimmeridge Clay Formation is named after the English village of Kimmeridge on Dorset's 'Jurassic Coast', a favourite haunt of fossil hunters. The sediments comprising the formation, which is particularly well exposed here, were probably deposited in shallow marine environment with an average water depth of 50-100 metres.

"We were particularly interested in the transition between organic-rich and organic-poor sediments," said Dr Ian Harding of the University of Southampton's School of Ocean and Earth Science at the National Oceanography Centre, Southampton (NOCS), and a member of the team that investigated the underlying processes.

A long-held hypothesis is that the organic-rich beds were the result of elevated planktonic productivity in sunlit surface waters, possibly accentuated by enhanced preservation of the resulting organic matter by the oxygen-depleted bottom waters resulting from this excess productivity.

A second possibility was that a cyclic rise and fall of the interface between oxygenated and oxygen-depleted waters was responsible for the transition between organic-rich and organic poor sediments. According to this theory, when oxygenated waters reached the seabed, organic matter already deposited would have been oxidised and degraded. These post-depositional 'burn down' events could have alternated with periods during which the bottom waters had little oxygen, favouring preservation of organic matter.

"The first theory emphasises changes in the amount of organic matter reaching the seabed, while the 'burn-down' theory puts more weight on the relative dominance of preservation or degradation after it has got there," said Dr Harding.

To distinguish between these two theories, he and colleagues from the University of Bremen and the Alfred Wegener Institute for Polar and Marine Research in Bremerhaven, analysed the chemical composition and organic content of a sediment core from a borehole in Swanworth Quarry in Dorset, originally drilled as part of the Natural Environment Research Council (NERC) Rapid Global Geological Events Project run by NOCS' Prof. John Marshall.

Monika Kodrans-Nsiah, a PhD student jointly supervised by Dr Harding and Dr Karin Zonneveld (Bremen) was responsible for analysing the fossilised organic cysts of various species of dinoflagellate, a group of tiny aquatic organisms, found in the sediments. Different dinoflagellate species are known to be adapted to different environmental conditions, so studying the distribution of 'dinocyst' fossils helps reconstruct past environments.

The lower part of the core was rich in organic carbon, with abundant dinocysts, and its chemical composition was indicative of anoxic conditions, implying that sediments were deposited and preserved in an oxygen-deficient environment.

However, the chemical composition of the uppermost sediments indicated the presence of oxygenated water when they were deposited. This transition was sudden, occurring at a drilling depth of 122.37 metres, but changes in organic content and dinocyst distributions were more gradual.

"It looks likely that influxes of well-oxygenated bottom water caused the oxidation and degradation of organic matter and cysts after they were deposited," said Dr Harding: "This would explain the gradual reduction in the amount of organic matter above the transition, and provide support for the idea of 'burn-down' events during the Jurassic."

The study was supported by the German Research Foundation (DFG grant EUROPROX). The investigated core was drilled as part of the Natural Environmental Research Council (NERC) Special Topic 'Rapid Global Geological Events (RGGE) Kimmeridge Drilling Project'.

The researchers are: Monika Kodrans-Nsiah, Christian März and Karin Zonneveld (University of Bremen). Ian Harding (SOES/NOCS), and Sabine Kasten (Alfred Wegener Institute for Polar and Marine Research, Bremerhaven). MKN and CM are now at the University of Szczecin and the University of Oldenburg, respectively.

Story Source:

Adapted from materials provided by National Oceanography Centre, Southampton (UK).

Journal Reference:

1. Kodrans-Nsiah et al. **Are the Kimmeridge Clay deposits affected by "burn-down" events? Palynological and geochemical studies on a 1 metre long section from the Upper Kimmeridge Clay Formation (Dorset, UK)**. *Sedimentary Geology*, 2009; 222 (3-4): 301 DOI: 10.1016/j.sedgeo.2009.09.015

http://www.sciencedaily.com/releases/2010/01/100119111055.htm

Animals Populated Madagascar by Rafting There

How did the lemurs, flying foxes and narrow-striped mongooses get to the large, isolated island of Madagascar sometime after 65 million years ago? A pair of scientists say their research confirms the longstanding idea that the animals hitched rides on natural rafts blown out to sea. (Credit: Image courtesy of Purdue University)

ScienceDaily (Jan. 21, 2010) — How did the lemurs, flying foxes and narrow-striped mongooses get to the large, isolated island of Madagascar sometime after 65 million years ago?

A pair of scientists say their research confirms the longstanding idea that the animals hitched rides on natural rafts blown out to sea.

Professors Matthew Huber of Purdue and Jason Ali of the University Hong Kong say that the prevailing flow of ocean currents between Africa and Madagascar millions of years ago would have made such a trip not only possible, but fast, too. The findings, based on a three-year computer simulation of ancient ocean currents, will be published in the journal *Nature* and were posted on Nature's website on Jan. 20.

The idea that animals rafted to the island is not new. Since at least 1915, scientists have used it as an alternative theory to the notion that the animals arrived on Madagascar via a land bridge that was later obliterated by shifting continents. Rafting would have involved animals being washed out to sea during storms, either on trees or large vegetation mats, and floating to the mini-continent, perhaps while in a state of seasonal torpor or hibernation.

Huber and Ali's work supports a 1940 paper by George Gaylord Simpson, one of the most influential paleontologists and evolution theorists of the 20th century. Simpson introduced the concept of a "sweepstakes" process to explain the chance of raft colonization events taking place through vast stretches of geological time. Once the migrants arrived on the world's fourth largest island, their descendants evolved into the distinctive, and sometimes bizarre forms seen today.

"What we've really done is prove the physical plausibility of Simpson's argument," Huber said.

Anthropologists and paleontologists have good reason to be interested in Madagascar's animals. The island is located in the Indian Ocean roughly 300 miles east of Africa over the Mozambique Channel and is otherwise isolated from significant land masses. Its isolation and varied terrain make it a living laboratory for scientists studying evolution and the impact of geography on the evolutionary process.

Madagascar has more unique species of animals than any location except Australia, which is 13 times larger. The island's population includes 70 kinds of lemurs found nowhere else and about 90 percent of the other mammals, amphibians and reptiles are unique to its 226,656 square miles.

The question has always been how the animals arrived there in the first place. Madagascar appears to have been an island for at least 120 million years, and its animal population began arriving much later, sometime after 65 million years ago.

The raft hypothesis, which scientists refer to as "dispersal," has always presented one big problem, however. Currents and prevailing winds between Madagascar and Africa flow south and southwest, away from, not toward, the island.

Yet, the land bridge hypothesis also is problematic in that there is no geologic evidence that such a bridge existed during the time in question. Also, there are no large mammals such as apes, giraffes, lions or elephants, indigenous to Madagascar. Only small species such as lemurs, the island's signature species; hedgehog-like tenrecs; rodents; mongoose-like carnivores; and similar animals populate the island.

The animals of Madagascar also appear to have arrived in occasional bursts of immigration by species rather than in a continuous, mixed migration. They likewise appear to have evolved from single ancestors, and their closest relatives are in Africa, scientists say. All of which suggests Simpson's theory was correct.

Ali, who has a research focus in plate tectonics -- the large-scale motions of the Earth's outer shell -- kept running across the land bridge hypothesis in the course of his work. The question intrigued him because the notion of a bridge between Madagascar and Africa appeared to break rules of plate tectonic theory. A background in oceanography also made him think ocean currents between Africa and Madagascar might have changed over time.

"Critically, Madagascar and Africa have together drifted more than 1,600 kilometers northwards and could thus have disrupted a major surface water current running across the tropical Indian Ocean, and hence modified flow around eastern Africa and Madagascar," says Ali, an earth sciences professor.

That led Ali to contact Huber, a paleoclimatologist who reconstructs and models the climate millions of years in the past. Huber, a Purdue earth and atmospheric sciences professor, has a particular interest and expertise in ocean currents, which have a significant impact on climate.

Huber models ancient conditions at a time when the planet was much warmer than it is today, and he specializes in lengthy, highly detailed simulations. He uses the modeling of a warmer Earth in the past -- warm enough for crocodiles to live in an ice-free Arctic -- to help understand conditions generated by today's global warming and to project what the warming trend may hold for the future.

When Ali contacted him about the Madagascar question, Huber had just finished running a three-year simulation on a supercomputer operated by Information Technology at Purdue (ITaP), Purdue's central information technology organization. The modeling produced 100 terabytes of output -- data with potential uses for a variety of purposes, including a study of ancient ocean currents around Madagascar.

The Purdue professor was able to show that 20 million to 60 million years ago, when scientists have determined ancestors of present-day animals likely arrived on Madagascar, currents flowed east, toward the island. Climate modeling showed that currents were strong enough -- like a liquid jet stream in peak periods -- to get the animals to the island without dying of thirst. The trip appears to have been well within the realm of possibility for small animals whose naturally low metabolic rates may have been even lower if they were in torpor or hibernating.

Huber's computer modeling also indicates that the area was a hotspot at the time, just as it is today, for powerful tropical cyclones capable of regularly washing trees and tree islands into the ocean.

"It seems likely that rafting was a distinct possibility," the study concludes. "All signs point to the Simpson sweepstakes model as being correct: Ocean currents could have transported rafts of animals to Madagascar from Africa during the Eocene."

The raft hypothesis has always been the most plausible, says Anne Yoder, director of the Duke University Lemur Center. She specializes in using molecular biogenetic techniques and geospatial analysis to examine the evolutionary history of Madagascar. But Ali and Huber's study now puts hard data behind it, says the Duke professor of biology, biological anthropology and anatomy.

"I was very excited to see this paper," says Yoder, whom Nature asked to review the study prior to publication. "Dispersal has been a hypothesis about a mechanism without any actual data. This takes it out of the realm of storytelling and makes it science."

Ali says the study also is relevant to the movement of animal species elsewhere on the planet, lending support for dispersal over a competing idea that animals arrived at their positions on the drifting land masses of the continents as the Earth took its current form.

Moreover, the Madagascar study provided a test case confirming scientists' ability to model ocean and atmosphere interactions in a past greenhouse climate, Huber said. The National Science Foundation recently funded Huber to further simulate ocean currents in the Eocene epoch, roughly 39 million to 56 million years ago, using the methodology he applied to Madagascar.

Story Source:

Adapted from materials provided by Purdue University.

Journal Reference:

1. Jason R. Ali & Matthew Huber. **Mammalian biodiversity on Madagascar controlled by ocean currents**. *Nature*, January 21, 2010

http://www.sciencedaily.com/releases/2010/01/100120131159.htm

Prototype for a New Living Concept: Living Module Makes Its Debut

Inside view (computer graphic). (Credit: Image courtesy of Empa)

ScienceDaily (Jan. 21, 2010) — On 12th January 2010 the "Self" living module was presented publicly for the first time at the Swissbau exhibition in Basel. "Self" is a novel, highly innovative module for working and living which is self-sufficient in energy and water consumption. It includes a bedroom, bathroom, toilet and kitchen and is being used as a test bed and demonstrator for new building concepts and energy technologies by the research institutes Empa and Eawag.

The "Self" living module is designed as a living area and workplace for two persons. It is about the size of a shipping container and is independent of external water and energy supplies. Because the "Self" module is easily transported and can be located almost anywhere without difficulty, it is particularly suitable for temporary use, for example as a mobile research station, an event organizer's dwelling and office, or as an inhabited advertising vehicle, to name but a few possibilities.

Two undergraduates at the Zurich University of the Arts (ZHdK), Bjoern Olsson und Sandro Macchi, designed the Empa concept-demonstrator for their final year project, and since 2008 they have both been working together with the team led by Mark Zimmermann of Empa's Building Technologies Laboratory on the practical implementation of their design study. As a research and demonstration project "Self" is intended to provide concrete proof that it is possible to live -- at least temporarily -- without loss of comfort even when making sole use of natural sources of energy. The prototype module, constructed with the help of a wide range of universities and industrial partners, is being presented for the first time at the Swissbau fair for the construction and real estate sectors held on the Basel Exhibition Site from the 12th to 16th January.

Independent of external energy and water supplies

"Self" is 7.7 meters long, 3.45 meters wide and 3.2 meters high. Weighing in at around 5 tonnes, the container can easily be transported by truck or helicopter. The challenge for the two young designers lay in integrating the technical, supply and spatial requirements efficiently while maintaining comfort levels for the inhabitants. Technical input was provided by Empa and Eawag as well as other partner institutions

and companies. In order, for example, that two persons might live in "Self" without needing external water supplies, rain water which collects on the roof of the module must be treated to make it potable, and lightly soiled washing water ("gray water") must be recycled. In the living room a transparent 200 liter fresh water tank makes it clear to the occupants how much water they are using. Making consumption visible is an important feature for the two designers. Bjoern Olsson and Sandro Macchi are convinced that "…abstract consumption s don't actually mean very much. To change our behavior we need to make resource usage tangible and clearly visible."

Testing innovative technologies and materials

Hardly any of the features of the "Self" module reflect the current state of the art -- nearly everything is made of specially designed and manufactured components, one example being the shell of the container which is made of glass fiber reinforced polymer sandwich. Thermal insulation is provided by high performance vacuum insulating panels, a heat exchanger warms the fresh air using heat extracted from the exhaust air stream, the water filter operates almost without using any electric power and the toilet consumes just one liter of water per flushing cycle.

The project is also testing the practical applications of hydrogen technology -- that is the synthesis, storage and usage of hydrogen for cooking and heating, for instance. The gas is generated by electrolysis using environmentally friendly electrical power supplied by solar cells on the roof of the module. Until it is required the hydrogen is stored in containers of metal hydride material, also an Empa-developed first.

For the foreseeable future the "Self" module will be used as a technology demonstrator and be exhibited at trade fairs and shows. Later Empa intends to utilize the module as living quarters for guests or as a research station in the mountains.

Story Source:

Adapted from materials provided by Empa, via AlphaGalileo.

http://www.sciencedaily.com/releases/2010/01/100118092018.htm

Infrared Hunt Begins: WISE Starts All-Sky Survey

This artist's conception shows NASA's Wide-field Infrared Survey Explorer, or WISE, mapping the whole sky in infrared. The mission will unveil hundreds of thousands of asteroids, and hundreds of millions of stars and galaxies. (Credit: Ball/NASA/JPL-Caltech)

ScienceDaily (Jan. 21, 2010) — NASA's Wide Field Infrared Survey Explorer (WISE) began its survey of the infrared sky Jan. 14, 2010. The mission will spend nine months scanning the sky one-and-a-half times in infrared light, revealing all sorts of cosmic characters -- everything from near-Earth asteroids to young galaxies more than ten billion light-years away.

WISE, which launched Dec. 14, 2009, from Vandenberg Air Force Base in California, will uncover hundreds of thousands of asteroids, and hundreds of millions of stars and galaxies. Its vast catalog of data will provide astronomers and other missions with data for mine for decades to come.

NASA's Jet Propulsion Laboratory manages the Wide-field Infrared Survey Explorer for NASA's Science Mission Directorate, Washington. The principal investigator, Edward Wright, is at UCLA. The mission was competitively selected under NASA's Explorers Program managed by the Goddard Space Flight Center, Greenbelt, Md. The science instrument was built by the Space Dynamics Laboratory, Logan, Utah, and the spacecraft was built by Ball Aerospace & Technologies Corp., Boulder, Colo. Science operations and data processing take place at the Infrared Processing and Analysis Center at the California Institute of Technology in Pasadena. Caltech manages JPL for NASA.

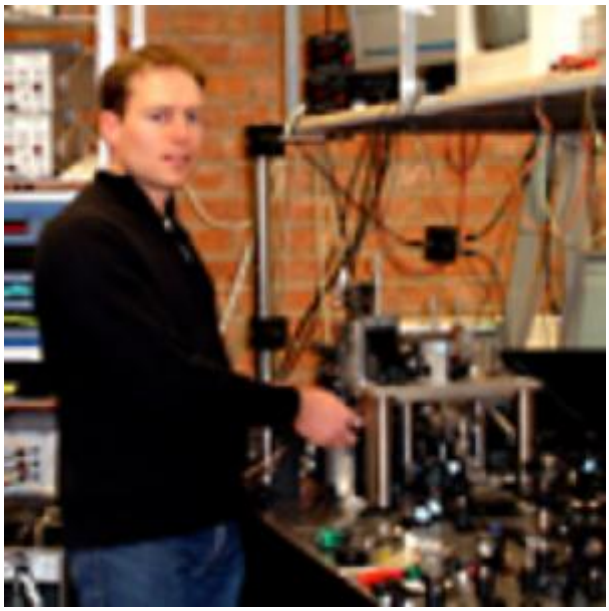
More information is online at http://www.nasa.gov/wise, http://wise.astro.ucla.edu and http://www.jpl.nasa.gov/wise .

Story Source:

Adapted from materials provided by NASA/Jet Propulsion Laboratory.

http://www.sciencedaily.com/releases/2010/01/100119085538.htm

Biophysicists Manipulate 'Zipper,' Reveal Protein Folding Dynamics



Christoph Gebhardt in his laboratory. (Credit: Image courtesy of Technische Universitaet Muenchen)

ScienceDaily (Jan. 20, 2010) — Biophysicists at TUM, the Technische Universitaet Muenchen, have published the results of single-molecule experiments that bring a higher-resolution tool to the study of protein folding. How proteins arrive at the three-dimensional shapes that determine their essential functions -- or cause grave diseases when folding goes wrong -- is considered one of the most important and least understood questions in the biological and medical sciences.

Folding itself follows a path determined by its energy landscape, a complex property described in unprecedented detail by the TUM researchers. In the *Proceedings of the National Academy of Sciences*, they report taking hold of a single, zipper-like protein molecule and mapping changes in its energy landscape during folding and unfolding.

Previous studies, including atomic force microscopy experiments by the same Munich laboratory, have gone a long way toward characterizing energy thresholds or barriers that stand between a protein's unfolded and folded states. Detailed observations of the quick transition from one state to the other have remained elusive. The new results open the door to higher-resolution, direct measurements. Better characterization of the folding process is seen as a vital link in understanding the chain of events leading from DNA coding for a protein to that protein's biological function. Another motivation for research in this field is the search for new drugs and therapies, because malfunctions in protein folding are implicated in a number of serious diseases -- including diabetes, cancer, cystic fibrosis, prion diseases, and Alzheimer's.

This is the latest in a long series of single-molecule biophysical experiments carried out by Professor Matthias Rief and colleagues in the TUM Department of Physics. Co-authors Christof Gebhardt and Thomas Bornschloegl are members of Rief's lab; Gebhardt also is a member of the Munich Center for Integrated Protein Science.

As a model system for studying real-time protein folding dynamics, the TUM scientists chose a so-called leucine zipper found in yeast. It offers, as proteins go, a relatively simple "coiled coil" structure and zipper-like folding action: Picture two amino acid strings side by side, joined at the bottom, open at the top, and made essentially to zip together.

The researchers extended this structure so that they could make independent measurements at the top, bottom, and middle parts of the zipper. They took hold of the free ends at the top of the zipper with handles made of double-stranded DNA. These DNA handles in turn were attached to tiny beads that could be directly manipulated by "optical tweezers" -- a tool based on the ability of laser beams with a certain kind of profile to pin down nanoscale objects. One end of the protein molecule was held fixed, and the other was held under tension but with some freedom to move, so that folding dynamics could be measured directly, in real time, as the protein zipped and unzipped. This arrangement enabled measurements with high resolution in both space and time.

"What I consider the major improvement is that the new experiments allow the observation of thousands of transitions between the folded and the unfolded state," Rief said. "This enables us to detect not only the folded and unfolded states but also, directly, the excursions of the large energy barriers separating those states. This has previously been impossible, and it now allows direct insight into the precise energy profile of this barrier."

Story Source:

Adapted from materials provided by Technische Universitaet Muenchen.

Journal Reference:

1. J. Christof M. Gebhart, Thomas Bornschloegl, and Matthias Rief. **Full distance resolved folding energy landscape of one single protein molecule**. *Proceedings of the National Academy of Sciences*, 2010; (in press)

http://www.sciencedaily.com/releases/2010/01/100119103730.htm

Near-Earth Encounters Can 'Shake' Asteroids

Asteroids. For decades, astronomers have analyzed the impact that asteroids could have on Earth. New research by MIT Professor of Planetary Science Richard Binzel examines the opposite scenario: that Earth has considerable influence on asteroids -- and from a distance much larger than previously thought. (Credit: NASA)

ScienceDaily (Jan. 20, 2010) — For decades, astronomers have analyzed the impact that asteroids could have on Earth. New research by MIT Professor of Planetary Science Richard Binzel examines the opposite scenario: that Earth has considerable influence on asteroids -- and from a distance much larger than previously thought. The finding helps answer an elusive, decades-long question about where most meteorites come from before they fall to Earth and also opens the door to a new field study of asteroid seismology.

By analyzing telescopic measurements of near-Earth asteroids (NEAs), or asteroids that come within 30 million miles of Earth, Binzel has determined that if an NEA travels within a certain range of Earth, roughly one-quarter of the distance between Earth and the moon, it can experience a "seismic shake" strong enough to bring fresh material called "regolith" to its surface. These rarely seen "fresh asteroids" have long interested astronomers because their spectral fingerprints, or how they reflect different wavelengths of light, match 80 percent of all meteorites that fall to Earth, according to a paper by Binzel appearing in the Jan. 21 issue of *Nature*. The paper suggests that Earth's gravitational pull and tidal forces create these seismic tremors.

By hypothesizing about the cause of the fresh surfaces of some NEAs, Binzel and his colleagues have tried to solve a decades-long conundrum about why these fresh asteroids are not seen in the main asteroid belt, which is between Mars and Jupiter. They believe this is because the fresh surfaces are the result of a close encounter with Earth, which obviously wouldn't be the case with an object in the main asteroid belt. Only those few objects that have ventured recently inside the moon's orbital distance and have experienced a "fresh shake" match freshly fallen meteorites measured in the laboratory, Binzel said.

Clark Chapman, a planetary scientist at the Southwest Research Institute in Colorado, believes Binzel's work is part of a "revolution in asteroid science" over the past five years that considers the possibility that something other than collisions can affect asteroid surfaces.

How they did it: Binzel's team used a large NASA telescope in Hawaii to collect information on NEAs, including a huge amount of spectral fingerprint data. Analyzing this data, the group examined where a sample of 95 NEAs had been during the past 500,000 years, tracing their orbits to see how close they'd come to Earth. They discovered that 75 NEAs in the sample had passed well inside the moon's distance within the past 500,000 years, including all 20 fresh asteroids in the sample.

Binzel next determined that an asteroid traveling within a distance equal to 16 times the Earth's radius (about one-quarter of the distance to the moon) appears to experience vibrations strong enough to create fresh surface material. He reached that based on his finding that about one-quarter of NEAs are fresh, as well as two known facts -- that the space weathering process that ages regolith can happen in less than one million years, and that about one-quarter of NEAs come within 16 Earth radii in one million years.

Before now, people thought an asteroid had to come within one to two Earth radii to undergo significant physical change.

Next steps: Many details about the shaking process remain unknown, including what exactly it is about Earth that shakes the asteroids, and why this happens from a distance as far away as 16 Earth radii. What is certain is that the conditions depend on complex factors such as the velocity and duration of the encounter, the asteroid's shape and the nature of the preexisting regolith. "The exact trigger distance depends on all those seismology factors that are the totally new and interesting area for cutting edge research," Binzel said.

Further research might include computer simulations, ground observations and sending probes to look at the surfaces of asteroids. Binzel's next steps will be to try to discover counterexamples to his findings or additional examples to support it. He may also investigate whether other planets like Venus or Mars affect asteroids that venture close to them.

Story Source:

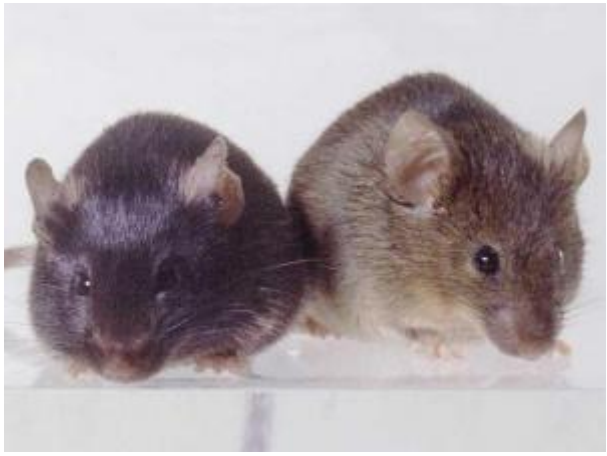
Adapted from materials provided by Massachusetts Institute of Technology, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Binzel et al. **Earth encounters as the origin of fresh surfaces on near-Earth asteroids**. *Nature*, 2010; 463 (7279): 331 DOI: 10.1038/nature08709

http://www.sciencedaily.com/releases/2010/01/100120131149.htm

Copper-Free Click Chemistry Used in Mice



Laboratory mice. (Credit: Image courtesy of DOE/Lawrence Berkeley National Laboratory)

ScienceDaily (Jan. 20, 2010) — For the first time, the widely used molecular synthesis technique known as click chemistry has been safely applied to a living organism. Researchers with Lawrence Berkeley National Laboratory (Berkeley Lab) and the University of California (UC) Berkeley have crafted a unique copper-free version of click chemistry to create biomolecular probes for *in vivo* studies of live mice. Conventional click chemistry reactions require a copper catalyst that is toxic to cells and organisms.

"We developed a variant of the click chemistry reactions that possesses comparable kinetics to the conventional copper-catalyzed reactions, only without the requirement of a toxic metal," says Carolyn Bertozzi, a Berkeley Lab-UC Berkeley chemist who leads this research. "Our latest studies have now established copper-free click chemistry as a bioorthogonal reaction that can be executed in the physiologically relevant context of a mouse."

Bertozzi and her research group used copper-free click chemistry to label glycans in a variety of mouse tissues including the intestines, heart and liver. Glycans are sugars that are ubiquitous to living organisms and abundant on the surfaces of cells. They are central to the signaling that takes place between cells during development and are also involved in bacterial and viral infections, as well as the immune system's response to such infections.

"There is great scientific interest in monitoring the dynamics of glycans as they move about within cells and on the cell surface, but the means to tag glycans with imaging probes in living organisms has been lacking," says Bertozzi, who is the director of Berkeley Lab's Molecular Foundry, a faculty scientist with Berkeley Lab's Materials Sciences and Physical Biosciences Divisions, and the T.Z. and Irmgard Chu Distinguished Professor of Chemistry as well as a professor of Molecular and Cell Biology at UC Berkeley. She is also an investigator with the Howard Hughes Medical Institute (HHMI).

For the past decade, Bertozzi, a leading authority on glycobiology, has worked with various collaborators to devise means by which glycans can be used for molecular imaging in living cells and organisms.

"Molecular imaging reveals a wealth of information about biomolecules in their native environments and glycans are appealing targets for molecular imaging," she says. "A major focus of my research has been the development of chemical approaches for probing the functions of glycans in cell-based systems, and the application of these tools to studies of glycobiology."

Two years ago, Bertozzi and her research group developed the first copper-free variant of the click chemistry reactions, which they used to probe glycan dynamics in living cells and in live zebrafish

embryos. Now they have applied copper-free click chemistry to the laboratory mouse, which is widely regarded as the model organism for studying human pathology.

The results of this latest development have been published in the *Proceedings of the National Academy of Sciences* (PNAS). Co-authoring the paper with Bertozzi were Pamela Chang, Jennifer Prescher, Ellen Sletten, Jeremy Baskin, Isaac Miller, Nicholas Agard and Anderson Lo.

Chemistry with a Click

Click chemistry is best known for a copper-catalyzed azide-alkyne reaction that makes it possible for certain chemical building blocks to "click" together in an irreversible linkage, analagous to the snapping together of Lego blocks. Since its introduction in 2001 by the Nobel laureate chemist Barry Sharpless of the Scripps Research Institute, the copper-catalyzed azide-alkyne reaction has proven extremely valuable for attaching small molecular probes to various biomolecules in a test tube or on fixed cells. However, it can't be used for biomolecule labeling in live cells or organisms because of copper's toxicity.

Earlier work by Bertozzi and her group had shown that glycans can be metabolically labeled with azides -- a functional group featuring three nitrogen atoms -- via a reaction they devised, which they called the Staudinger ligation. To apply click chemistry to glycans, she and her colleagues designed a ring-shaped molecule, called difluorinated cyclooctyne or DIFO, that reacts with azides rapidly at physiological temperatures without the need for a toxic catalyst.

"This copper-free click reaction of azides and DIFO combines the biocompatibility of the Staudinger ligation with the fast reaction kinetics of click chemistry," Bertozzi says.

To apply their copper-free click chemistry to living mice, Bertozzi and her group delivered azides to the surfaces of target cells within the mice via a metabolic precursor, then labeled select glycans(those that bore corresponding azido sialic acids) by covalent reaction *in vivo* with a panel of cyclooctyne-FLAG peptide conjugates. The labeled biomolecules were probed by *ex vivo* analysis of cells and tissue lysates.

"The relative amounts of ligation products observed with different cyclooctynes suggest that both intrinsic reaction kinetics and other properties such as solubility and tissue access govern the efficiency of copper-free click chemistry," Bertozzi says. "More broadly, copper-free click chemistry appears to possess the requisite bioorthogonality to achieve specific biomolecule labeling in this important model organism."

This research was primarily supported by a grant from the National Institutes of Health.

Story Source:

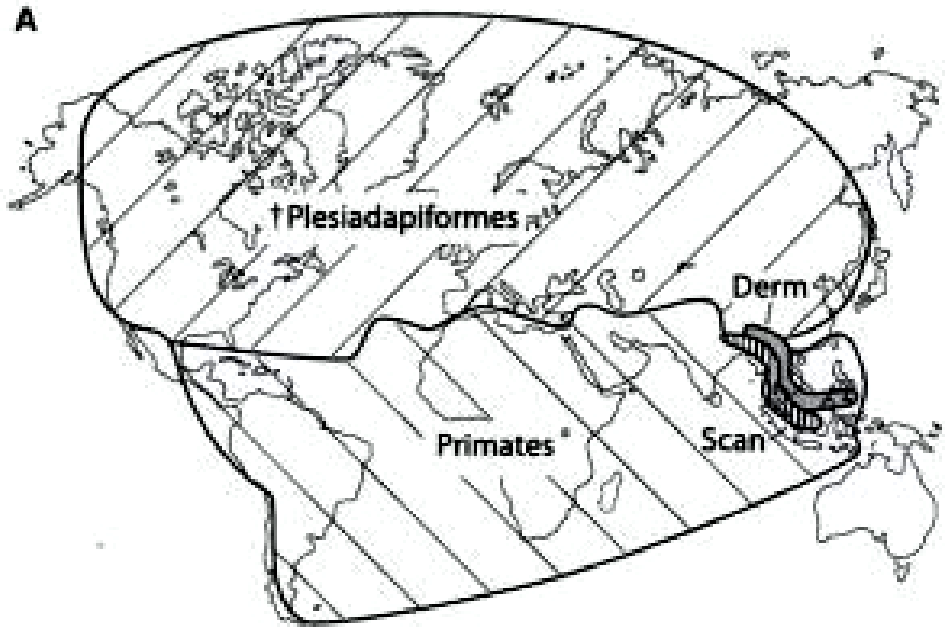
Adapted from materials provided by DOE/Lawrence Berkeley National Laboratory.

Journal Reference:

1. Pamela V. Chang, Jennifer A. Prescher, Ellen M. Sletten, Jeremy M. Baskin, Isaac A. Miller, Nicholas J. Agard, Anderson Lo, and Carolyn R. Bertozzi. **Copper-free click chemistry in living animals**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.0911116107

http://www.sciencedaily.com/releases/2010/01/100119154719.htm

New Theory on the Origin of Primates



New biogeographic reconstruction of primates, flying lemurs, and tree shrews about 185 millions of years in the early Jurassic. (Credit: Image courtesy of Buffalo Museum of Science)

ScienceDaily (Jan. 20, 2010) — A new model for primate origins is presented in *Zoologica Scripta*, published by the Norwegian Academy of Science and Letters and The Royal Swedish Academy of Sciences. The paper argues that the distributions of the major primate groups are correlated with Mesozoic tectonic features and that their respective ranges are congruent with each evolving locally from a widespread ancestor on the supercontinent of Pangea about 185 million years ago.

Michael Heads, a Research Associate of the Buffalo Museum of Science, arrived at these conclusions by incorporating, for the first time, spatial patterns of primate diversity and distribution as historical evidence for primate evolution. Models had previously been limited to interpretations of the fossil record and molecular clocks.

"According to prevailing theories, primates are supposed to have originated in a geographically small area (center of origin) from where they dispersed to other regions and continents" said Heads, who also noted that widespread misrepresentation of fossil molecular clocks estimates as maximum or actual dates of origin has led to a popular theory that primates somehow crossed the globe and even rafted across oceans to reach America and Madagascar.

In this new approach to molecular phylogenetics, vicariance, and plate tectonics, Heads shows that the distribution ranges of primates and their nearest relatives, the tree shrews and the flying lemurs, conforms to a pattern that would be expected from their having evolved from a widespread ancestor. This ancestor could have evolved into the extinct *Plesiadapiformes* in north America and Eurasia, the primates in central-South America, Africa, India and south East Asia, and the tree shrews and flying lemurs in South East Asia.

Divergence between strepsirrhines (lemurs and lorises) and haplorhines (tarsiers and anthropoids) is correlated with intense volcanic activity on the Lebombo Monocline in Africa about 180 million years ago. The lemurs of Madagascar diverged from their African relatives with the opening of the

Mozambique Channel (160 million years ago), while New and Old World monkeys diverged with the opening of the Atlantic about 120 million years ago.

"This model avoids the confusion created by the center of origin theories and the assumption of a recent origin for major primate groups due to a misrepresentation of the fossil record and molecular clock divergence estimates" said Michael from his New Zealand office. "These models have resulted in all sorts of contradictory centers of origin and imaginary migrations for primates that are biogeographically unnecessary and incompatible with ecological evidence."

The tectonic model also addresses the otherwise insoluble problem of dispersal theories that enable primates to cross the Atlantic to America, and the Mozambique Channel to Madagascar although they have not been able to cross 25 km from Sulawesi to Moluccan islands and from there travel to New Guinea and Australia.

Heads acknowledged that the phylogenetic relationships of some groups such as tarsiers, are controversial, but the various alternatives do not obscure the patterns of diversity and distribution identified in this study.

Biogeographic evidence for the *Jurassic* origin for primates, and the pre-*Cretaceous* origin of major primate groups considerably extends their divergence before the fossil record, but Heads notes that fossils only provide minimal dates for the existence of particular groups, and there are many examples of the fossil record being extended for tens of millions of years through new fossil discoveries.

The article notes that increasing numbers of primatologists and paleontologists recognize that the fossil record cannot be used to impose strict limits on primate origins, and that some molecular clock estimates also predict divergence dates pre-dating the earliest fossils. These considerations indicate that there is no necessary objection to the biogeographic evidence for divergence of primates beginning in the *Jurassic* with the origin of all major groups being correlated with plate tectonics.

Story Source:

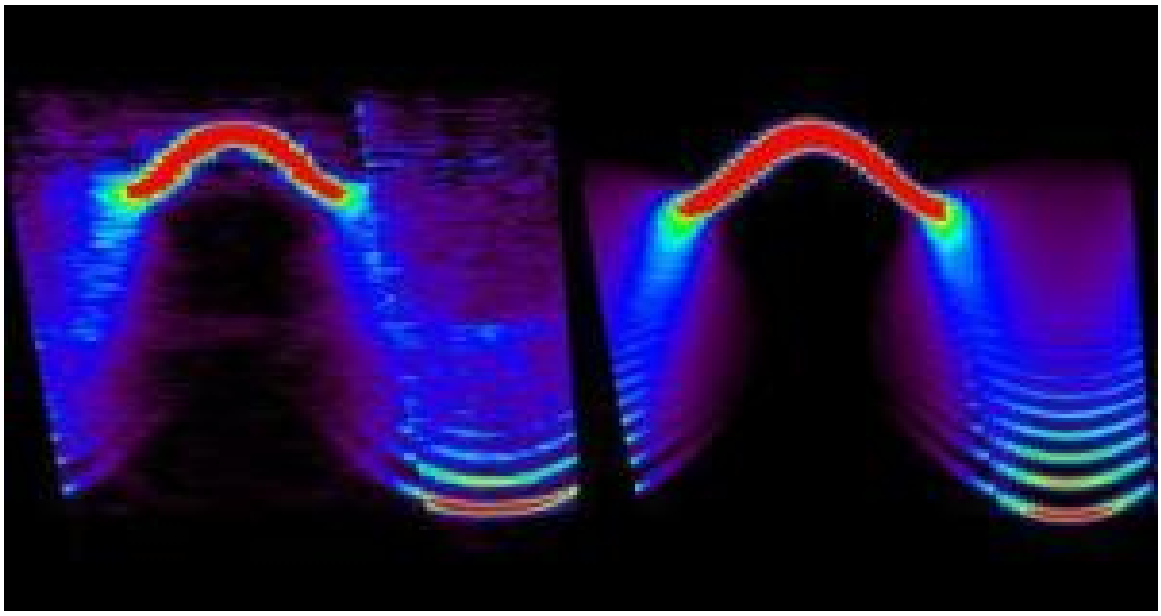
Adapted from materials provided by Buffalo Museum of Science.

Journal Reference:

1. Michael Heads. **Evolution and biogeography of primates: a new model based on molecular phylogenetics, vicariance and plate tectonics**. *Zoologica Scripta*, 2009; DOI: 10.1111/j.1463-6409.2009.00411.x

http://www.sciencedaily.com/releases/2010/01/100119154710.htm

Exotic Symmetry Seen in Ultracold Electrons



Spectrum of magnetic resonances observed by neutron scattering in cobalt niobate in zero magnetic field, data (left) and calculation (right). (Credit: Image courtesy of University of Oxford)

ScienceDaily (Jan. 20, 2010) — An exotic type of symmetry -- suggested by string theory and theories of high-energy particle physics, and also conjectured for electrons in solids under certain conditions -- has been observed experimentally for the first time.

An international team, led by scientists from Oxford University, report in a recent article in *Science* how they spotted the symmetry, termed E8, in the patterns formed by the magnetic spins in crystals of the material cobalt niobate, cooled to near absolute zero and subject to a powerful applied magnetic field.

The material contains cobalt atoms arranged in long chains and each atom acts like a tiny bar magnet that can point either 'up' or 'down'.

When a magnetic field is applied at right angles to the aligned spin directions, the spins can 'quantum tunnel' between the 'up' and 'down' orientations. At a precise value of the applied field these fluctuations 'melt' the ferromagnetic order of the material resulting in a 'quantum critical' state.

'You might expect to see random fluctuations of the spins at this critical point but what we uncovered was a remarkable structure in the resonances of the magnetic spins indicating a perfectly harmonious state,' said Radu Coldea from Oxford University's Department of Physics who led the team.

As the critical state was approached the researchers observed that the chain of atoms behaved like a 'magnetic guitar string'.

Radu added: 'The tension comes from the interaction between spins causing them to magnetically resonate. We found a series of resonant modes. Close to the critical field the two lowest resonant frequencies approached closely the golden ratio 1.618…, a characteristic signature of the predicted E8 symmetry.'

He is convinced that this is no coincidence and it reflects a subtle form of order present in the quantum system.

The resonant states seen experimentally in cobalt niobate may be our first glimpse of complex symmetries that can occur in the quantum world. "The results suggest that similar 'hidden' symmetries may also govern the physics of other materials near quantum critical points where electrons organize themselves according to quantum rules for strong interactions,' Radu told us.

The research was supported by EPSRC and Radu aims to use a new EPSRC grant to explore the physics of materials near quantum criticality.

The team included Dr Radu Coldea, Dr Elisa Wheeler and Dr D Prabhakaran from Oxford University's Department of Physics, as well as researchers from Helmholtz Zentrum Berlin, ISIS Rutherford Laboratory, and Bristol University.

Story Source:

Adapted from materials provided by University of Oxford. Original article written by Pete Wilton.

http://www.sciencedaily.com/releases/2010/01/100118232345.htm

Treating Panic Disorder on the Web

ScienceDaily (Jan. 20, 2010) — An online treatment system for patients suffering with panic disorder and anxiety problems combine biofeedback therapy with web technologies and allows patients and medical professionals to communicate effectively, according to research published in the *International Journal of Business Intelligence and Data Mining.*Vincent Tseng and Bai-En Shie of the National Cheng Kung University are working with psychiatrist Fong-Lin Jang of the Chi-Mei Medical Center, in Tainan, Taiwan, to develop a system they say will have a "pivotal impact" on the healthcare industry.

The increasing pace of life, the industrialisation of society, and the advent of digital technology are all thought to underlie the growing prevalence of mental illness. Disorders, such as anxiety, obsessive-compulsive disorder, and depression are now diagnosed more frequently than ever before.Panic disorders are not easily diagnosed but do represent chronic illness for countless patients and lead to hospitalisation with increasing frequency. Patients can become acutely fearful and uncomfortable and suffer dizziness, chest pain, difficulty breathing, a racing pulse, and even palpitations, all of which increase the sense of panic and mimic the symptoms of a heart attack or asthma episode, hence the emergency room admissions.

Sufferers often restrict their day to day activities to avoid inducing anxiety and the problem persists can lead to substance abuse and depression. Victims of panic disorder often have a poor quality of life overall.The team has coupled a wireless-enabled finger-ring device that measures skin temperature with a web-enabled system. The system provides a convenient channel for communication between patients and healthcare worker as well as allowing hospital staff to allow patients to ask questions and download pertinent information.

The key to the system is that patients can also upload physiological data and their self-assessment to the database. The "emotion ring" continuously monitors and records the patient's finger skin temperature, which the researchers explain is a useful indicator of the patient's emotional state. It may simply provide a focus. Patients are then taught muscle and mental relaxation exercises and how to observe the effects of these on their skin temperature, thus providing a biofeedback mechanism that can also be monitored by their healthcare worker.Temperature biofeedback has been utilized in medicine for more than three decades and because performance anxiety can occur during biofeedback a professional therapist must help the patient master the sensation of relaxation, especially in the initial stages of training.

The team has tested the system with ten patients in a pilot study. "Once the patients learned the cues for relaxation and the method to obtain rapid relaxation, they were able to apply the methods and cues to relieve the symptoms of panic disorder," they conclude. The next step is to develop a related system that works with mobile devices rather than a personal computer."After receiving the muscle relaxation program, patients could feel the difference between relaxation and tension, and learned the skill of relaxation," Tseng says, "The most important is that patients had fewer panic attacks and had improvement in Panic Disorder Severity Scale(PDSS). A large multi-center clinical trial with this system is going on in Taiwan."

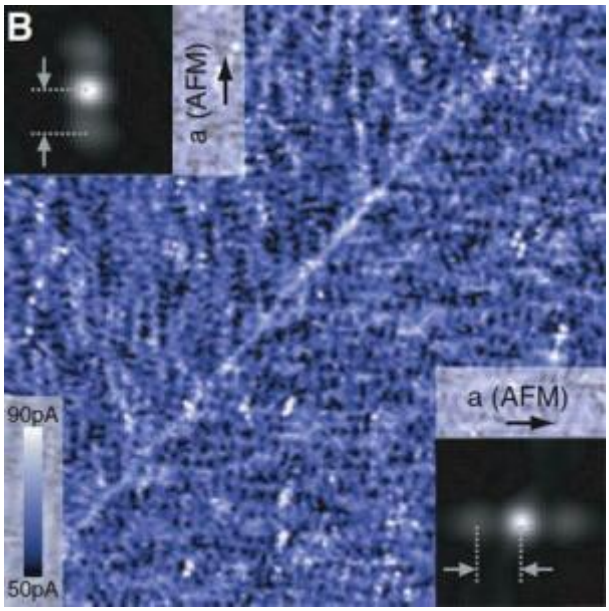
Adapted from materials provided by Inderscience Publishers, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Shie et al. **Intelligent panic disorder treatment by using biofeedback analysis and web technologies**. *International Journal of Business Intelligence and Data Mining*, 2010; 5 (1): 77 DOI: 10.1504/IJBIDM.2010.030300

http://www.sciencedaily.com/releases/2010/01/100119103726.htm

New Superconductivity Mechanism Found in Iron Compound



STM scan showing a 96-nanometer square of an iron-based superconductor shows electrons lined up in parallel rows suggesting a 'liquid-crystal' state of the electron fluid. The parallel arrangements appear in random domains across the entire crystal, oriented either vertically or horizontally. The diagonal line across this image is the boundary between two domains. The discovery of this arrangement indicates that the mechanism of iron-based superconductors is more complex than previously believed, and may be similar to the mechanism in cuprates. (Credit: Davis Lab)

ScienceDaily (Jan. 20, 2010) — A surprising discovery by Cornell researchers of electronic liquid crystal states in an iron-based, high-temperature superconductor is another step toward understanding superconductivity and using it in such applications as power transmission.

"Because these findings appear similar to what we have observed in the parent state of [copper-based] superconductors, it suggests this could represent a common factor in the mechanism for high-temperature superconductivity in these two otherwise very different families of materials," said team leader J.C. Séamus Davis, Cornell's J.D. White Distinguished Professor of Physical Sciences and director of the U.S. Department of Energy's Center for Emergent Superconductivity. The researchers describe their findings in the Jan. 8 issue of the journal *Science.*

Many theorists had expected the iron-based materials to act more like conventional metal superconductors, where electrons pair up to carry current effortlessly but without requiring any specific spatial arrangements of the atoms in the metal. These materials conduct electricity with zero resistance only at temperatures near absolute zero, or -270 degrees Celsius (-454 Fahrenheit).

Cuprate, or copper-based, and newly discovered iron-based superconductors operate at a range of warmer, though still chilly, temperatures (up to -120 degrees Celsius or -184 Fahrenheit for cuprates and -220 degrees Celsius or -364 Fahrenheit for iron-based compounds) that make them potentially more practical for such large-scale, real-world applications as zero-loss power transmission lines.

Cuprates are oxides of copper "doped" with various other atoms. Iron-based superconductors -- first demonstrated only in 2008 -- are mostly doped compounds of iron and arsenic. Somehow the doping distorts the crystal structure of the material in a way that makes it possible for electrons to flow without resistance. Understanding how this works could open the door to engineering even higher-temperature, or ideally, room-temperature, versions.

The scientists used a specially built scanning tunneling microscope (STM) in Davis' lab at Cornell, in which a tiny probe is moved across a surface in steps smaller than the width of an atom. By varying a current flowing between the probe and the surface, Davis is able to read out a spectrum of the energy levels of electrons in the material and produce a picture of the distribution of the electrons. Davis was recently awarded the Kamerlingh-Onnes Prize for inventing this technique.

Davis and colleagues examined "underdoped" samples of a compound of calcium, iron, cobalt and arsenic that becomes a superconductor when the amount of cobalt doping is increased. The particular material they used, made by Paul Canfield at the U.S. Department of Energy's (DOE) Ames Laboratory in Iowa, was a crucial choice, Davis said, because it could be sliced to produce an atomically flat and perfectly debris-free surface needed for the STM techniques.

It became clear to the team that they were on to something very different than expected. They observed static, nanoscale lineups of electrons spanning about eight times the distance between individual iron atoms, all aligned along one axis of the underlying crystal, reminiscent of the way molecules line up in a liquid crystal.

Liquid crystals, used in electronic displays, are a sort of intermediate state between liquid and solid in which molecules line up in parallel rows that can control the passage of light. In the solid crystals of materials like high-temperature superconductors, electrons do not remain attached to individual atoms but behave like a fluid, and here, Davis said, the electrons seem to be in a state analogous to a liquid crystal. "You can't use ordinary solid-state physics to understand materials this complicated," he said.

The scientists also found that the electrons that are free to travel through the material do so in a direction perpendicular to these aligned electronic liquid crystal states. This indicates that the electrons carrying the current are distinct from those apparently aligned in the electronic liquid crystals.

The next step will be to see how these conditions affect the superconductivity of the material when it is transformed to a superconductor.

The observations are "amazingly similar" to what Davis and his team have seen in cuprates. "If we're able to relate our observations in the iron-based superconductors to what happens in cuprate superconductors, it may help us understand the overall mechanism for high-temperature superconductivity in all of these materials. That understanding could, in turn, help us to engineer new materials with improved superconducting properties for energy applications," Davis said.

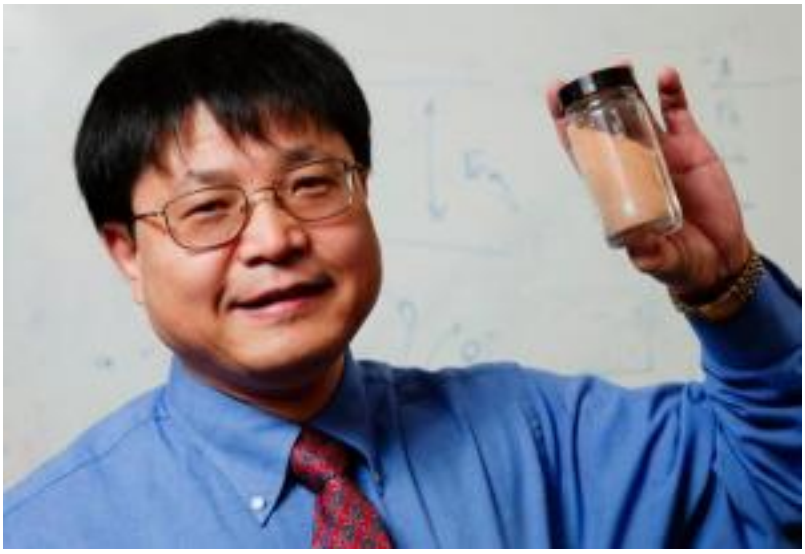
Scientists from the National High Magnetic Field Laboratory at Florida State University and St. Andrews University, Scotland, collaborated on this research, funded by DOE's Office of Science; the National Science Foundation; the Office of Naval Research; the U.K. Engineering and Physical Sciences Research Council; and the Scottish Funding Council.

Story Source:

Adapted from materials provided by Cornell University. Original article written by Bill Steele and Anne Ju.

http://www.sciencedaily.com/releases/2010/01/100118231646.htm

New Visible Light Photocatalyst Kills Bacteria, Even After Light Turned Off



Jian Ku Shang, a professor of materials science and engineering, holds a sample of a new photocatalytic material that uses visible light to destroy harmful bacteria and viruses, even in the dark. (Credit: Photo by L. Brian Stauffer)

ScienceDaily (Jan. 20, 2010) — In the battle against bacteria, researchers at the University of Illinois have developed a powerful new weapon -- an enhanced photocatalytic disinfection process that uses visible light to destroy harmful bacteria and viruses, even in the dark.

Based upon a new catalyst, the disinfection process can be used to purify drinking water, sanitize surgical instruments and remove unwanted fingerprints from delicate electrical and optical components.

"The new catalyst also has a unique catalytic memory effect that continues to kill deadly pathogens for up to 24 hours after the light is turned off," said Jian Ku Shang, a professor of materials science and engineering at the U. of I.

Shang is corresponding author of a paper that is scheduled to appear in the *Journal of Materials Chemistry*, and posted on the journal's website.

Shang's research group had previously developed a catalytic material that worked with visible light, instead of the ultraviolet light required by other catalysts. This advance, which was made by doping a titanium-oxide matrix with nitrogen, meant the disinfection process could be activated with sunlight or with standard indoor lighting.

"When visible light strikes this catalyst, electron-hole pairs are produced in the matrix," Shang said. "Many of these electrons and holes quickly recombine, however, severely limiting the effectiveness of the catalyst."

To improve the efficiency of the catalyst, Shang and collaborators at the U. of I. and at the Chinese Academy of Sciences added palladium nanoparticles to the matrix. The palladium nanoparticles trap the electrons, allowing the holes to react with water to produce oxidizing agents, primarily hydroxyl radicals, which kill bacteria and viruses.

When the light is turned off, the palladium nanoparticles slowly release the trapped electrons, which can then react with water to produce additional oxidizing agents.

"In a sense, the material remembers that it was radiated with light," Shang said. "This 'memory effect' can last up to 24 hours."

Although the disinfection efficiency in the dark is not as high as it is in visible light, it enables the continuous operation of a unique, robust catalytic disinfection system driven by solar or other visible light illumination.

In addition to environmental applications, the new catalyst could also be used to remove messy, oily fingerprints from optical surfaces, computer displays and cellphone screens, Shang said.

The work was supported by the National Science Foundation through the Center of Advanced Materials for the Purification of Water with Systems at the U. of I. Some of the work was performed at the U. of I.'s Frederick Seitz Materials Research Laboratory, which is partially supported by the U.S. Department of Energy.

Story Source:

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

http://www.sciencedaily.com/releases/2010/01/100119121539.htm

Cardiologists Discover 'Pouch' in Heart That May Raise Stroke Risk

UCI's Dr. Subramaniam Krishnan says a heart pouch may be present in 30 percent to 35 percent of individuals. (Credit: Photo by UC Irvine Health Affairs)

ScienceDaily (Jan. 20, 2010) — UC Irvine cardiologists have found a pouchlike structure inside the heart's left atrial chamber that may be a potent source of stroke-causing blood clots.

About 80 percent of the 700,000-plus strokes that occur annually in the U.S. are due to blood clots blocking a brain artery. In up to a third of these cases, the clots' origin cannot be determined. Study co-author Dr. Subramaniam Krishnan said the discovery of this left atrial pouch could provide answers and inform neurologists' efforts to prevent stroke recurrences.

Krishnan and Dr. Miguel Salazar of UCI first spotted the pouch during autopsy research. Subsequent ultrasound and CT scans of patients' hearts confirmed the finding. The researchers estimate that the anatomical feature, which Krishnan likened to a kangaroo pouch, is present in 30 percent to 35 percent of individuals. Study results appear in the January issue of *Journal of the American College of Cardiology: Cardiovascular Interventions*.

"The cul-de-sac nature of the heart pouch can promote stagnation of the blood, forming clots that can travel into the brain and cause a stroke," Krishnan said. "It was thought that the body of the left atrium was largely smooth and unlikely to be a source of blood clots, but we have found that not to be true for roughly one in three people."

Krishnan and UCI neurologist Dr. Mark Fisher are currently studying the prevalence of the left atrial pouch in patients who have already had strokes. "This finding points to a potentially important cause of strokes," Fisher said. "The presence of this pouch could change how neurologists treat these patients and lead to new therapeutic strategies for preventing strokes."

Story Source:

Adapted from materials provided by University of California - Irvine.

Journal Reference:

1. Subramaniam C. Krishnan, Miguel Salazar. **Septal Pouch in the Left Atrium: A New Anatomical Entity With Potential for Embolic Complications**. *J Am Coll Cardiol Intv*, 2010; 3: 98-104 DOI: 10.1016/j.jcin.2009.07.017

http://www.sciencedaily.com/releases/2010/01/100119154715.htm

Gorillas Carry Malignant Malaria Parasite, Study Reports

Gorillas. (Credit: iStockphoto/Guenter Guni)

ScienceDaily (Jan. 20, 2010) — The parasite that causes malignant malaria in humans has been detected in gorillas, along with two new species of malaria parasites, reports a study co-authored by UC Irvine biologist Francisco Ayala.

The study also confirms a recent discovery by Ayala and colleagues that human malignant malaria, caused by *Plasmodium falciparum*, originated from a closely related parasite found in chimpanzees in equatorial Africa. *P. falciparum* is responsible for 85 percent of malignant malaria infections in humans and nearly all deaths from the disease.

The researchers cautioned that increased contact between primates and humans -- mostly because of logging and deforestation -- creates a greater risk of new parasites being transmitted to humans. It also could further jeopardize endangered ape populations by spreading diseases to them. Finding *P. falciparum* in gorillas also complicates the challenge of eradicating malaria.

"Hundreds of billions of dollars are spent each year toward ridding humans of malignant malaria. But success may be a pyrrhic victory, because we could be re-infected by gorillas -- just as we were originally infected by chimps a few thousand years ago," said Ayala, corresponding author of the study, published in the *Proceedings of the National Academy of Sciences.*

The researchers analyzed fecal samples from 125 wild chimpanzees and 84 gorillas in Cameroon and tested blood samples from three gorillas in Gabon. They identified two new closely related species of malaria parasites -- *Plasmodium GorA* and *Plasmodium GorB* -- that infect gorillas. The animals also were found to harbor *P. falciparum*, previously thought to only infect humans.

In August, Ayala and colleagues published a study reporting that *P. falciparum* had been transmitted to humans from chimpanzees perhaps as recently as 5,000 years ago -- and possibly through a single mosquito. Before then, malaria's origin had been unclear.

Chimpanzees were known to carry the parasite *Plasmodium reichenowi*, but most scientists assumed the two parasites had existed separately in humans and chimpanzees for the last 5 million years.

The discovery could aid the development of a vaccine for malaria, which each year causes 2 million infant deaths and sickens about 500 million people, mostly in sub-Saharan Africa. It also furthers understanding of how infectious diseases such as HIV, SARS, and avian and swine flu can be transmitted to humans from animals.

In addition to Ayala, French scientists Franck Prugnolle, Patrick Durand, Cecile Neel, Benjamin Ollomo, Celine Arnathau, Lucie Etienne, Eitel Mpoudi-Ngole, Dieudonne Nkoghe, Eric Leroy, Eric Delaporte, Martine Peeters and Francois Renaud worked on the gorilla study.

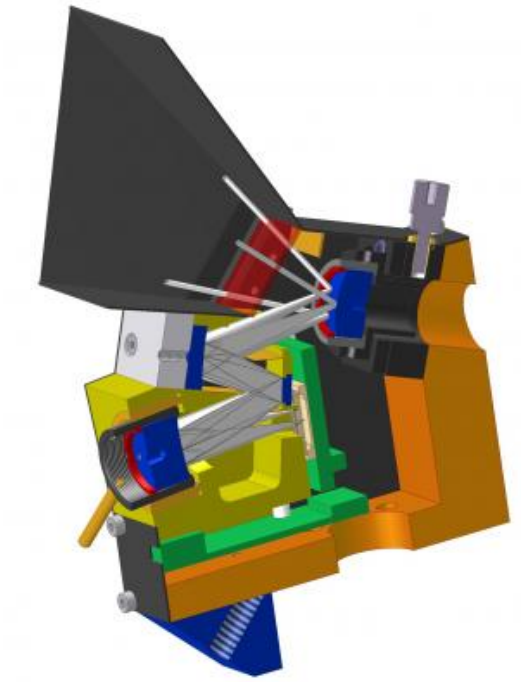
Funding was provided by France's Institute of Research for Development, National Center for Scientific Research, Ministry of Foreign Affairs and National Agency for Research on AIDS, as well as Gabon's International Center for Medical Research in Franceville.

Story Source:

Adapted from materials provided by University of California - Irvine.

http://www.sciencedaily.com/releases/2010/01/100119133517.htm

Novel Zoom Objective With Deformable Mirrors



Novel zoom objective with deformable mirrors.
(Credit: Image courtesy of Fraunhofer-Gesellschaft)

ScienceDaily (Jan. 20, 2010) — Unmanned aerial vehicles UAVs deployed on landscape analysis missions carry optical measuring equipment that is required to operate free of chromatic aberration. Researchers have now designed an all-reflective zoom objective with deformable mirrors.

An small unmanned aerial vehicle (UAV) circles above the ground, capturing the typical green of a coniferous forest or the radiated heat from a town. The objectives in its on-board measuring equipment must function free of chromatic aberration across a wide spectral range -- from the ultraviolet region through the visible band and right up to the near and medium infrared range. In such a scenario, conventional lens systems comprised of several lens elements are of limited use: when required to image a wide spectral range, the image quality drops -- the image suffers from color fringing and becomes blurred.
Traditionally, specific lenses have been used for each different spectral band. However, the difficulty is that UAVs can only carry a limited amount of weight.

Researchers from the Fraunhofer Institute for Photonic Microsystems IPMS are currently working to make it possible to capture images free from chromatic aberration in a number of spectral ranges using a single system. This would have the advantage of prolonging the battery's life and increasing the aircraft's endurance. Group manager Dr. Heinrich Grüger of the IPMS says: "We've come up with a design for a new objective in which we've used mirrors instead of standard lens elements." The objective is comprised of four mirrors, carefully arranged to avoid obscuration -- this produces a higher-contrast image. Two deformable mirrors take care of the triple zoom range -- with no loss of image quality. The new design eliminates the need for elaborate mechanical guides within the lens barrel.

Grüger believes the new objective is potentially highly marketable: "Both the automation technology sector and the automobile and equipment engineering sector would profit from this type of objective." Suitable deformable mirrors will have to be created -- conventional optical mirrors are rigid. Grüger says: "For the zoom function, we need mirrors that will permit flexible actuator control of the radius of curvature." Although IPMS scientists have already developed deformable mirrors, they have not yet managed to achieve the size and degree of variability required for the mirror zoom objective. Optical simulations have shown that the mirrors would need to be at least 12 millimeters in diameter in order to produce a zoom objective with a sufficient f-number. Nevertheless, the researchers have already been able to demonstrate the optical performance of the objective: they built three identical setups with three different focal lengths in which the deformable mirrors were replaced by conventional rigid mirrors.

Story Source:

Adapted from materials provided by Fraunhofer-Gesellschaft.

http://www.sciencedaily.com/releases/2010/01/100118091911.htm

Siblings Play Formative, Influential Role as 'Agents of Socialization'

What we learn from our siblings when we grow up has -- for better or for worse -- a considerable influence on our social and emotional development as adults, according to an expert in sibling, parent-child and peer relationships at the University of Illinois. (Credit: iStockphoto/Andrea Gingerich)

ScienceDaily (Jan. 20, 2010) — What we learn from our siblings when we grow up has -- for better or for worse -- a considerable influence on our social and emotional development as adults, according to an expert in sibling, parent-child and peer relationships at the University of Illinois.

Laurie Kramer, a professor of applied family studies in the department of human and community development at Illinois, says that although a parent's influence on a child's development shouldn't be underestimated, neither should a sibling's.

"What we learn from our parents may overlap quite a bit with what we learn from our siblings, but there may be some areas in which they differ significantly," Kramer said.

Parents are better at teaching the social niceties of more formal settings -- how to act in public, how not to embarrass oneself at the dinner table, for example. But siblings are better role models of the more informal behaviors -- how to act at school or on the street, or, most important, how to act cool around friends -- that constitute the bulk of a child's everyday experiences.

"Siblings are closer to the social environments that children find themselves in during the majority of their day, which is why it's important not to overlook the contributions that they make on who we end up being," Kramer said.

Kramer, who along with Katherine J. Conger, of the University of California at Davis, co-edited a volume on this topic for a recent issue of the journal New Directions for Child and Adolescent Development, says a clearer understanding of how siblings function as "agents of socialization" will help answer critical societal questions such as why some children pursue antisocial behavior.

"We know that having a positive relationship with siblings is related to a whole host of better outcomes for teenagers and adults," Kramer said. "A lot of current research looks at how children learn undesirable

behaviors like smoking, drinking and other delinquent acts, from exposure to an older sibling's antisocial behaviors as well as that of their sibling's friends. For example, a female teen is at higher risk for getting pregnant if her older sister was a teenage mother. Developing a better understanding of sibling influences can help us design effective strategies for protecting younger children in families."

According to Kramer, in order to maximize an older sibling's positive influence, one of the most important things parents can do is to help foster a supportive relationship between the siblings from the very beginning.

"We know from longitudinal studies that if kids start off their relationship with a sibling on a positive note, it's more likely to continue positively over time," she said.

Variables such as gender and age difference don't make much of a difference between siblings. "It's not all that important whether you're spaced closer together or farther apart, or if you have a brother or a sister," Kramer said. "What's really much more important are the social behaviors that children learn in their early years that they can use to develop a positive relationship with a sibling. That's why it's important for parents to encourage siblings to be engaged with one another and develop a relationship where there is mutual respect, cooperation and the ability to manage problems."

Kramer said children who grow up as an only child are not necessarily less socially competent than children who grow up with siblings, but they are more likely to have developed social skills through friends as opposed to brothers and sisters.

"Growing up just with parents is a different environment for young people," she said. "Parents of only children might want to think about how they can help their child have social experiences with other children, whether that's through childcare, preschool or play dates."

Do single children establish surrogate siblings with cousins and friends?

"They may be encouraged by parents to develop deeper relationships, and that's a good thing because it provides them an opportunity to develop some of these social competencies that they probably won't acquire if they're limited to interacting with their parents and teachers," Kramer said.

Parents who have children who are spaced closely together in age may not see much of a need to have children over to the house once a week because their children are already having significant social experiences within the family unit, Kramer said.

But children whose siblings are spaced further apart in age are most likely to have different sets of friends and different social experiences because they may be in distinct school contexts or involved in unique activities. "It's possible that siblings who are spaced further apart are very connected within the home, but their social experiences outside the family may be pretty different," Kramer said.

And, Kramer notes, having Wally Cleaver for an older brother doesn't necessarily mean the younger sibling will turn out like Wally -- they may end up like Beaver.

"We know that not all younger children turn out like their older siblings," Kramer said. "There are many cases where younger siblings work very hard to carve out their own unique path and be different from their brothers and sisters, a process researchers refer to as 'de-identification.'

They may choose a different path in which to excel or make their mark to base their own identity on. That child may choose to focus on sports, the arts or being the social one. It relieves them from the pressure to be seen or compared to their elder sibling, particularly if they're afraid that they won't be able to measure up.

"So they out who they are, what they believe in and what's important to them, in reaction to how they perceive their siblings."

Kramer cautions that while we don't know all of the implications of sibling influence, "we do know that growing up in a family where there is another child makes it a very different environment socially, cognitively and emotionally," Kramer said.

"Children learn things through growing up with other children in the house, just as they learn things growing up in a more adult-oriented environment if they're a single child. We need to understand that better so that we can form a more realistic understanding of child and family development."

Funding for this research was provided by the U.S. Department of Agriculture.

Story Source:

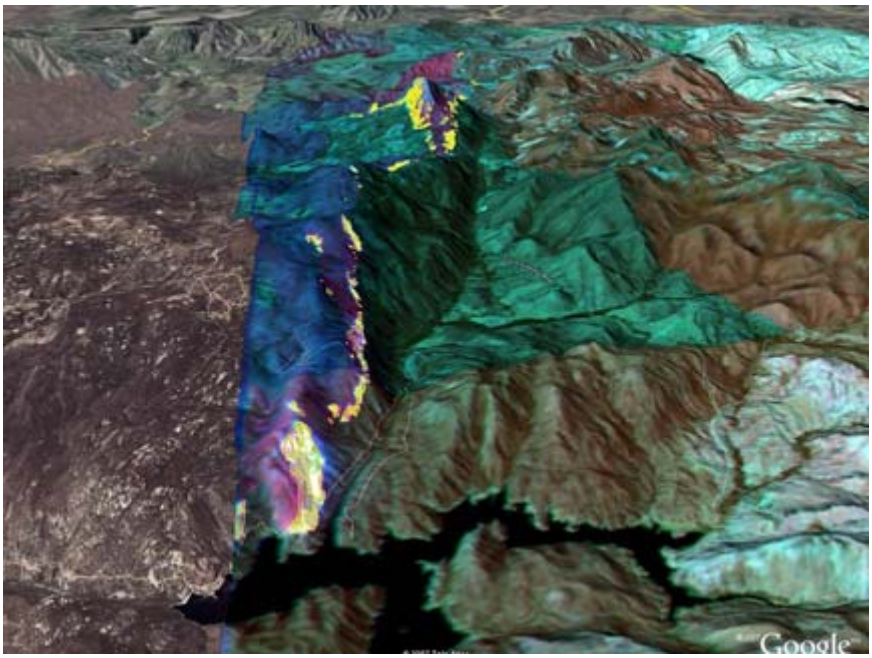
Adapted from materials provided by University of Illinois at Urbana-Champaign.

http://www.sciencedaily.com/releases/2010/01/100115112104.htm

The Fires Down Below: 'Look-Down' Technology

By: Sue Russell

The war being waged against wildfires from Southern California to Greece and Australia is almost as complex as the infernos themselves. Innovative computer mapping tools advance, as do airborne imaging techniques that can look straight through black smoke for views of emerging dangers no firefighter ever sees. However, some crews battle blazes on bulldozers older than they are, and funding is tight all around. Still, the breakthroughs keep coming.



The Viz Lab is a large, dimly lit, war room dominated by huge, computer-generated maps projected onto dark walls. Its tool kit includes an array of links to information and imaging feeds gathered by satellites, airplanes, unmanned aerial vehicles (or UAVs) and helicopters from sources like NASA and Google Maps. The lab is bent on delivering real-time (or pretty darned close) computer mapping and imaging to a wildfire's first responders so they'll know just what the blaze is doing, where and when.

Data fusion is the name of the game at the San Diego State University's Immersive Visualization Center — layering sophisticated weather, atmospheric, smoke and fire data and images onto, say, a topographical Google Earth map. It provides an illuminating picture for emergency operations chiefs who urgently need to pinpoint trouble spots and interpret fast-changing developments.

Once, fire perimeters were indicated by simple black lines on old-fashioned land maps — best guesses made from the field without benefit even of GPS. Now, satellites or aircraft use "look down" technology to create 3-D topographical images of what lies below dark, billowing smoke. Tools distinguish live from burned vegetation and show in various colors rapidly updated information on a blaze's "hot spots" and accelerating or subsiding dangers.

"It's absolutely dramatically more useful," explained Eric Frost, co-director of the Viz Lab.The Viz Lab normally focuses on geographic information systems research for homeland security and disaster relief. But it also proactively tracks everything from brush fires on its doorstep to natural disasters worldwide. Last February, for example, it helped map wildfires in Australia that killed 173 people. "It takes less than

half a second to go from here to Australia on fiber optics," Frost noted.The lab's before-and-after imaging of 2005's Indonesian tsunami benefited those rushing to maximize disaster response efforts. And after Hurricane Katrina, Frost's team observed that an oceanfront casino had relocated to a new spot — atop a vital four-lane highway. Priceless information.

The Viz Lab can do all kinds of clever stuff with wildfires such as gathering data on flame heights and temperatures, and wind direction fluctuations, allowing tweaks in suppression tactics.In October 2007, San Diego County's numerous raging wildfires killed seven people and forced 500,000 to evacuate. Plagued by the notorious, fast-moving Santa Ana "devil winds," the blazes burnt more than 325,000 acres.

With next-generation radar from the National Weather Service, smoke movement can be viewed less than 10 minutes out of real time or even faster in a less data-rich mode. "During these fires," Frost said, "images were about three minutes from real time." Because it elongates in the direction of the major wind, smoke tells a really important story for those planning suppression efforts.

Layering images of the fire spread onto maps showing the positions of houses, roads and infrastructures, then layering on images showing where brush and wildland had been burned or spared, was enormously informative.

NASA's MODIS (for "moderate resolution imaging spectroradiometer") satellite imagery proved very effective. It can be processed to show smoke very well. NASA's Earth Observing-1 imagery also was used to see through the smoke to the fires below.

During major emergencies, data and satellite imagery pours in to the Viz Lab from dozens of sources, notably NASA and the military. But for the 2007 San Diego fires, new ground was broken when NASA staffers, along with Google programmers and engineers, physically descended on the Viz Lab to work side by side with its team and wrestle with problems like overwhelmed computers and getting near real-time images — free of charge — to all who needed them. When the Viz Lab's own computer systems crashed, a switch to the Web servers of the nearby California Institute for Telecommunications and Information Technology saved the day.

Moving information around sounds simple. It's not. The true head-scratcher remains how to convert gigantic maps that only supercomputers can run into micro images and tiny files that can be transmitted to fire chiefs and ultimately to firefighter's individual GPS units. The challenge lies in extracting and creating bite-sized files for tiny networks out of the big picture, "rather than this massive thing that is going to fracture the system," Frost said.

Droning On and On

Military and National Guard air support arrived too late in San Diego in 2007 for the liking of some. Frost, a true believer that communication, networking and relationship-building pays off, saw it differently. One triumph: "NASA very graciously agreed to bring the Ikhana Predator B here and to pay the bill, which was way over $1 million."

The Ikhana UAV (or drone, as remotely piloted aircraft, with their military connotations, are often called), is usually used on long-term earth science observation missions and as an airborne platform for developing and evaluating new UAV technologies, but it has been used to fight California fires since 2007. It collects real-time thermal-infrared data and can fly for up to 30 hours at high altitude carrying science and technical research sensors as well as atmospheric and remote-sensing instrumentation.

Hyperspectral imaging instrumentation, for example, collects, measures and analyzes reflected light in the form of a spectral fingerprint and by doing so, can see what we cannot. It can spot a vehicle hidden by vegetation and can reveal what lies below clouds and smoke so precisely that it can even distinguish a maple tree from an oak. Watching a fire perimeter's fluctuations shows where a fire is bursting out and

where efforts to battle it are working; and with state-of-the-art imaging, good quality information can be on the ground to emergency operations centers or fire battalion chiefs in 10 minutes.

In 2007, while National Guard, Air Force and Navy aircraft provided images, and the U.S. Forest Service delivered more environmental information, back in the Viz Lab, Google brainiacs helped build software on the spot to create topographical maps embodying all the available data and imagery.

The armory of information-gathering methods grows. Synthetic aperture radar (or SAR), for instance, can differentiate between burned and new trees, and can also be used at night or to see through fog or clouds. It's invaluable to have precise, up-to-date locations for all remaining fuels — everything flammable from trees, brush, plants and timber, to houses and other structures - so is infrared imaging that can read moisture levels in shrubs and grasses and monitor when they get dangerously low and combustibility is rising.

Data fusion maps also enable close monitoring of hazardous materials in relation to smoke movement and can give advance warning when a fire is headed for a danger spot like a large propane tank or chemicals. That, in turn, allows officials to advise people living downwind to get away. It also helps rescue and relief agencies set up their facilities out of harm's way.

Precisely how most wildland firefighters toil in the dark was chillingly revealed by the Viz Lab's 2007 high-resolution images. Staffers saw hidden perils like fire creeping up a hillside behind firefighters, a blaze splitting off and hot spots out in front. Firefighters know when embers are flying over their heads but, especially if they're flying over a hill, they don't know what they are doing behind them.

The revelations drove home the courage of firefighters: "The fire's burning behind them and they're caught in the squeeze, and yet they're still standing there," said Frost, his awe obvious.

The Ikhana, which is 36 feet long with a 66-foot wingspan, can't fly close to large fires or in intense winds, so it's not the optimum aircraft for imaging wildfires. (Just as well, since few wildfires have an Ikhana on scene.) A solution now gaining traction is to use small, high-speed UAVs — some less than 10 percent the size of an Ikhana for perhaps as little as 1 percent of the cost — to carry in pods the high-tech instruments needed to image wildfires.

SDSU recently acquired three new UAVs, made by RP Flight Systems in Texas, with a wingspan of just 4 ft. Yet the SDSU drones can give better imagery — typically, they fly 400-500 ft. above ground — for far less money than the Ikhana.

The downside? They can carry some key imaging programs, but these very small models can't hold them all. However, their other advantages compensate. The Ikhana has to fly at far higher altitudes to comply with FAA rules. Meanwhile, since these small, civil UAVs have no military use and aren't federal assets, they neatly avoid governmental red tape. (For instance, having to clear classified data slowed down the transmission of the Ikhana's imaging in San Diego in 2007.)

SDSU's small UAVs can deliver infrared imaging of plant life, and with forward-looking infrared (or FLIR), can show where the fire is by reading heat. What they can't view, Frost noted, is, "the composition of the smoke and the great details of the vegetation. And having SAR would provide far higher-resolution images, too, and extremely accurate detections of any changes going on."

That said, these UAVs clearly are a welcome new tool. Improved models are definitely viable and will likely be developed as budgets permit, so it can be expected that the civil use of UAVs in wildfire fighting will expand. With the optimal craft, Frost theorized, "you could fly around a fire, collect imagery, process it, send it down to the ground, and maybe get a fire perimeter every 10 minutes."

On the Ground

There are also entirely different "look down" technologies. In 2003, now-retired California Department of Forestry and Fire Protection Chief Bill Clayton envisioned sensors and digital cameras on tall towers detecting backland fires almost instantly, then relaying data and images back to operations chiefs and on to firefighters who could see imminent threats for themselves on laptop computers. We're not quite there yet, but we are inching forward.

The Wildland Fire Detector System, an optical system currently used in Turkey's governmental agency, the General Directorate of Forestry, is now being evaluated by private clients and governmental agencies in Oregon and California, Australia, Chile and Greece. Smoke is always the first indicator of fire — because tall trees and dense vegetation can hide flames — so having smoke detected in the first five minutes or so could dramatically reduce damage. The WFDS can monitor grasslands, but it shines in forest settings by detecting smoke far sooner than flames might reach the crowns of tall trees, finally making them visible to observers.

"The system consists of remote monitoring locations that scan the area and feed information to the control tower," Dennis Akers, Wildland Detection Systems' CEO, wrote in an e-mail. "At the control center — which can be unattended — the system analyzes the data stream and issues an alarm if a wildfire has started. The system has the capability to identify the GPS coordinates of the fire."

Control centers monitor up to 16 remote sites simultaneously with Windows-based computers and microwave links. Since visual and audible alarms don't require independent operators, noted Akers, "they can be integrated into the existing public safety system, reducing operating cost."

Each remote monitoring point has a digital video camera, power (usually solar-charged battery power), and a communications line (usually point-to-point microwave). A single remote sensor can cover 10,000 acres, or more than 300 square miles. And new technology, Akers was careful to note, has successfully eliminated a high false alarm rate.

The California Department of Forestry and Fire Protection itself has more than 350 remote automated weather stations — towers with computerized sensing equipment that samples weather conditions hourly, then transmits data to a satellite. The U.S.'s second largest fire department, CalFire covers more than 31 million acres of rural California. In 2008, the agency alone responded to 3,593 fires involving 380,310 acres. (California's total firefighting efforts that year, including those of federal and county agencies, involved 6,255 fires and 1,593,690 acres.)

And the U.S. Forest Service, teamed with the U.S. Geological Survey Center for Earth Resources Observation and Science, is using the Burned Area Emergency Response Imagery Support program for fast satellite imagery and data delivery. The Forest Service's Remote Sensing Applications Center also uses the MODIS Active Fire Mapping Program, which can detect fires as small as 100 square meters burning at 1,500 degrees Fahrenheit.

Cloud cover, or the fire's position relative to the MODIS sensor, can hamper detection. But, it offers the public a general overview of fire information.

Still, people whose lives and homes may be in peril crave their updates in real-time, not every four to six hours. And while few systems can cope when 100,000 people descend on a Web site to download a PDF file, the Viz Lab can now handle about 10 million hits a day. It will also gladly host Web sites free for emergency response agencies in the midst of a wildland blaze or other disaster. All they have to do is ask.

http://www.miller-mccune.com/science_environment/the-fires-down-below-look-down-technology-1758?utm_source=Newsletter93&utm_medium=email&utm_content=0126&utm_campaign=newsletters

Your Guide to the Carbon Rainbow

By: Elisabeth Best

When I imagine carbon, the first image that comes to mind is one of a big, black rock akin to the lump of coal you hope not to find at the bottom of your Christmas stocking. But the new report by the Economics of Ecosystems and Biodiversity initiative of the U.N. Environmental Programme argues that carbon comes in more than just your basic black: There is brown, green and blue carbon, too.

Here's *Miller-McCune*'s guide to the latest in carbon fashion, so that you can be in the know for the U.N. Climate Change Conference (COP15) in Copenhagen this December.

Brown carbon: Brown carbon is a light-absorbing particle in the Earth's atmosphere that has the unique characteristics of both cooling the planet's surface and warming its atmosphere. It was originally distinguished from black carbon in a 2006 report by M.O. Andreae, who has a doctorate in oceanography, and A. GelencsÄr, a chemist. Research published in 2008 by Arizona State University professor Peter Crozier suggests that this nanoscale atmospheric aerosol species is abundant in the atmosphere over East Asian countries and should be explicitly included in models of radiative forcing (the gap between energy radiation reaching the Earth and that leaving through the upper atmosphere).

Bottom line: It's not black; it's an aerosol, and it plays a complex role in climate change.

Green carbon: Green carbon is the carbon that is stored in terrestrial ecosystems such as forests, pastures and soils. This carbon can be released into the atmosphere through deforestation and fire. The U.N. Framework Convention on Climate Change noted in a 2008 report that increasing green carbon stores through reforestation and preservation efforts has great potential to combat global warming.

The skinny: Green carbon might become a lot more popular after COP15, especially since a number of mechanisms have already been proposed to help encourage reforestation in developing countries.

Blue carbon: Blue carbon is carbon that lives in the world's oceans. An estimated 55 percent of carbon in living organisms is stored in mangroves, marshes, seagrasses, coral reefs and macro-algae. This carbon is cached for millennia, unlike green carbon, which may be stored for decades or centuries. A new report from UNEP, The Food and Agriculture Organization, and UNESCO's Intergovernmental Oceanographic Commission highlights the alarming fact that blue carbon ecosystems are being degraded five to 10 times faster than rainforests. Coastal ecosystem services are valued at $25 billion per year — they provide vital nutrition for close to 3 billion people.

The down-low: Restoring the blue carbon sinks in the ocean, and slowing and reversing deforestation in the rainforests could mitigate emissions up to 25 percent.

Black carbon: Last but not least, black carbon is the carbon formed through incomplete combustion of fuels — essentially soot. It is the most widely discussed form of carbon, and some scientists suspect it is second only to carbon dioxide as a contributor to global warming. Black carbon can be reduced through the adoption of clean-burning technologies.

In sum: Black carbon reduction may be one of the most efficient ways for us to mitigate global warming now.

So there you have it — your guide to the carbon rainbow! We'd tell you to print out a copy for the coverage of COP15, but we'd rather you save the green carbon.

http://www.miller-mccune.com/news/your-guide-to-the-carbon-rainbow-1635

The Age of Affirmation

By: Elisabeth Best

When you turn on the evening news, are you actually hoping to learn something?

A new study suggests that viewers worldwide turn to particular broadcasters to affirm — rather than inform — their opinions. It's a notion familiar to those dismayed by the paths blazed by cable news networks FOX and MSNBC — although the study finds one (perhaps unlikely) network may actually foster greater intellectual openness.

The study in the December issue of *Media, War & Conflict* by Shawn Powers, a fellow at the USC Center on Public Diplomacy, and Mohammed el-Nawawy, an assistant professor in the department of communication at Queens University of Charlotte, found that the longer viewers had been watching Al Jazeera English, the less dogmatic they were in their opinions and therefore more open to considering alternative and clashing opinions.

Al Jazeera English is a global news network that "aims to give voice to untold stories, promote debate, and challenge established perceptions." Launched on Nov. 15, 2006, the network is accessible to more than 120 million households worldwide; it is currently available on only a handful of satellite networks in the United States.

The network is based in Doha, Qatar, and is funded by the Qatari government, a U.S. ally.

There has been fierce opposition to the network from groups in the United States, such as Accuracy in the Media, that have decried it as a "terrorist news network" due to its connection to Al Jazeera Arabic, an older satellite network known for broadcasting tapes made by Osama bin Laden and al-Qaeda. In the wake of 9/11, then-U.S. Secretary of State Colin Powell even urged the Qataris to shut the network down.

Powers and el-Nawawy point out that satellite television, first introduced to the Arab world during the 1991 Gulf War, altered both the structure of the global news media system and its role in times of war.

Although the invention had the potential to provide a truly global forum for cross-cultural communication, the researchers found that audiences around the world increasingly turn to broadcasters not for new world news, but for information that fits within their pre-existing worldviews.

The researchers drew on a six-country study of the media viewing habits and cultural, political and psychological temperaments of viewers of three global news networks: the U.S.-based Cable News Network International, the United Kingdom's BBC World and Al Jazeera English. The study relied on "media system dependency theory," which suggests that media are best viewed as an information system whose effectiveness relies on the scarcity or exclusivity of their information resources.

Their work focused on people who had watched AJE within the past month and provides a record of the attitudes of the viewers, relative to their dependence on AJE, CNNI and BBC as information sources, as well as the duration and frequency of their AJE viewership.

The researchers conducted a cross-sectional survey on selectively chosen global news audiences in Malaysia, Indonesia, Qatar, Kuwait, U.K., and U.S. These countries were chosen for their relative levels of AJE viewership and their ability to signify existing cultural perspectives on the "West versus Islam" culture clash.

Whether or not you agree with the intellectual "father of the clash of civilizations," Samuel P. Huntington (and there is no shortage of scholars weighing in on that debate), Huntington's prediction that the confrontation between "Western" and "Islamic" would dominate the world stage well into the 21st century may seem disturbingly true (although some argue that his prophecy was self-fulfilling).

A 2006 study conducted by the Pew Global Attitudes Project found that many Westerners see Muslims as "fanatical, violent, and lacking tolerance," whereas Muslims in the Middle East and Asia see Westerners as "selfish, immoral, and greedy — as well as violent and fanatical."

In times of war, Powers and el-Nawawy argue, the mainstream media are more likely to tailor their coverage to reinforce the attitudes of their viewers rather than provide the more detached viewpoint traditionally expected in reporting. But AJE seeks to transcend the nation-based paradigm and still provide a personalized, journalistically sound perspective on global events. In other words, it tries to avoid the "war journalism" approach.

Powers and el-Nawawy show that global media consumers tuned in to international news media that they thought would further substantiate their opinions about U.S. policies and culture, and provide them with information on the international issues that they deemed most important. The study found a strong relationship between the participants' attitudes toward U.S. policy and culture and their choice of broadcaster. Those who were dependent on BBC World and especially CNNI were overall more supportive of U.S. foreign policy.

But researchers found that the longer participants had been watching AJE, the less dogmatic they were in their thinking, as measured by a survey evaluating dependence on particular networks and support for U.S. policies. This is not to say that AJE viewers were not affected by the opinions promoted by the network: The more frequently participants tuned into AJE, the less supportive they were of the U.S. policy toward the Palestinian-Israeli conflict and the more critical they became of U.S. policy in Iraq.

The reduced dogmatism applies only to the cognitive levels of thinking, or the way in which people process new information. People who are less dogmatic in their thought are more open to information that contradicts their worldviews, whereas people who think very dogmatically are more likely to ignore or minimize information that does not support their own beliefs. These levels of dogmatism are strongly related to political and cultural tolerance, and how people behave in confrontational situations.

Over time, these effects may strengthen. Michael Bruter, a senior lecturer at the London School of Economics, found that biased news had a "time bomb" effect on the European Union citizens who participated in his study: A steady diet of intentionally skewed news did not immediately affect readers' opinions, but they did have an impact on citizens' opinions six months after the biased flow shut off.

The idea that media consumers may tune into news that supports their opinions is illustrated by a study of viewers of Comedy Central's *The Colbert Report*, who see the satirical comedian's act as nodding toward their political beliefs — regardless of where they fall on the political spectrum. Liberals see his bombastic comments as a parody of conservative talk shows; conservatives see him making digs at liberalism.

Powers and el-Nawawy are hopeful that the power of the news may be harnessed for good. "The positive relationship between the length of AJE viewership and lower levels of dogmatism offers promise that global news media, when working to combat a counterproductive style of 'war journalism,' can indeed be a positive and proactive force in the creation of a global civil society."

Whether or not major news networks will abandon the principles of war journalism, however, remains to be seen.

http://www.miller-mccune.com/media/the-age-of-affirmation-1698?utm_source=Newsletter93&utm_medium=email&utm_content=0126&utm_campaign=newsletters

The Smoldering Trash Revolt

By: Melinda Burns

Every time a Californian breaks the law and throws a battery into the trash, it's a headache for someone like Kevin Hendrick.

As director of the Del Norte Solid Waste Management Authority, Hendrick spends $50,000 in taxpayer money providing one day per year on which county residents can bring in their household hazardous waste, including batteries, for proper disposal. The problem is, only 5 percent of them ever show up.

It's driving cities and counties crazy all over the country. In California alone, they spend $500 million yearly trying but failing to manage discarded household batteries, fluorescent lights, hypodermic needles, cell phones, radios, microwaves, printers, computers and televisions — "problem products" that the state has banned from municipal landfills.

As in Del Norte, most people don't bother to bring in their hazardous waste on special collection days. And that means a lot of toxic mercury, cadmium, nickel, arsenic and lead is getting buried in the dump.

"We can't let that stuff come in the garbage," Hendrick said. "These products get banned without a plan. And because we don't know any better, we in local government just keep stepping up and trying to solve the problem. We need to push back. I keep thinking of Gandhi. If we refuse to cooperate, then what?"

The "push-back," in fact, is under way. During the past year, lawmakers in Maine, California, Minnesota and Oregon have proposed ways to start shifting the burden of waste disposal from the public to the private sector. Washington state has looked into the idea, and Rhode Island is studying it. They call it "product stewardship," "extended producer responsibility" and "responsible recycling."

Whatever the label, it means manufacturers themselves would be required to pay for collecting, recycling and disposing of designated products after their customers are through with them.

Supporters — local governments and environmentalist groups — say product stewardship would encourage manufacturers to design less-toxic products and reduce packaging waste. Prices would likely go up for consumers, they say, but ratepayers would not be subsidizing waste disposal for things they didn't buy.

Business groups say the practice would hurt consumers and kill jobs.

In a letter to the California Assembly last year, the California Chamber of Commerce said that a broad framework for product stewardship would raise prices and impose a "vast new regulatory regime," under which "virtually any product could be selected."

"This will make covered products more expensive at a time when businesses are struggling to stay afloat and consumers are trying to stretch their resources as far as possible," the chamber said.

Out in front
Because of industry opposition in California, it's fallen to Maine, the most sparsely populated state east of the Mississippi, to take the legislative lead.

Maine faces a $400 million budget shortfall, and the bill, "An Act to Provide Leadership Regarding the Responsible Recycling of Consumer Products" stands a good chance, said Rep. Melissa Innes, D-Yarmouth, the author. A joint state House and Senate committee hearing on the legislation is set for Jan. 22. Democrats have a majority in both houses.

"It could be a nice feel-good bill," Innes said. "I don't expect to get support from the Chamber of Commerce, but I'm trying not to get a stampede of opposition."

Product stewardship is well established in Europe, Canada, Japan and South Korea, and it's not foreign to the United States. In recent years, 19 states, including Maine and Minnesota, but not California, have passed "take-back" laws requiring producers — that is, manufacturers, brand owners and importers — to collect and recycle household electronics.

Maine has five product-by-product stewardship laws, the most in the nation. In 2004, it was the first state to require producers to take back discarded televisions, computer monitors, desktop printers and video game consoles.

According to a study by the University of Southern Maine, published in the December issue of *Waste Management*, Maine nearly quadrupled its collection and recycling of electronic waste from 2006, when the law went into effect, through 2008. Many of the used televisions and monitors likely came out of people's attics and garages, the study said. According to the U.S. Department of Commerce, nationwide, 75 percent of obsolete electronics end up in storage.

Under Maine's e-waste program, producers pay most but not all of the recycling and disposal costs. In 2008, the study shows, Maine's cities and towns paid about $382,000 to collect and store discarded TVs and monitors, and producers paid $1.9 million to transport, dismantle and recycle them. Some residents paid a small drop-off fee, and others paid nothing.

In addition, Maine requires producers to take back mercury-containing thermostats and auto-switches, compact fluorescent light bulbs, and, beginning in 2011, mercury lamps. A current bill also would require producer take-backs for drugs.

What's different about Innes' new bill is that, rather than continue with product-by-product legislation, it would give the state's Department of Environmental Protection broad authority to choose what to regulate. Producers would be required to turn in recycling and disposal plans and meet collection rates

approved by the department. Companies that failed to participate would be fined up to $10,000 daily, and so would retailers that sold their products.

If the bill passes, the state would likely focus on products that contain toxics, and products such as paint and pesticides, Innes said.

"We're going after the low-hanging fruit," she said. "This is just the next smart step."

Yarmouth spends $10,000 yearly to hold one household hazardous waste collection day, a cost the city cannot afford, Innes said. Plus, she added, Canada has created many new jobs through product stewardship. And if businesses are required to bear the disposal costs for their own products, Innes said they might choose greener ways to make them.

"All of our waste goes to a waste energy plant, where it burns and goes into the air," she said. "Even though we have scrubbers and filters, they can only capture so much. We pay for that in our health."

'Tired and mad'

Maine may be ahead, but California is giving it a push, said Bill Sheehan, executive director of the Product Policy Institute, an Athens, Ga.-based nonprofit group that advocates for a "zero-waste" society.

"Maine is clearly a leader in being first and most prolific," Sheehan said. "They 'got it' early on. But a lot of the energy for extended producer responsibility is coming from local governments, and that movement is sweeping down the West Coast."

The California Product Stewardship Council, a coalition of local governments, has collected 76 endorsements for product stewardship from frustrated cities, counties and government associations.

"We're at a place in time where local government is saying, 'We're tired, we're mad and we're not going to take it any more,'" said Rob D'Arcy, who manages hazardous materials for the County of Santa Clara and is the council's chairman.

"Our county spends $4 million to collect hazardous waste from five percent of households," D'Arcy said. "It's almost disgraceful, the responsibility that's placed on local government to pay for these services, when they should be functions of the market."

To help address these concerns, California Assemblyman Wesley Chesbro, D-Humboldt, proposed sweeping product stewardship legislation similar to Maine's last year, but it never came to a vote. At the end of this month, his aides said, Chesbro will introduce a new bill naming five or six products that manufacturers would have to collect, recycle and dispose of once they are discarded, including a few that are banned from landfills and a few that contaminate the ocean.

"When you try to create a comprehensive framework, you allow every manufacturer to imagine that they're going to be first on the list," Chesbro said in December. "It's not hard to scare them. That's the political difficulty we've run into."

As an example, the Pharmaceutical Research and Manufacturers of America, representing the leading drug research and biotechnology companies in the U.S., says product stewardship could increase the cost of drugs and create a greater potential for drug diversion through theft, because the discarded medicines would be collected in one place.

"Take-back programs do not make environmental sense when the easiest, most acceptable way to rid the home of unused medicines is to dispose of them in household trash," the trade group said in a recent press release. "... Creating a new process for disposing of unused medicines would be a complex task that will

require significant financial resources. ..."

Chesbro has had more success with a bill that would require California to recycle 75 percent of its municipal waste by 2020. His bill was approved last year by the Assembly and is now under review in the state Senate.

Back in 1971, Chesbro was the founder of one of the state's first recycling centers. Recycling, he said, has created 85,000 jobs in California and could create more "green" jobs, if product stewardship becomes the law.

"We talk about going green as a way of getting out of our economic troubles," Chesbro said. "Recycling is the proven way of doing that. The problem is that the responsibility has always fallen on local cities and counties. There's never been any kind of comprehensive responsibility on the manufacturers of the products."

In Minnesota, another legislator with experience in the recycling business is promoting a product stewardship bill like Maine's. Rep. Paul Gardner of Shoreview, a member of the Democratic-Farmer-Labor Party, said, it's hard "to get people to understand what we're doing," but, he said, his bill, HF 2047, is becoming more attractive in a bad economy.

"Governments are looking for ways to cut costs, and this is one way to do it. You shift the cost from taxpayers to people who buy a particular type of product. And if every manufacturer has to comply with the same law, that can force them to work together and figure out how to pool resources."

The mounting trash heap

There's no question that Americans are throwing away more trash than ever before. It's up from 2.7 pounds per person per day in 1960 to 4.5 pounds in 2008, according to the U.S. Environmental Protection Agency. About 75 percent of trash is products and packaging, materials that may contain plastics, acids, heavy metals and petroleum by-products harmful to public health.

Recycling, meanwhile, has leveled out nationally at about 33 percent of the municipal waste stream. (California leads the nation with a recycling rate of 58 percent). On average, then, most of the trash in the United States is buried or burned.

Around the country, a few companies are already investing in recycling. Battery manufacturers run recycling centers for used rechargeable household batteries. Gas stations take back used oil. Coca-Cola has built the world's largest plastic bottle-to-bottle recycling plant. Anheuser-Busch has been recycling aluminum cans for 30 years. Hewlett-Packard takes back cell phones. Ford vehicles are 85 percent recyclable. And carpet manufacturers recycle about 5 percent of used carpets.

These efforts are welcome, but they do not go nearly far enough, said Heidi Sanborn, executive director of the California Product Stewardship Council.

"Our per-capita waste generation is still going up," Sanborn said. "We're not anywhere close to where we need to be. We've got to stop the bleed. Manufacturers have to meet a collection rate, and fund and manage the system, and part of the discussion is how many products are being sold into the market. Otherwise, there is no transparency."

Generations ago, American soft drink and beer manufacturers voluntarily ran "take-back" programs to collect bottles, refund deposits and refill the returned bottles. This is "cradle-to-cradle" packaging, and many environmental groups favor it as a way to reduce ocean litter.

Geoff Brosseau, executive director of the California Stormwater Quality Association, a nonprofit group that supports product stewardship, said Bay Area cities and counties are spending tens of millions of

dollars to capture street trash before it gets into the storm drains. The state recently ordered a 40 percent reduction in storm water trash for the region by 2015.

"We're not sure how we're going to comply," Brosseau said. "The timing couldn't be any worse. Cities have less money than even last year. They're not the source of the pollution: It's the residents and the manufacturers."

Only one prominent business group in the state, the California Retailers Association, has announced that it favors product stewardship, if it's phased in slowly. The owners of supermarket chains and department stores do not want to be on the hook for collecting or recycling the tens of thousands of products they sell, said Pamela Williams, senior vice president.

Williams predicts that eventually, the cost of waste disposal will pass to the private sector. The list of products requiring a manufacturer "take-back" will continue to grow and might soon include bug sprays, dog collars and even shampoos, Williams said.

"This is a massive change in the marketplace," she said, "but the world isn't going to end. We know it's coming."

http://www.miller-mccune.com/business_economics/the-smoldering-trash-revolt-1750?utm_source=Newsletter93&utm_medium=email&utm_content=0126&utm_campaign=newsletters

Play, Then Eat: Shift May Bring Gains at School

By TARA PARKER-POPE

Kirsten Luce for The New York Times **SWITCHED** Children playing before lunch at Sharon Elementary School in Robbinsville, N.J. “Kids are calmer after they’ve had recess first,” the school’s principal said.

Can something as simple as the timing of recess make a difference in a child’s health and behavior?Some experts think it can, and now some schools are rescheduling recess — sending students out to play before they sit down for lunch. The switch appears to have led to some surprising changes in both cafeteria and classroom.Schools that have tried it report that when children play before lunch, there is less food waste and higher consumption of milk, fruit and vegetables. And some teachers say there are fewer behavior problems.

“Kids are calmer after they’ve had recess first,” said Janet Sinkewicz, principal of Sharon Elementary School in Robbinsville, N.J., which made the change last fall. “They feel like they have more time to eat and they don’t have to rush.”One recent weekday at Sharon, I watched as gaggles of second graders chased one another around the playground and climbed on monkey bars. When the whistle blew, the bustling playground emptied almost instantly, and the children lined up to drop off their coats and mittens and file quietly into the cafeteria for lunch.

“All the wiggles are out,” Ms. Sinkewicz said.

One of the earliest schools to adopt the idea was North Ranch Elementary in Scottsdale, Ariz. About nine years ago, the school nurse suggested the change, and the school conducted a pilot study, tracking food waste and visits to the nurse along with anecdotal reports on student behavior.

By the end of the year, nurse visits had dropped 40 percent, with fewer headaches and stomachaches. One child told school workers that he was happy he didn’t throw up anymore at recess.

Other children had been rushing through lunch to get to the playground sooner, leaving much uneaten. After the switch, food waste declined and children were less likely to become hungry or feel sick later in the day. And to the surprise of school officials, moving recess before lunch ended up adding about 15 minutes of classroom instruction.

In the Arizona heat, “kids needed a cool-down period before they could start academic work,” said the principal, Sarah Hartley.

“We saved 15 minutes every day,” Dr. Hartley continued, “because kids could play, then go into the cafeteria and eat and cool down, and come back to the classroom and start academic work immediately.”

Since that pilot program, 18 of the district’s 31 schools have adopted “recess before lunch.”The switch did pose some challenges. Because children were coming straight from the playground, the school had to install hand sanitizers in the lunchroom. And until the lunch system was computerized, the school had to distribute children’s lunch cards as they returned from recess.

In Montana, state school officials were looking for ways to improve children’s eating habits and physical activity, and conducted a four-school pilot study of “recess before lunch” in 2002. According to a report from the Montana Team Nutrition program, children who played before lunch wasted less food, drank more milk and asked for more water. And as in Arizona, students were calmer when they returned to classrooms, resulting in about 10 minutes of extra teaching time.One challenge of the program was teaching children to eat slower. In the past, children often finished lunch in five minutes so they could get to recess. With the scheduling change, cafeteria workers had to encourage them to slow down, chew their food and use all the available time to finish their lunch.Today, about one-third of Montana schools have adopted “recess before lunch,” and state officials say more schools are being encouraged. “The pilot projects that are going on have been demonstrating that students are wasting less food, they have a more relaxed eating environment and improved behavior because they’re not rushing to get outside,” said Denise Juneau, superintendent of the Office of Public Instruction. “It’s something our office will promote to schools across the state as a best practice.”

Children’s health experts note that such a switch might not work in many urban school districts, where lower-income children may start the day hungry.

“It’s a great idea, but first we’ve got to give them a decent breakfast,” said Dr. David Ludwig, director of the obesity program at Children’s Hospital Boston. “A lot of kids skip breakfast and arrive at lunch ravenous.”And for a seemingly simple scheduling change, it can create some daunting logistical problems. Children often have to return to hallways and classrooms after recess for bathroom breaks and hand washing and to pick up lunch bags. The North Ranch Elementary School regularly fields calls from schools in colder climates with questions on how to deal with coats, hats, galoshes and mittens. “In Arizona, we don’t have to deal with that,” said Dr. Hartley, the principal.

Many school districts say such problems make them reluctant to switch. A 2006 study in The Journal of Childhood Nutrition & Management reported that fewer than 5 percent of the nation’s elementary schools were scheduling recess before lunch.

But at the Sharon Elementary School, the principal, Ms. Sinkewicz, says the challenges have been worth it. In the past, children took coats, hats and mittens with them to the lunchroom, then headed outside. Now they have time to return coats to lockers so they don’t have to carry them to the lunchroom.

“For some reason, kids aren’t losing things outside,” Ms. Sinkewicz said. “The lost-and-found mound has gone down.”

http://well.blogs.nytimes.com/2010/01/25/play-then-eat-shift-may-bring-gains-at-school/?nl=health&emc=healthupdateema1

In Labor, a Snack or a Sip?

By RONI CARYN RABIN

Maternity wards have long forbidden women in labor to eat or drink. Even when labor goes on and on, the bill of fare is usually limited to ice chips.

Now a systematic review of existing studies has found no evidence that the restrictions have any benefit for most healthy women and their babies.

The prohibitions are meant to reduce the risk of Mendelson's syndrome (named for Dr. Curtis L. Mendelson, the New York obstetrician who first described it in the 1940s), which can occur if the contents of the stomach are drawn into the lungs while the patient is under general anesthesia.

While rare, the syndrome can be fatal. But nowadays the use of general anesthesia during labor and delivery is also rare. Caesarean sections are generally done using regional anesthesia.

"My own view of this has always been that you could say one shouldn't eat or drink anything before getting into a car on the same basis, because you could be in an automobile accident and you might require general anesthesia," said Dr. Marcie Richardson, an obstetrician and gynecologist at Harvard Vanguard Medical Associates in Boston, who was not connected to the new study.

Beth Israel Deaconess Medical Center, where Dr. Richardson delivers, estimates that just 1 to 2 percent of women in labor are given general anesthesia.

The restrictions date back almost seven decades, said Joan Tranmer, an associate professor of nursing at Queen's University in Kingston, Ontario, an author of the new review, published last week by the Cochrane Collaboration.

"We thought it was time to question this, now that we're in the 2000s," said Dr. Tranmer, who said she had seen all too many women in labor complaining of thirst and dry mouth resort to sucking wet washcloths.

"With improved anesthetic techniques, we don't do general anesthesia a lot anymore," she said. "And even when they have to administer general anesthesia, they've improved the techniques, and the risk is very, very low.

"So we turned the question around and asked: Is there any benefit to restricting oral food and fluid during labor? And we found no benefit and no harm."

The authors acknowledged that they found relatively little evidence to analyze: 11 studies, including just 5 randomized controlled trials encompassing 3,130 women.

All of the studies looked at women who were in active labor and at low risk of requiring general anesthesia. One compared complete restriction of food and drink with complete freedom to eat and drink at will, two compared water with other liquids and foods and two compared water with carbohydrate drinks.

There were no statistically significant differences in such primary outcomes as the rate of Caesarean sections and fetal Apgar scores, or in secondary outcomes, like the need for pain relief or duration of labor. One small study, however, did find an increase in C-sections among women taking carbohydrate drinks compared with those limited to drinking water.

Some hospitals have lifted restrictions on drinking during labor in recent months, since the American Congress of Obstetricians and Gynecologists issued new guidelines last August allowing patients to drink clear liquids. But the guidelines kept the restriction on solid foods.

"The problem is going to be for emergency C-sections, which are rare but not unheard of," said Dr. William Henry Barth Jr., chairman of the society's committee on obstetrics practice. "There's just not time in that setting to stop and do regional anesthesia. And it can be unpredictable."

Anesthesiologists were critical of the review, saying none of the studies were large enough to evaluate the impact of eating on risks during general anesthesia.

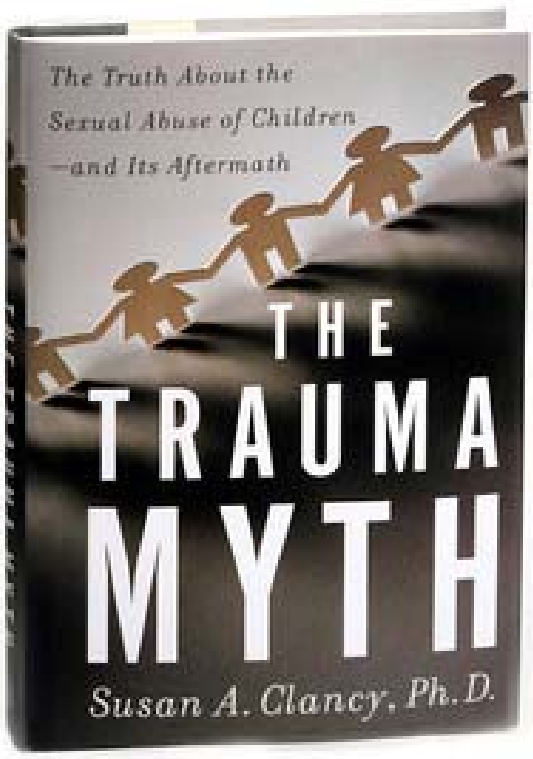
"From an anesthesiologist's perspective, they missed the boat on this one," said Dr. Craig M. Palmer, chairman of the committee on obstetrical anesthesia for the American Society of Anesthesiologists.

"They looked at the impact on the progression of labor, but to be honest, that's not an issue for anesthesiologists. Our primary concern is patient safety."

http://www.nytimes.com/2010/01/26/health/26child.html?ref=health

Abusing Not Only Children, but Also Science

By ABIGAIL ZUGER, M.D.



Given the vested interests lurking all over the current medical landscape, it is no wonder that the scientific method is so often mauled a little in transit. Cases of data ignored or manipulated to serve an agenda are like muggings in a bad neighborhood: you hear about them all the time, but in fact relatively few are ever openly examined.

And so even readers with no personal or professional connection to the sexual abuse of children may be edified by "The Trauma Myth," a short tale of one such particularly fraught episode.

For a graduate research project at Harvard in the mid-1990s, the psychologist Susan A. Clancy arranged to interview adult survivors of childhood sexual abuse, expecting to confirm the conventional wisdom that the more traumatic the abuse had been, the more troubled an adult the child had become.

Dr. Clancy figured she knew what she would find: "Everything I knew dictated that the abuse should be a horrible experience, that the child should be traumatized at the time it was happening — overwhelmed with fear, shock, horror."

But many carefully documented interviews revealed nothing of the sort. Commonly, the abuse had been confusing for the child but not traumatic in the usual sense of the word. Only when the child grew old enough to understand exactly what had happened — sometimes many years later — did the fear, shock and horror begin. And only at that point did the experience become traumatic and begin its well-known destructive process.

Dr. Clancy questioned her findings, reconfirmed them and was convinced. Her audience, when she made the data public, was outraged.

First, her data flew in the face of several decades of politically correct trauma theory, feminist theory and sexual politics.

Second, Dr. Clancy found that the world had little appetite for scientific subtlety: "Unfortunately, when people heard 'not traumatic when it happens,' they translated my words to mean, 'It doesn't harm victims later on.' Even worse, some assumed I was blaming victims for their abuse."

Dr. Clancy reports that she became a pariah in lay and academic circles. She was "crucified" in the press as a "friend of pedophiles," colleagues boycotted her talks, advisers suggested that continuing on her trajectory would rule out an academic career.

All that fuss about one little word — "trauma" — and a change in its timing. Why should it matter one way or the other?

Dr. Clancy suggests several reasons her data aroused such passion. For one thing, a whole academic and therapeutic structure rides on the old model of sexual abuse; her findings had the potential to undermine a host of expensive treatment and prevention projects.

Meanwhile, she argues, it is her model that may really help victims. Adult survivors of childhood abuse are commonly mortified by their own behavior as children. By not fighting back or calling for help, they blame themselves for effectively colluding with their abuser. It can be intensely comforting for them to hear that their reaction, or lack thereof, was completely normal.

Dr. Clancy's model also makes some sense of the whole sticky question of repressed memory. Most traumatic events are likely to be vividly remembered. But if instances of sexual abuse are simply among the many confusions that characterize childhood, they are perfectly forgettable: "Why should a child remember them if, at the time they happened, they were not particularly traumatic?" Only when reprocessed and fully understood do the memories leap into focus.

Even without all these practicalities, the moral of Dr. Clancy's story is clear: science should represent truth, not wishful thinking. When good data fly in the face of beloved theory, the theory has to go.

Dr. Clancy writes with the precision and patient repetition of a good teacher on complicated terrain. Her prose could not be clearer, and her points are restated many, many times over. But at Amazon.com, an outraged customer-reviewer has already pounced.

"It is appalling," the reviewer wrote, "that 'experts' like Susan Clancy can get away with having a book published with a title that is not only false, but one that tells sexual perpetrators, 'Go ahead, sexually abuse children, they like it, and they aren't going to be traumatized by it.' "

Science is sometimes no match for conviction, and often, evidently, good writing is not either.

Speaking of good writing, two other new books this month stumble a little in that regard, even as they promise readers the world.

In "The Language of Life," Dr. Francis S. Collins, the director of the National Institutes of Health and a renowned investigator into the human genome, conducts a tour of the mythic land of personalized genetic medicine, in theory just around the corner.

Using his very own genome as a guide, Dr. Collins covers the familiar territory of cancer-associated genes, then heads for the more arcane regions that govern aging and susceptibility to various infections. It should be an exciting trip, but alas, if you are one of those whose eyelids begin to droop when the nucleotides come marching out, this book spells stupor for you.

And in "The Language of Pain," Dr. David Biro, a New York dermatologist, gives himself the assignment of creating a rhetoric of pain. "Pain is difficult to express," Dr. Biro writes. "We end up wringing our hands and resigning ourselves to silence" — hence the legion of missteps in treating pain properly.

In a 2000 memoir, "One Hundred Days," Dr. Biro wrote movingly of his own experience with a rare blood disease ultimately cured by a bone marrow transplant. But in this book the personal touch is pretty much gone; instead he studiously mines the great works of art, literature and philosophy for apt pain-related metaphors. The effect is that of a well-done honors thesis — comprehensive and full of good intentions but not very readable.

http://www.nytimes.com/2010/01/26/health/26zuger.html?ref=health

A New Way to Look for Diseases' Genetic Roots

By NICHOLAS WADE

The hunt for the genetic roots of common diseases has hit a blank wall.

The genetic variants found so far account in most cases for a small fraction of the genetic risk of the major killers. So where is the missing heritability and why has it not showed up?

A Duke geneticist now suggests that the standard method of gene hunting had a theoretical flaw and should proceed on a different basis. The purpose of the $3 billion project to decode the human genome, completed in 2003, was to discover the genetic roots of common diseases like diabetes, cancer and Alzheimer's. The diseases are called complex, meaning that several mutated genes are probably implicated in each. A principal theory has long been that these variant genes have become common in the population because the diseases strike late in life, after a person has had children. Bad genes would not be eliminated by natural selection at that age, as they would if the diseases struck before the child-bearing years.

So to find disease genes, the thinking went, do not decode the entire genome of every patient — just look at the few sites where genetic variations are common, defined as being present in at least 1 percent of the population. These sites of common variation are called SNPs (pronounced "snips"), and biotech companies have developed ingenious devices to recognize up to 500,000 SNPs at a time. The SNP chips made possible genomewide association studies in which the genomes of many patients are compared with those of healthy people to see which SNPs are correlated with the disease.

The SNP chips worked well, the studies were well designed, though enormously expensive, and some 2,000 disease-associated SNPs have been identified by university consortiums in the United States and Europe.

But this mountainous labor produced something of a mouse.

In each disease, with few exceptions, the SNPs accounted for small percentage of the genetic risk. A second puzzling feature was that many of the disease-linked SNPs did not occur in the DNA that codes for genes, but rather in the so-called junk regions of the genome. Biologists speculated that these SNPs must play an as-yet-undefined role in deranging the regulation of nearby genes.

In an article this week in the journal PLoS Biology, the Duke geneticist David B. Goldsteinph.d and his colleagues propose an explanation for both findings.

They argue that the common disease-common variant idea is largely incorrect: natural selection has in fact done far better than expected in eliminating disease-causing variants from the population. It follows that the major burden of disease is carried by a multitude of rare variants — ones too rare to have been programmed into the SNP chips.

So why have the genomewide association studies linked some SNPs to disease, if in fact it is the rare variants that cause it?

In Dr. Goldstein's view, the SNPs could simply be acting as surrogate markers for the rare variants. Until now, geneticists have assumed a disease-linked SNP was either itself a cause or was a marker for a disease variant nearby. But Dr. Goldstein's team calculated that the rare variants associated with a SNP can occur up to two million units of DNA away from it. This means that the disease-associated SNPs do not necessarily point to anything useful and that it is dangerous to assume the nearest gene is the cause of the disease.

If SNPs are indeed rather indirect markers of disease, that would explain why many have turned up in junk DNA.

But why do the SNPs get implicated in the genomewide association studies if in fact it is the rare variants that cause disease? Most of the SNPs are ancient, which is how they got to be common, whereas the disease-causing rare variants are mostly recent, because natural selection is always sweeping them away. After a SNP is created, some of the population has it and the rest continue to carry the standard DNA unit at that site in their genome.

When the rare disease-causing variants build up much later, Dr. Goldstein suggests, some will be on stretches of DNA containing the SNP and others on stretches of DNA with the standard unit. Since the allocation is random, more rare variants will be sometimes lie on the DNA with the SNP, and the SNP will appear as statistically associated with the disease even if it is not.

The association is not exactly spurious — Dr. Goldstein calls it "synthetic" — but it is indirect, so much so as to make many SNPs useless for identifying the genes that cause disease.

Geneticists have long been aware of this possibility, but Dr. Goldstein's team has shown theoretically that this could happen more often than expected. He has also examined the question in reverse by doing a genomewide association study of sickle cell anemia.

Though the disease is known to be caused by a variant in a single gene, the Duke geneticists found a statistically significant association with 179 SNPs, spread across a stretch of DNA two and a half million units in length and containing dozens of genes. Most of these SNPs were clearly pointing at the wrong thing.

Genomewide association studies, conducted with hundreds of patients, can each cost in the range of $10 million or more. Though the studies may have led researchers up a blind alley in many cases, they were not a mistake, Dr. Goldstein believes.

"I think most people now view genomewide association studies as something we absolutely had to do and have now done," he said. "It's fair to say that for many common diseases nothing of very great importance was discovered, but those studies have told us what to do next."

That next step, in his view, is to sequence, or decode, patients' entire genomes and then to look for likely mutations in the genes themselves. The cost of sequencing a human genome has been plummeting in recent years, and it may now be possible to sequence large numbers of patients.

Finding even a few of the rare variants that cause disease could point to genes that make suitable targets for drug makers. The SNPs statistically linked to disease have mostly failed to identify the right genes, but the rare variants may, Dr. Goldstein said.

The Icelandic gene-hunting firm deCODE genetics, which emerged last week from bankruptcy, has long led in detecting SNPs associated with common disease. Dr. Kari Stefansson, the company's founder and research director, agreed that whole genome sequencing would "give us a lot of extremely exciting data." But he disputed Dr. Goldstein's view that rare variants carried most of the missing heritability. Both deCODE genetics and scientists at the Broad Institute in Cambridge, Mass., have sequenced regions of the genome surrounding SNPs in search of rare variants, but have found very few, Dr. Stefansson said.

"We can speculate till we are blue in our faces," he said, "but the fact of the matter is that there is no substitute for data."

http://www.nytimes.com/2010/01/26/science/26gene.html?ref=health

Patient Safety: Conversation to Curriculum

By DANIEL BLUMENTHAL and ISHANI GANGULI

Two summers ago, as bright-eyed third-year medical students, we rushed into clinics and operating rooms, eager to apply our textbook knowledge at last to the daily practice of working with patients.

To our untrained eyes, the system in which we were expected to deploy this knowledge was often baffling, with its unfamiliar rituals of scribbled notes and morning rounds. And it was at its most baffling when things did not go according to plan: if a patient took an unexpected turn for the worse, was that because of natural causes or medical error?

Since the publication of the well-known Institute of Medicine report in 1999 estimating that medical errors kill as many as 98,000 people a year, the topic has become part of the national conversation. More recently, a study in The New England Journal of Medicine and a new book, "The Checklist Manifesto," by Dr. Atul Gawande (Metropolitan Books, 2009), have testified to the efficacy of surgical checklists and the value of encouraging all members of a surgical team to speak up about potential sources of error.

But so far, the conversation has been slow to trickle down to medical schools.

A 2008 survey by the Liaison Committee on Medical Education, which accredits United States medical schools, reported that two-thirds of medical schools mentioned patient safety in a required course, with an average of two sessions on the topic.

But another survey of 391 medical students by the nonprofit Institute for Healthcare Improvement found that four out of five felt their exposure to the topics of patient safety and quality improvement had been fair at best. And Dr. David Davis, senior director for continuing education and performance improvement at the Association of American Medical Colleges, told us there was "still some debate" about how and when to teach this material.

Why haven't medical schools moved faster? For one, medical education is a zero-sum game, with vast amounts of material to cover. Dr. Donald M. Berwick, president of the health care institute, said the idea that schools "should give up the Krebs cycle or membrane transport" — basic biochemistry concepts —

for patient safety was hard to swallow. Further, doctors tend to put a much higher value on their own clinical skills than on communication and cross-checking. While "medicine has historically valued disciplinary excellence — doing your doctoring or surgery right," Dr. Berwick said, most errors probably "lie at interfaces and handoffs" from one doctor to another.

In 2003, deans at 10 medical schools, including Dartmouth, the University of Minnesota and the University of Illinois, formed a collaborative group to foster communication across disciplines. Each school experiments with teaching strategies, then shares the results with the collaborative.

At Dartmouth, for instance, students participate in debriefing sessions with teams of medical professionals trained to respond quickly to in-hospital emergencies. Courses at other schools have invited parents of children injured or killed as a result of errors to talk with students about their experiences, putting a human face on the problem.

In a new three-week course on patient safety, fourth-year students at the University of Pennsylvania spend time at the Wharton School of Business. Among other things, they learn how Toyota's model of product reliability can be applied to health care.

"The final piece is the economic analysis," said Dr. Richard Shannon, chairman of the Penn health system's department of medicine. "What does this mean? What do hospital infections cost in real dollars?"

Through such sessions, students can learn how medical errors are defined and how to tell an error from a negative outcome, said Dr. Melissa A. Fischer, an assistant professor of medicine at the University of Massachusetts Medical School. As she emphasizes to her students, "bad things can happen even when everything is done right."

Because curriculum change at a national level has been slow, organizations like Dr. Berwick's institute are taking another approach: reaching out to students who are eager to tackle these issues.

The institute's new Open School for Health Professions is a hub of free online courses, case studies and discussion forums addressing errors and other quality improvement topics. The school went live in fall 2008 and has already registered more than 20,000 students, with more than 173 school- and hospital-based chapters in 41 states and 24 countries, according to its director, Jill Duncan.

The challenge is translating open discussion among medical, nursing and pharmacy students in online forums into open discussion on the hospital floor, and in turn, into day-to-day change in health care quality. Studies have implicated poor communication in medical errors — especially between doctors of different ranks — and demonstrated the role of open communication in improving patient outcomes.

As fresh observers of hospital dynamics across specialties, medical students are in an ideal position to effect change by speaking up. But patient safety experts question whether doctors, particularly those in hierarchical fields like surgery, are really ready to hear it — especially, Dr. Berwick said, from medical students, who run the risk of being labeled "troublemakers" and "naïve."

These factors suggest a pressing need for a cultural shift, one that dissolves the secrecy surrounding medical errors and allows trainees and seasoned doctors to speak openly about their mistakes and those their colleagues have made.

The psychological safety of this blame-free setting can feel scarce indeed in some high-powered institutions. A classwide poll of third-year students revealed that most of us had witnessed errors by superiors or peers or had committed them ourselves — and demonstrated our striking ignorance of what to do about them.

Harvard's limited coursework on this topic is by no means unique among medical schools. But as we came to realize, the tenets of avoiding medical error must be learned and enforced in real time.

So on the wards we did our best to develop good habits: rechecking medication flow sheets to ensure that a patient was getting the treatments we ordered, or making the trek from the on-call room to the nurses' station at 4 a.m. to confirm that he was scheduled for his early morning CT scan.

It took a degree of humility to ask what seemed the obvious question and confidence to approach senior doctors with our own literature search on the best way to manage a patient's unruly hypertension.

The hope is that thinking through these issues, and understanding the advantages and flaws of current practices, will help us become better doctors.

"What's the purpose of medical school? And what is the product we have in mind? And who ought to answer that?" asked Dr. Lucian Leape, a patient safety researcher at the Harvard School of Public Health. "When I go to a doctor, I should have somebody who I know is competent, who I know I can trust and who will put my interests first. Two of those three have nothing to do with science."

Daniel Blumenthal and Ishani Ganguli are fourth-year students at Harvard Medical School.

http://www.nytimes.com/2010/01/26/health/26error.html?ref=health

The Ozone Hole Is Mending. Now for the 'But.'

By SINDYA N. BHANOO

That the hole in Earth's ozone layer is slowly mending is considered a big victory for environmental policy makers. But in a new report, scientists say there is a downside: its repair may contribute to global warming.

It turns out that the hole led to the formation of moist, brighter-than-usual clouds that shielded the Antarctic region from the warming induced by greenhouse gas emissions over the last two decades, scientists write in Wednesday's issue of Geophysical Research Letters.

"The recovery of the hole will reverse that," said Ken Carslaw, a professor of atmospheric science at the University of Leeds and a co-author of the paper. "Essentially, it will accelerate warming in certain parts of the Southern Hemisphere."

The hole in the layer, discovered above Antarctica in the mid-1980s, caused wide alarm because ozone plays a crucial role in protecting life on Earth from harmful ultraviolet radiation.

The hole was largely attributed to the human use of chlorofluorocarbons, chemical compounds found in refrigerants and aerosol cans that dissipate ozone. Under an international protocol adopted in 1987, many countries phased out the compounds, helping the ozone to start reconstituting itself over the Antarctic.

For their research, the authors of the new study relied on meteorological data recorded between 1980 and 2000, including global wind speeds recorded by the European Center for Medium-Range Weather Forecasts.

The data show that the hole in the ozone layer generated high-speed winds that caused sea salt to be swept up into the atmosphere to form moist clouds. The clouds reflect more of the sun's powerful rays and help fend off warming in the Antarctic atmosphere, the scientists write.

The sea spray influx resulted in an increase in cloud droplet concentration of about 46 percent in some regions of the Southern Hemisphere, Dr. Carslaw said.

But Judith Perlwitz, a University of Colorado professor and a research scientist at the National Oceanic and Atmospheric Administration, said that although the paper's data were sound, she questioned the conclusions.

Even as the ozone layer recovers, greenhouse gas emissions are expected to expand, she said. She predicted that the rise in temperatures would cause wind speeds to increase over time and have the same cloud-forming effect that the ozone hole now has.

"The question is whether the wind is really going to slow down, and that I doubt," she said.

"The future is not just determined by the recovery of the ozone hole," she said. "We're also increasing our use of greenhouse gases, which increases the speed of the winds all year long."

Dr. Perlwitz also pointed out that the ozone hole was not expected to fully recover to pre-1980 levels until at least 2060, according to the World Meteorological Organization's most recent report on the issue.

http://www.nytimes.com/2010/01/26/science/earth/26ozone.html?ref=science

Turning Trash Piles Into a Bird-Watcher's Paradise

By JAMES BARRON

"Do you see what I see?" Seth Wollney asked.

The only thing a fledgling bird-watcher saw through his binoculars was a Boeing 757.

It turned out that six tiny meadowlarks, with their bright yellow feathers and necklace-like black markings around their throats, were on the ground, in a marshy stretch of what used to be the largest landfill in the world.

These days the Fresh Kills landfill is somewhere between its infamous, stinking past and its future as Freshkills Park, a 2,200-acre park with meadows and wetlands and a strange-looking name. The parks department, apparently hoping for a fresh start, is smashing the two words together and lower-casing the K. The project is expected to take decades, but the department hopes to have a small part open within the next few years.

Enter the bird-watchers, their high-powered binoculars and long-lens cameras around their necks, their illustrated reference guides in their pockets.

Every other month for the last year, the parks department has led birders through Freshkills. This explains why Mr. Wollney, a public programs associate from the Staten Island Museum, was climbing a 150-foot mountain on Sunday morning, trailed by more than 20 others who had signed up for the tour.

The mountain was once a garbage pile. Now it has been sealed off with a plastic membrane and covered with a special kind of grass. Maybe on a clear day a Burton Lane-Alan Jay Lerner song would come to mind. Sunday, with blustery winds and a spitting sky, was not that day.

Still, in two hours the birders reported seeing everything from common mergansers to buffleheads, which one woman in the group said were behaving like bobblehead dolls. And Raj Kottamasu, a parks

department manager who led the tour with two officials of the Staten Island Museum, said red-tailed hawk sightings were "pretty much guaranteed."

"It's actually not uncommon to have a large bird population on a former landfill site," he said. "A good portion of the Meadowlands was landfill, and that's a really popular site for bird-watching."

Mary Eyster, a member of the Brooklyn Bird Club, said she had gone bird-watching in a handful of local landfills. At one, she saw five kinds of owls, including a Northern saw-whet.

Yes, a northern ... huh?

"There's one in Prospect Park," she said. "It's hard to tell from a pine cone. It's in a tree with pine cones." She said that her first sighting was with Peter Dorosh, the president of the Brooklyn Bird Club: "He said, 'There it is.' I said, 'That's a pine cone.' But it wasn't." (And, truth be told, the sharp-eyed Ms. Eyster had seen the meadowlarks on the mountain at Freshkills even before Mr. Wollney had.)

To the birders, Fresh Kills is not what it once was. "There used to be more birds when it was a dump," said Susan Fowler, an office administrator who lives in West New Brighton. "It used to be they could see a garbage pile from space. Now they'll see a park from space." (Mr. Wollney said later that the space-viewing was completely not true: "The Great Wall of China is not visible from space, either.")

Maybe not. But some of the birders said the population had diminished. Anne Purcell recalled going to Fresh Kills for the Christmas Bird Count, an avian census conducted from mid-December to early January each year. "The highest count, we had 100 red tails when the dump was still operating," Ms. Purcell said. "And the gull numbers were incredible."

"Upwards of 50,000 great black back gulls," said Edward Johnson, the director of science at the Staten Island Museum, who served as a spotter on the tour.

"Not seagulls," Ms. Purcell said. "People make that mistake."

Mr. Johnson nodded. "Now we only get in the hundreds, maybe the low thousands," he said. "We closed down their food sources."

The tour began at the Eltingville Transit Center, a park-and-ride bus station about a mile and a half (as the you-know-what flies) from the entrance to Fresh Kills. The parks department provided a 24-seat bus, but before it pulled out, there was paperwork. Everyone had to sign a form promising not to hold the Sanitation Department responsible for injuries or death at the landfill. "It's the standard Department of Sanitation waiver for a construction site," Mr. Kottamasu explained. "The half that's not under construction is where we're going."

He also explained about the bathrooms. There are none at Fresh Kills — yet. An environmentally friendly comfort station is on the drawing board. Mr. Kottamasu advised birders to use the restrooms in the transit center.

On the way to Fresh Kills, the bus passed an area called Owl Hollow, which Mr. Kottamasu said would be the first part of the transformation to Freshkills. No owls were seen. "I'm not sure why it's called Owl Hollow," Mr. Kottamasu said.

Soon the bus was at the gate to Fresh Kills, and a moment later Mr. Johnson was telling the driver to hit the brakes. "There's a red-tailed hawk in a tree right there," he said.

The birders in the bus oohed and ahhed. The hawk responded by taking off. Soon it was making lazy circles in the sky, 22 miles from Broadway and 1,235 miles from Oklahoma.

“You always hear about the family on Fifth Avenue,” said Sheila Swigert, a retired teacher from St. George. “They make films and they protest. These out here in the forgotten borough. ...” Her voice trailed off.

Ms. Purcell recalled seeing a barn owl perched in a crane on one of her earlier trips to Fresh Kills. Not a feathery crane, but the big blue metal kind that was once the workhorse of the Sanitation Department fleet, with big jaws that scooped the trash from garbage barges and dumped it in the landfill. Toward the end of the tour the bus passed a row of them, standing silent.

The birders visited two of Fresh Kills’ four peaks: North Mound, which will be called North Park once Freshkills opens as a park, and South Mound, which will become South Park.

“I was waiting for the ‘South Park’ reference,” Ms. Purcell said, struggling to remember the names of the characters on the long-running Comedy Central series.

Of the two, North Mound is taller, at 150 feet, Mr. Kottamasu said. As the birders reached the top, he was talking about a viewing platform the parks department plans to build for birders, overlooking an adjacent wildlife refuge on land that was never part of the landfill.

And Mr. Wollney was talking about a scientific paper he had read about “people who were here 12,000 years ago” — back in the pre-garbage age.

http://www.nytimes.com/2010/01/26/nyregion/26bird.html?ref=science

Energy Grants Seek Reliable Source for Diagnostic Aid

By MATTHEW L. WALD

WASHINGTON — Amid a global shortage of a radioactive isotope used to diagnose cancer, heart disease and kidney problems, the Energy Department on Monday moved to develop two radically different sources for the material.

Supplies have been short since last May, when the reactor in Chalk River, Ontario, that used to be the biggest supplier of the isotope was shut down because of a leak. It is under repair, but even if it can be restarted, it is more than a half-century old and its future is uncertain. A Dutch reactor that can also be used is almost as old and has been shut for extended periods, some planned, some not.

The isotope, Molybdenum-99, known as Moly-99, produces a product that decays extremely rapidly by throwing off a unit of gamma radiation that lights up organs and structures and is easy to locate with detectors. By using the isotope, doctors can see such things as tumors or blood flow in the heart. Because it decays quickly it does not linger in the body, but the same quality also makes it impractical to stockpile.

When available, the material is used in more than 40,000 medical procedures a day in the United States.

Existing production processes use weapons-grade uranium, and split it in a reactor. About 6 percent of the atomic fragments are Moly-99, which can be chemically separated from the other components. The Moly-99 itself is not helpful, but it breaks down, at the rate of half every 66 hours, into another radioactive material, Technetium-99m, which is extremely useful. The Technetium-99m breaks down again, by half every six hours. In that second breakdown it gives off a detectable gamma ray.

On Monday, General Electric announced that it had received $2.25 million, and said it would put up an equal amount, to develop a new way to make Moly-99. Its plan is to take a naturally-occurring material, Moly-98, and insert it into the heart of a commercial nuclear power reactor. Those reactors run for months at a time, making them impractical for use in producing a short-lived material.

But the reactors built by General Electric have tiny openings at the bottom, intended to allow technicians to insert an instrument that counts neutrons, the sub-atomic particles that sustain a nuclear chain-reaction. G.E., with its partner Hitachi, wants to put the molybdenum, in a pencil-like shape, on the mechanism that usually holds the neutron-measuring instrument. It would remain in the reactor for about eight days. In that time, some of the Moly-98 would pick up an extra neutron and become Moly-99.

The process could be used at two or more reactors, said Chris Monetta, a senior vice president at G.E. Hitachi Nuclear Energy's nuclear fuel cycle advanced programs, and would provide steady supplies for medical use.

"We've done this on a lab scale basis," said Kevin Walsh, the chief executive of Global Nuclear Fuel, a joint venture of G.E., Hitachi and Toshiba. The development project would cost about $30 million, he said, and the agreement with the Energy Department requires large-scale capability by the end of 2013.

The other path the Energy Department is pursuing to produce more of the isotope is a tiny new reactor, being developed by Babcock & Wilcox Technical Services Group, a subsidiary of McDermott International. It would have about one ten-thousandth the power output of a commercial reactor, and it would run on uranium in a liquid form. The uranium would be the fuel, providing the neutrons, and also the target, the material split to make Moly-99. The reactor would be shut down periodically, and the molybdenum filtered out of it. The unused uranium would go back into the reactor, a recycling that would minimize waste.

The uranium would be of low enrichment, unsuitable for bombs. And to shut down the reactor, engineers say, the fuel would simply be allowed to flow into a container of a different shape, one that would not sustain a chain reaction because the liquid would be spread over too big an area. Babcock & Wilcox received $9 million from the government, an amount that Bob Cochran, president of the company's Technical Services Group, said would pay for less than half the work; he would not say what the total project would cost. His company has a partner, Covidien, a radiopharmaceutical company that produces Moly-99 in a form hospitals can use from material supplied by the Dutch reactor.

The National Nuclear Security Administration, the part of the Energy Department that manages nuclear weapons, provided the grants. It has been seeking alternative ways to produce the material that did not involve shipping weapons-grade uranium abroad. The agency acted as Congress was moving toward banning the use of bomb-grade uranium for the purpose, because of the risk of diversion for military use. A bill proposed by Representative Edward J. Markey, Democrat of Massachusetts, and Fred Upton, Republican of Michigan, would ban the use of bomb-grade uranium for medical isotope production. It has passed the House and is awaiting action by the Senate.

http://www.nytimes.com/2010/01/26/science/26nuke.html?ref=science

Structural Integrity and People, Too

By FRED A. BERNSTEIN

DURING one three-week period recently Iwan Baan touched down in Amsterdam, Mexico City, Miami, New York, Milan, Rome, Tokyo, Medellín and Basel, where he photographed buildings designed by some of the world's top architects, including Herzog & de Meuron, Rem Koolhaas and Toyo Ito. Along with Steven Holl, Thom Mayne and the Japanese firm Sanaa, they have helped turn Mr. Baan, 34, into almost certainly the most peripatetic architectural photographer in the world as well as one of the most widely published.

Just five years after he took up architectural photography, Mr. Baan is "remaking the genre," said Charles Renfro, a partner in Diller Scofidio & Renfro, for whom he has photographed projects like the High Line and the renovated Lincoln Center. For decades magazine editors, developers and architects themselves favored a static style of photography that framed buildings as pristine objects. Mr. Baan's work, while still showing architecture in flattering lights and from carefully chosen angles, does away with the old feeling of chilly perfection. In its place he offers untidiness, of the kind that comes from real people moving though buildings and real cities massing around them.

Mr. Baan sees buildings as backdrops for his photographs of people, he said during a recent visit to New York. Looking at a picture of the new Cooper Union building in the East Village, designed by Mr. Mayne, Mr. Baan said, "It's about the woman shuffling down the street." His work owes as much to Diane Arbus and Henri Cartier-Bresson as to Julius Shulman or Ezra Stoller, the pre-eminent architectural photographers of the late 20th century.

And where Shulman may be best known for exalting glass houses that hovered above Los Angeles, Mr. Baan often does the opposite, chartering helicopters to photograph buildings as small objects amid relentless urban sprawl. If Shulman and Stoller's glorifying of pure form was an ideal match for the purist Modern architecture of their era, Mr. Baan's conjuring of real life may be ideally suited to a time when architects like Mr. Koolhaas are creating buildings meant to absorb and reflect the messiness of 21st-century cities.

Mr. Baan, who grew up outside Amsterdam, got his first camera, an Agfa Clack, at 12 but quickly traded it in for a more sophisticated model. In the mid-1990s he studied photography at the Royal Academy of Art, in The Hague, but he didn't plan to shoot architecture because when he tried it, he was asked for "incredibly boring" pictures, he said, "with blue sky and no people." And he never finished school, in part, he said, because some of his professors didn't consider his digital work "real photography." At the end of the decade he lived in New York, where he took photos for a series of children's books.

Like many technophiles of his generation, he was fascinated by the Internet. In 2004 he saw an exhibition of images produced by Mr. Koolhaas's research studio, AMO, on the history of Europe, and — looking for work — he wrote a proposal for turning it into an interactive Web site. Months after he submitted it, he got a call asking if he could accompany Mr. Koolhaas to Brussels to present the idea to an official of the European Union.

That trip led to a number of collaborations with Mr. Koolhaas, including an assignment to document construction of the CCTV tower in Beijing, which involved flying to Beijing every eight weeks. He contacted the offices of Herzog & de Meuron (whose Bird's Nest stadium was being built for the 2008 Olympics) and Steven Holl (whose Linked Hybrid, a series of residential towers connected by sky bridges, was breaking ground), asking if he could photograph their buildings there. Rather than waiting to be chosen by clients, "he chose our architecture," Mr. Holl recalled.

Mr. Baan said he was drawn to the Chinese projects largely because the migrant construction workers who lived on site — as many as 10,000 in the case of CCTV — created entire communities for him to photograph, with the new buildings as backdrops. And he was able to capture pretty much what he saw. Nobody bothered to pose for the young man with a self-effacing manner and a hand-held Canon.

Unmarried and unattached, Mr. Baan books his own travel, negotiates his own fees by e-mail (it helps that he speaks three languages) and carries all the equipment he needs in a shoulder bag. He works for architects, their clients or magazines, including several European publications. Last year the Italian design magazine Abitare sent Mr. Baan to Norway to photograph the Knut Hamsun Center, a museum by Mr. Holl north of the Arctic Circle. Mr. Holl then purchased the rights to the photographs, which were distributed to news outlets. Given the building's remote location, Mr. Baan's photographs will be crucial to how it is received internationally, Mr. Holl said.

In his spare time Mr. Baan is photographing a series of little-known Richard Neutra houses in Europe for a coming show at the MARTa Herford museum in Herford, Germany. And he has flown to Africa repeatedly to photograph the work of contemporary African architects, a personal passion. He had two books out last year, one on the work of Sanaa, the Japanese firm known in New York for the New Museum of Contemporary Art, the other on the Porsche Museum in Stuttgart, Germany. He accepted the Porsche commission, he said, knowing that he would take an approach to the building at odds with the smooth, luxurious image of the cars.

Mr. Baan maintains a studio in Amsterdam — his nominal hometown — where he has developed techniques for taking panoramic photographs of the insides of architectural models. As part of the symbiosis between Mr. Baan and the architects he works with, his panoramas of their models, presented to prospective clients, have helped them win commissions. In addition to working for stars like Mr. Koolhaas he is also helping to popularize the work of young architects whose work he admires, including Sou Fujimoto, who has created some highly innovative houses in remote parts of Japan.

Mr. Baan may never put down roots, but he and a friend, the Dutch-born architect Florian Idenburg, are considering building a two-family house in Brooklyn. (Mr. Idenburg has a wife and children.) That will give Mr. Baan a place to stay and yet another building, in another throbbing city, to use as a backdrop for his startling photos.

http://www.nytimes.com/2010/01/24/arts/design/24baan.html?ref=design

For Tapestry, One More Renaissance
By CAROL KINO

WHEN Chris and Suzanne Sharp conceived of their Banners of Persuasion tapestry project, the premise was fairly straightforward. “In the Renaissance people would commission an artist to do a tapestry for them,” Mr. Sharp said in a phone interview, “and then they’d commission a workshop to produce the design. We thought it would be interesting to return to the same format and that synergy between the commissioning person and the artist and the workshop.”

The results of that synergy are up through Feb. 13 in the show “Demons, Yarns & Tales,” at the James Cohan Gallery in Chelsea. It is the first purely artistic endeavor for the Sharps, owners of the Rug Company in London, which produces artisanal floor coverings. They had often considered working with artists, Mr. Sharp said, but the typical rug weave of 100 knots per square inch does not allow for much nuance and detail. Tapestry, which he said “enables literally hundreds of knots per square inch,” offered vastly more expressive potential, one reason that the medium was as highly regarded during the Renaissance as painting.

The couple set up a tapestry workshop just north of Shanghai, in a community full of expert weavers. Then they sought out “artists we adored,” Mr. Sharp said. “There was a lot of convincing them, because nobody’s done much with tapestry recently.”Eventually 14 artists came on board, including the American painter Kara Walker and the British pop artist Peter Blake. While a few offered existing work, others created new projects. Each piece was then scaled up to monumental size and redrawn on graph paper, a process that often took several months. After that the weavers took over.

Although many of the tapestries ended up embodying some conceptual twist, Mr. Sharp didn’t plan it that way.

“We were interested to see whether it would be perceived as craft or fine art,” he said. “I think people often get a bit stuck on the line between them.”

Gavin Turk
‘Mappa Del Mundo’

When the Sharps approached the British artist Gavin Turk, best known for making cast bronze facsimiles of trash-filled garbage bags, he said he immediately thought of the Italian conceptualist Alighiero e Boetti's long-running series of embroidered world maps. "I wondered if it was possible to do something that combined my interest in waste with a Boetti kind of image," he said. "I wondered if we could make the map out of rubbish that we found on the street."

While making continents from crashed boxes and cans, Mr. Turk mulled over the way painters have rendered volumetric objects throughout art history. "For neo-realism and Pop Art, you would take a solid three-dimensional object, and then you would make it two-dimensional," he said. "With Cubism you'd look at it from different sides at the same time." But with his piece, "you start with a three-dimensional object, and then it gets crushed" to the point that it resembles wallpaper. "It's sculpture to flat," he said.

Shahzia Sikander
'Pathology of Suspension'

The Pakistani-born artist Shahzia Sikander has always played with the process of transformation. Although she studied traditional Indo-Persian miniature painting, she has consistently stretched the boundaries of the genre, mixing up different eras and painting styles and exploring variegated mediums, from drawing and watercolor to video and animation. When offered the chance to work with tapestry, she said, "I wanted to see what would happen in that translation" from drawing to weaving. "I was interested in what would be the obvious loss — the nuances — but obviously the very tactile sensibility of this medium would replace it."

Yet what's surprising is how much nuance remained, once her original work — a tiny 12-by-18-inch piece made up of different-sized ink, gouache and graphite drawings collaged on top of one another — was scaled up to 9 by 6 feet and rendered in wool and silk. To convey the details and the multiple layers, some of which are translucent, the artisans chose different weaves, from fine to coarse, and raised silk embroidery.

"There was a sense of lack of control," Ms. Sikander said, because the execution was carried out by others. "But I was interested in all the other things that would come into the picture."

Fred Tomaselli
'After Migrant Fruit Thugs'

Fred Tomaselli has been hooked on Renaissance tapestries since he saw them in a 2002 show at the Metropolitan Museum of Art. "There's something in the warp and the woof of those weaves that reminds me very much of pixilation," he said.

For this project he decided to reinvestigate "Migrant Fruit Thugs" (2006), which, like much of his other work, is "a hybrid of paint, photographic collage and real objects," he said, including leaves from the fig trees in his own garden, all of it suspended in layers of glistening resin. The challenge lay in translating this multilayered, multimedia work into a uniform weaved surface.

To suggest depth the birds and foliage were fashioned from silk against a black matte wool ground, while the leaves were veined with metallic thread "to impart their life force," Mr. Tomaselli said. "I've always been really inspired by applied arts that aren't exactly painting or craft, like marquetry and tapestry, and I've allowed those influences to be part of my work," he added. "So it was interesting for me to go back to the source and to make a tapestry out of a work that was probably initially inspired by a tapestry."

http://www.nytimes.com/2010/01/24/arts/design/24tapestries.html?ref=design

When More Is Decidedly Less
By ALICE RAWSTHORN

LONDON — It wasn't my finest moment. A friend was showing me his new house in which all of the bathrooms were fitted with what looked like gloopily shaped iPods instead of taps. I switched one on, and lights appeared to reveal the controls. You could change the water's temperature by pressing one control, and its velocity with another. But, hard though I tried, I couldn't turn it off.

"Don't worry," groaned my friend. "It happens all the time." He struggled fruitlessly with the controls, then went online to find the instructions on the manufacturer's Web site. Guilty though I felt at having caused such a kerfuffle, I couldn't help wondering why he'd bought those fancy digital taps. What's wrong with the old-fashioned ones that you turn on and off by hand?

My friend had fallen victim to the curse of over-complicated design. He'd believed in the blandishments of a dazzling "innovation" that promised to make his life easier, but was so woefully misconceived that it threatened to make it harder.

You've probably been cursed too. Inoperable cellphones. Impenetrable Web sites. Neurotically overstyled objects. Too much packaging. Digital versions of this, that and the other. Things with esoteric functions that we're unlikely to ever be able to pronounce correctly, let alone to want to use. We've all tussled with them from time to time.

There's nothing new in this. Ever since the Industrial Revolution, designers have striven to make things that offer more than their predecessors. More speed. More power. More functions. More whatever. If the "more" is well chosen and executed, it can lead to progress; but if not, it could have the opposite effect. Who has enough time to go online to find out how to turn off a tap?

The problem is that we're at a particular stage of the design cycle when so many "innovations" are spurious, that the risk of them over-complicating our lives is scarily high. There's no excuse for this, not least because qualities like "clarity" and "simplicity" loom large in almost every design doctrine.

"Clarity" tops the list of the key principles of design thinking identified by the World Economic Forum's Global Agenda Council. One of the sessions at the Forum's annual meeting this week in Davos, Switzerland, will explore how those principles can help to tackle urgent social, economic and environmental problems. (Full disclosure: I am a member of the Global Agenda Council on Design and will be speaking at the session in Davos.)

Another speaker will be the American software designer John Maeda, who devoted a book to defining "The Laws of Simplicity" in which he identified "thoughtful reduction" as the key objective of responsible design. "When I wrote the book four or five years ago, it was during the rise of complex all-in-one devices that coincided with the 'more is better' mood," he explained. "Now we're in a situation where simplicity isn't just a good idea — it's a necessity."

Why then are so many designers — and the companies they work with — still so prone to over-complicating things? One explanation is habit, because lazy designers have always presumed that adding "more" will make things better, without bothering to assess whether it will.

Sometimes the result is dodgy styling. Take the current crop of espresso machines. They're the SUVs of the modern kitchen. Too big. Too blingy. Too tricksy. Too much. My vote for the worst offender goes to Casa Bugatti's ridiculously overwrought diVa. The silly name says it all, and the over-complicated spelling makes it worse.

Worse still is functional over-complication, especially if it is intended for use in desperate circumstances. Cameron Sinclair, co-founder of Architecture for Humanity, the global volunteer network, encounters far too many examples in development and emergency reconstruction projects. "My favorite is the reverse osmosis water drum designed for women and girls in Africa," he said. "The designers neglected to realize that 80 percent of the water was waste so people spent hours rolling 30 gallons of dirty water back and forth to get a few gallons of clean water."

Thoughtless designers have always caused such problems, but now face new challenges, many of which are linked to digitization. One issue is the sheer power of current technology. As Mr. Maeda points out, even the smallest cellphone is more complex than a bulldozer these days.

Yet many exemplars of clarity and simplicity in design are recent digital inventions. Among them is data visualization, the new visual language that depicts complex information clearly. So are digital devices, like the iPod and iPhone, whose operating systems — or user interface (U.I) software — were developed from scratch. These are the products that can be operated most easily and instinctively. It tends to be trickier to use ones whose U.I.s have evolved over time by patching together different software programs. Trickier still are newly digitized versions of existing objects. Not only can they feel counterintuitive, their U.I. design is often less coherent.

The digital tap is an extreme example. As the original works so well, there is no justification for digitizing it, and the result is doomed to feel unnecessarily contrived. But similar difficulties apply to products that need to be digitized, like television sets. "They drive me crazy," groaned Mr. Maeda. "Pick any one of the new ones. Turning on the TV doesn't mean you'll necessarily be able to watch anything."

Sadly, more and more products seem set to suffer the same fate, as many of the objects we use daily are "replaced" by digital touch screens. Think of the iPhone, which fulfills the functions of a watch, phone, camera, clock, DVD and CD player, barometer, and so on. The skills of their U.I. designers will be just as important in determining how pleasurable — or otherwise — it will be to use them, as old-fashioned considerations, like how they look. And it's those same designers that we're counting on to save us from the curse of over-complicated design.

http://www.nytimes.com/2010/01/25/arts/25iht-design25.html?ref=design

The Quilt as Canvas
By CHRISTOPHER HANN

MORRIS TOWNSHIP

JACK WALSH was introduced to the world of quilts around 1990, he said, when he saw a BBC program on the subject and started collecting with the passion of the newly converted. In short order, he bought a pair of Mennonite quilts, a Native American quilt and a Victorian-style crazy quilt.

"And I had not the foggiest idea of what I was doing," he recalled recently in an informal lecture at the Morris Museum here. Today, Mr. Walsh's collection includes more than 80 art quilts, in which contemporary artists apply nontraditional techniques and materials to an age-old form. Thirty-six of them are on loan to the museum for "Art Quilts: Contemporary Expressions From the Collection of John M. Walsh III," an exhibition through April 25.

The show reflects Mr. Walsh's fondness for outsize quilts and for the artistic audacity of their makers.

"Circus Quilt" is a good example. The work of Anne Kingsbury of Milwaukee, it depicts a three-ring circus, measures 6 feet by 15 feet, weighs 75 pounds and took three years to complete. Ms. Kingsbury used 376 handcrafted ceramic figures to portray audience members.

Another quilt, "Aged: covered by wisdom," by Kyoung Ae Cho, an associate professor of art at the University of Wisconsin-Milwaukee, consists of 441 geometrically arranged pieces of cut pine, each one roughly three inches square. The artist intended the patterns to "allow the viewer to visualize the existence and environmental history of this tree," according to the wall plaque.

"Millennium Portal #1," by Arturo Alonzo Sandoval, a professor of art at the University of Kentucky, is a round quilt six and a half feet in diameter, mounted to an electric motor that keeps it rotating twice a minute. Mr. Sandoval designed it to simulate the view that a future space traveler might glimpse from the porthole of a satellite.

The exhibition is organized in five sections in the museum's 4,200-square-foot main gallery. One section explores how artists use quilts to narrate a tale. In "Cedar Waxwings at the AT&T Parking Lot," Terese Agnew of Milwaukee compares the migration of birds to the displacement of telecommunications

workers after a mass layoff. A close inspection of the piece reveals several workers clutching pink slips as they return to their cars in the parking lot.

Ruth McDowell, a Massachusetts artist, made “Cod,” a two-sided quilt, as an elegy to her family’s history of fishing in Nova Scotia. The front depicts a school of cod, their scales shimmering like crystal, while the back names fishing vessels and their crew members lost at sea, among them the artist’s ancestors.

Describing the art quilts he collects, Mr. Walsh, 73, said, “It is quilting, but the artists have expanded that definition in so many ways.”

That expansion started in the 1960s, according to Linda Moore, the museum’s chief operating officer and the curator of the Walsh exhibition, when artists trained in more traditional media began experimenting with quilts.

“Academically trained artists were increasingly finding greater expressive opportunities in textiles, quilts in particular,” Ms. Moore said, “and they began to transform the traditional quilt from a bed covering into a canvas.”

Mr. Walsh, who lives in Martinsville, N.J., has had help in assembling his collection from Penny McMorris, an Ohio author, curator and authority on the art quilt, who has served as his mentor and consultant.

Ms. McMorris said she considered the art quilt to be a form of “mixed media.”

The artists, she said, “are using a broad variety of different media and techniques — painting on quilts, using photography — all of the broad, different techniques they bring to bear. It’s just a larger form. It’s like collage.”

Mr. Walsh also commissions quilts, asking the artists to explore a subject related to water; he owns Waltron of Whitehouse, N.J., which designs and manufactures instruments that measure water quality. Four such commissions are on display at the Morris Museum, including “Savannah, the Two of Cups,” which Susan Shie filled with a narrative about Mr. Walsh’s life.

Speaking of Mr. Walsh, Michael James, chairman of the Department of Textiles, Clothing and Design at the University of Nebraska and one of the quilters in the show, said, “He’s very determined that the quilts he acquires not just occupy space in his house.

“He shares them with the public, and that’s really important, because that’s what grows the audience.”

“Art Quilts: Contemporary Expressions From the Collection of John M. Walsh III,” through April 25 at the Morris Museum, 6 Normandy Heights Road, Morris Township; morrismuseum.org. (973) 971-3700.

http://www.nytimes.com/2010/01/24/nyregion/24artsnj.html?ref=design

In Suburban Houses, Roots of Modernism

By BENJAMIN GENOCCHIO

Levittown, the mass-produced suburb built in Nassau County after World War II, is often the first thing that comes to mind when the subject is Long Island architecture. Fair enough; it was the archetype for such communities throughout the country. But what is less well known is that Long Island provided fertile ground for early Modernism in American architecture. Many of the most prominent Modern architects designed homes here, including Frank Lloyd Wright, Philip Johnson and Marcel Breuer. A remarkable exhibition at the Heckscher Museum of Art seeks to document their achievements.

Sketches, blueprints, photographs, models and sample materials representing 28 projects by 23 Modern architects make up "Arcadia/Suburbia: Architecture on Long Island 1930-2010," organized by Erik Neil, an architectural historian and the museum's former director. It is a companion show to "Long Island Moderns: Artists on the North Shore From Edward Steichen to Cindy Sherman," a recent exhibition celebrating the role of Huntington and the North Shore of Long Island in American art.

The current show is installed chronologically, beginning with a pair of rare plan drawings and some photographs of the Aluminaire House (1931), designed by A. Lawrence Kocher and Albert Frey. Made using industrial materials, including aluminum, plate glass and steel, it was included in "Modern Architecture: International Exhibition" at the Museum of Modern Art in New York in 1932. The architect Wallace Harrison purchased the exhibition prototype for $1,000 and moved it to his property in Huntington. The house fell into disrepair and was scheduled for demolition in the 1980s but was rescued by faculty members and students of the New York Institute of Technology, who dismantled it and brought it to the Islip campus, where it was restored and remains today.

Modernist architecture in America has its origins in several sources, including the Prairie-style buildings of Frank Lloyd Wright and the designs of European architects like Le Corbusier, Ludwig Mies van der Rohe, Alvar Aalto and Walter Gropius. Its key features were clean geometric lines, a fondness for open plans and a preference for new materials and building technologies, including prefabrication. Expansive white walls and broad areas of glass were also typical features of early Modernist residential structures.

Epitomizing this Modern design aesthetic was the A. Conger Goodyear House (1938) in Old Westbury, designed by Edward Durell Stone as a weekend retreat for a wealthy industrialist; still privately owned, it

is protected by a preservation easement. On view in the show are photographs of the house by Ezra Stoller, a prominent architectural photographer. The dominant color inside and out is white; the walls are smooth and unadorned, while the rear facade of the house is a large expanse of glass. It looks something like a contemporary art gallery.

Also highlighted here is Mr. Johnson's Leonhardt House (1956) in Lloyd Harbor, jutting from a hillside. As at his own home, the Glass House in New Canaan, Conn., the public space was constructed entirely in glass, offering spectacular views of Long Island Sound. The architect's original elevation and plan drawings as well as some photographs of the completed building provide a wealth of detail about the overall design. (The house is still standing, but it has been substantially altered by subsequent owners.)

In addition to highlighting projects by some of the most prominent architects of the era, Mr. Neil has also included examples of the work of many talented but lesser-known Long Island architects. George Nemeny of Kings Point, one of the leading exponents of Modernism on Long Island, conceived the Frost House (1946), shown in one of Ezra Stoller's photographs here, for an affordable-housing competition. Built in Long Beach, the design follows Le Corbusier in its use of slender columns to support a white, unadorned box structure. Though Mr. Neil went looking for it, he said, he was unable to find it and does not know whether it still stands.

Herbert Beckhard collaborated with Marcel Breuer, but also continued his own practice as an architect. His best-known project on Long Island is probably the house he built for himself and his family in Glen Cove in 1964. The Beckhard House, represented here by a photograph, a magazine article and a book illustration, uses expanses of glass and a variety of stone walls to blur interior and exterior space. Like a lot of Modernist residential projects on Long Island, it emphasized integrating the design with the landscape and preserving native trees on the site.

Mr. Beckhard's house is still there and is occupied by his wife, Eleanor Sabesin Sanders. But there have been many serious losses over the years, including the destruction or radical alteration of important buildings designed by Mr. Johnson and Mr. Breuer. Drawings and photographs of several of these lost structures are included in the exhibition and the accompanying catalog, reminding us not only of the need to raise awareness about Modern architecture on Long Island but also of the importance of preserving what remains. This show is a great start.

"Arcadia/Suburbia: Architecture on Long Island 1930-2010," Heckscher Museum of Art, 2 Prime Avenue, Huntington, through April 11. Information:
(631) 351-3250 or heckscher.org.

http://www.nytimes.com/2010/01/24/nyregion/24artsli.html?ref=design

'The Drawings of Bronzino'
A Line Both Spirited and Firm

By HOLLAND COTTER

Agnolo Bronzino's was the hand to hire for a power portrait in mid-16th-century Florence. He could turn toddlers into potentates and make new-money Medicis look like decent people. His painting shaped late Mannerism, the profane, twisty, prosthetic style that erupted, like a repressed libido, between the humanist sanctities of the Renaissance and the smells and bells of the Counter-Reformation.

At his peak, in the 1550s, Bronzino was the most influential painter in Florence. And although his reputation went into eclipse, it never went away. By the 20th century he was back. In Henry James's 1902 "Wings of the Dove" a Bronzino portrait of a noblewoman, "with her long neck, her recorded jewels, her brocaded and wasted reds," is the culminating symbol of evanescent magnificence around which that deeply mannered novel turns.

Why, given his fame, this artist has had to wait some 500 years for a museum solo is a puzzle. But that solo, called "The Drawings of Bronzino," has now arrived at the Metropolitan Museum of Art. Encompassing all but two of the 61 works on paper currently attributed to him, and justifying each attribution in its spectacular catalog, the show is a scholarly tour de force. It is also, at first glance, an unexpectedly low-key take on an artist whose painting can have quite the opposite effect.

But drawing is the right place to start with Bronzino. The drawn line, disegno, was the root element of the Renaissance tradition from which he came. Its character varies from artist to artist among his Mannerist contemporaries. Parmigianino gave his line a swoony, ribbony lift; Jacopo Pontormo infused it with the encephalographic jitters.

Bronzino does something in between, less extreme. His line, or sense of movement, is vivacious but purposeful, hot but not wild. It was the energy source for his art.

Bronzino — a nickname — was born Agnolo di Cosimo di Mariano Tori in 1503, the son of a Florentine butcher. After initial training with so-so artists, he had the luck to be taken on by Pontormo, who was only nine years his senior and on the cutting edge of new Florentine art. Temperamentally they were

opposites, Pontormo a misanthrope, Bronzino a people person. Yet they developed a close bond, and collaborated on and off for decades.

Their mutual reliance may have been in part a response to the threatening era they lived in. In the early 16th century, Florence existed in a state of perturbation. It was twice ravaged by plague. Politically it was on sustained red alert. In 1492 Florentines had expelled a traitorous Medici ruler and established a republic. Over the next half-century the Medicis made repeated efforts to regain power. The city endured military siege; its economy rose and fell; the atmosphere was murderous. Many artists, including native sons like Michelangelo, left, never to return.

Bronzino stayed. As an artist and a poet he was thoroughly embedded in Florentine high culture, with its weave of European urbanity and Tuscan particularity. And although moving toward independence, he continued to work with Pontormo on large-scale paintings. In such paintings it can be difficult to sort out the contribution of one artist from another. And making such distinctions in the case of drawing can be as hard or harder.

Painting was all about finish, the smoothing over of discrepant textures, the hiding of the seams. Drawing occupied a far looser and more relaxed aesthetic category. Although drawings presented to clients as demonstration pieces were highly polished, most were disposable byproducts of routine studio activity. Young artists learned their trade by repeatedly drawing work by their seniors.

Established artists used drawings to rough out ideas, resolve problems, pass on instructions or just to relax their hand. Drawing was a medium in which one artist could be and do many things, and through which several different artists could share a signature style.

A main purpose of the Met exhibition is to sift through all these variables and isolate a body of drawings by one artist. And the method traditionally used is the blend of research, visual analysis and gut instinct known as connoisseurship. This approach is fully embraced by the show's organizers, George R. Goldner, the chairman of the museum's department of drawings and prints; Carmen C. Bambach, a Met curator; and the art historian Janet Cox-Rearick.

Questions of attribution are trickiest in drawings from Bronzino's early years, when he was under his teacher's spell. A bust-length study of a heavy-lidded youth, probably a studio assistant, from around 1527, is credited to Bronzino at the Met but appeared under Pontormo's name at the Philadelphia Museum of Art in 2004. The reassignment has been made on stylistic grounds, though the image still seems to float back and forth between the artists.

Identifying subjects can also lead to debate. A marvelous black chalk portrait of a bearded man dressed in what looks like an artist's apron was long assumed to be a portrait of Pontormo by Bronzino. At the Met the drawing is still by Bronzino but now depicts an unnamed "seated man." Why the change? According to the catalog, one art historian feels that that likeness is too impersonal to be an homage by a protégé to a beloved mentor. Another points out that the sitter is partially bald, and Pontormo was not.

Attributions are on firmer ground beginning in the 1530s, by which point Bronzino was a free agent with commissions of his own. A tender study of the "Dead Christ" — soft as a cloud of dust — relates to an existing fresco he did of a Pietà. A red chalk drawing of a nude youth playing panpipes is clearly a study for a panel painting called "The Contest of Apollo and Marsyas." Another nude, drawn on mustard-yellow ground, turns up in a fresco Bronzino created in the 1540s for the private chapel of the Medici duchess Eleonora of Toledo.

Eleonora was the wife of Cosimo I, Duke of Florence (1519-74). He taxed the city into the ground, and spent lavishly on art. He founded the Uffizi (the Met show is a collaboration with that museum and the Polo Museale Fiorentino), and bankrolled fantastic public spectacles (usually in his own honor). He hired

Bronzino as his court artist and charged him with producing political advertising in the form of frescos and tapestries, and with supplying a line of dynastic portraits.

The model of patrician portraiture Bronzino invented was picked up by the rest of Europe. In typical examples the sitters, whether adults or children, come across as simultaneously warm and chilly, serene with self-confidence but often, to quote James, "unaccompanied by joy." In each case the human figure seems to be molded from a compound of marble and flesh, and faces are rendered with an oddly cosmetic naturalism that anticipates Ingres.

There's a single painting at the very end of the Met show, Bronzino's "Portrait of a Young Man," owned by the museum. Done in the 1530s, it is a portrait of an unknown but superbly supercilious member of Florence's intellectual elite, someone who wears his basic republic black with flare and who would have understood the connoisseurial impulse, with its mix of fact and desire, that drives the exhibition.

Frankly, after three rooms of drawings that demand close scrutiny, the painting, with its colors, solid forms and indisputable Bronzino look, comes as a relief. You may well find yourself hungry for more of the same, and you'll have more in Florence next fall when a first survey of Bronzino's paintings opens at the Palazzo Strozzi.

Yet there's an aspect of the artist — call it his un-Mannerist side — that may be fully available only at the Met.

Take a look at the late drawing called "Head of a Young Man" from the J. Paul Getty Museum in Los Angeles. The sitter looks like someone the artist might have met on a beach, a surfer at Santa Monica. His neck and shoulders are bare; his hair wind-ruffled; his face, with its large, wide-spaced eyes looking straight at us, has the candid realism of a Fayum portrait.

Then look at a reproduction of the painting — it's in the catalog — for which the drawing is a study. There we see the sitter at half length, his neck encircled by a lace collar; his shoulders encased in a rich black coat, his hair covered by a plumed cap. His face is more perfectly composed but looks tranquilized, inelastic, masklike; his glance is off to the side, away from us, fixed on nothing in particular. The picture is fascinating: a seductive, princely invention. But it's more about haberdashery and attitude than about character. The face in the drawing is the one I remember, the face of someone real, someone I might actually know.

The exhibition remains at the Metropolitan Museum of Art through April 18; metmuseum.org, (212) 535-7710.

http://www.nytimes.com/2010/01/22/arts/design/22bronzino.html

Letting Postcards Tell Niagara Falls' Story

By BENJAMIN GENOCCHIO

Once a favorite of newlyweds, Niagara Falls has thrived for decades as a general tourist destination and, more recently, as the setting for several casinos. In the spring and summer months, the New York Power Authority even turns up the water flow to please the crowds.

The idea of Niagara Falls as a contrived and carefully choreographed version of what we call nature lies behind "You see I am here after all" (2008), a sprawling installation by the American artist Zoe Leonard at Dia:Beacon. It consists of about 4,000 vintage postcards of Niagara Falls that the artist collected from flea markets and online sales. They span more than half a century, from the early 1900s, when postcards were first accepted by the post office.

Ms. Leonard is interested in showing how postcards played a role in the transformation of Niagara Falls from a natural site to a bankable tourism destination. It is a project that is aligned with popular cultural scholarship, in particular Ginger Strand's compelling 2008 book "Inventing Niagara: Beauty, Power, and Lies," which charts the tawdry history of Niagara Falls and the abuses to which it has been subjected, including its temporary use as a dump site for nuclear waste.

Postcards are an especially privileged medium for the perpetuation and dissemination of idealized imagery. They are mass-produced, cheap and readily available at newsstands and souvenir shops. In the days before digital cameras and e-mail, millions of them were distributed annually around the world. But they also purport to serve as a witness as well as a memento of a visit — this is what I saw, they say, irrespective of actual viewing conditions.

The 4,000 postcards are grouped by viewing points — there were about a dozen or so ideal spots from which the falls were consistently photographed for over a century. The groupings are installed in linked grids that unfold along a wall in positions that correspond to the geography of the site; the vistas are from both the Canadian and American sides. The installation is 142 feet long, adding in breaks in the wall for doorways into other rooms; without the breaks the sections add up to about 116 feet.

Taken together, these cards illustrate the way in which popular visions of the falls were constantly revised and manipulated through hand-coloring, overpainting and cropping, reflecting both advances in print and camera technologies and evolving notions of preferences. The earlier images are unabashedly romanticized, while the more recent cards tend to stress detail, color accuracy and spatial depth.

But there is little evidence in the postcards of the extent to which the falls themselves have changed physically over time, either through erosion or human intervention. Over the years, the amount of water flowing over the falls was greatly reduced and regulated for the purpose of producing electricity, while unsightly outcroppings of rock were blasted away for scenic enhancement. Even the surrounding natural scenery was landscaped.

In spite of all the changes, nothing is allowed to disturb the prevailing popular image of Niagara Falls as an unblemished natural wonder. It remains basically the same, revealed in these cards to be what visual-studies experts like to call a "cultural construction" — something whose meaning and identity is shaped and framed by wider cultural forces, in this case a combination of national pride and the interests of the power and tourism industries.

Visiting Niagara Falls over the summer, I was struck by how much the experience reminded me of a visit to Disneyland. Everything had a price, from the parking lot to the viewing sites, each of which required a separate ticket. Inside the visitors' center on the Canadian side, tourists must navigate a maze of gift stores on the way to the falls. They can even have their pictures taken and superimposed on a perfect view of Horseshoe Falls — a modern-day $20 postcard.

Though "You see I am here after all" deals with popular imagery of Niagara Falls, it is in some ways a metaphor for the transformation of natural sites into tourist destinations across America. We take a wild landscape and rebrand and package it for mass consumption. We make it popular entertainment. Ms. Leonard invites us to ponder what is lost along the way.

"Zoe Leonard: You see I am here after all," at Dia:Beacon, Riggio Galleries, 3 Beekman Street, Beacon, through Sept. 7. Information: diaart.org or (845) 440-0100.

http://www.nytimes.com/2010/01/24/nyregion/24artwe.html?ref=design

Life in Two Worlds Influences a Photographer's Art
By JESSICA REAVES

If outsider status were the sole prerequisite for artistic success, Anna Shteynshleyger would be the most important artist of her time. As it is, she is not doing too badly: she is a rising star in the elite world of contemporary art photography.

Ms. Shteynshleyger's life has been largely defined by her separateness: as an immigrant in America, a religious Jew in the art world, a single parent in the Orthodox Jewish community. She has adapted by becoming a keen observer — the quintessential voyeur, whose photographs, some of which are on display at the Renaissance Society at the University of Chicago, reflect both a cool detachment and a quiet yearning.

Born in Soviet-era Moscow, Ms. Shteynshleyger, 32, was exposed at a young age to the political and emotional cost of living on society's fringes. Her parents were "refuseniks" — citizens, usually Jews, whose requests to emigrate were refused.

In 1987, Ms. Shteynshleyger's father was finally granted an exit visa. He went to the United States and eventually found a job at an engineering firm in Alexandria, Va. Five years later, he was joined by his wife and daughter.

They lived in nearby Gaithersburg, Md., a bedroom community 30 miles outside of Washington. The culture shock, Ms. Shteynshleyger said, was profound. At 15, she spoke almost no English, and was accustomed to the independence of a child living in a city. "In Moscow, you hop on the subway and you're everywhere," she said. "In Gaithersburg, it was just terrible. I had no way of connecting with the world."

Depressed, Ms. Shteynshleyger turned inward, finding solace in her camera and in a deepening relationship with God. To the chagrin of her secular parents, she embraced Orthodox Judaism. The undertaking was not easy, she said, but it felt imperative.

"Living in Gaithersburg didn't just make me into a photographer," Ms. Shteynshleyger said. "It made me find God. It was just that bad."

Following art school in Baltimore, where her religious practices and traditional dress made her an oddity, Ms. Shteynshleyger was one of nine photography students accepted into the master of fine arts program at the Yale University School of Art. She again struggled to balance her religious beliefs with the conventions of academic life.

"Did it work?" she said. "In retrospect, not at all. I was occupying two separate worlds — contemporary art and Judaism — and at the level of daily functionality, they don't really mix well."

Tod Papageorge, professor and director of graduate studies of the Yale photography program, remembers his former student as dryly witty, fiercely intelligent and a remarkably gifted artist — whose back-story felt inescapable.

"She clearly had a lot of things to work out in this bifurcated biography of hers," Mr. Papageorge said. "Russia and the States, art student and Orthodox Jew."

The force of those conflicting identities forged some truly fascinating work, said Gregory Crewdson, another of her instructors. "But it wasn't easy for her," Mr. Crewdson said. "You got the sense there was more at stake for her than for the average student."

A stark truth had emerged, one that continues to inform Ms. Shteynshleyger's work: When you try to live in two worlds, it is impossible to truly inhabit either.

In 2001, Ms. Shteynshleyger moved to New York City and married within the Orthodox community. Two years later, she followed her husband to the Chicago suburb of Des Plaines so he could be near a daughter from a previous marriage. She once again felt disconnected from her surroundings.

Over the next five years, she gave birth to two daughters, filed for divorce and fled suburbia for an apartment in the West Rogers Park section of Chicago. She also changed her artistic focus, moving away from vast, impersonal landscapes — as seen in "Siberia," her 2004 show at the Museum of Contemporary Art in Chicago — in favor of portraits that trace the intimate topography of daily lives, others' and her own.

The new direction attracted the attention of Hamza Walker, a curator at the Renaissance Society at the University of Chicago, who decided to mount an exhibit of her latest work. "Over the course of five years, she turned from 'Siberia' onto herself, brought on by a difficult marriage and personal experience," Mr. Walker said. "That's what drew me in. It's one of the hardest things to do."

The exhibition reveals the intimacies among friends, family and past loves, laying bare the daily detritus of a life: putatively whole, then shattered and eventually pieced back together.

And if the show's take on families — the artist's projections of happiness and fulfillment — feels diffident, even cold, that is because to a certain extent it is. That is the trick, after all, of Ms. Shteynshleyger's work: Prickly self-protection coexists with supreme vulnerability.

There is a challenge inherent in her pictures, and an invitation: Here is what I don't have, she seems to be saying. Here is what I imagine you do have, which I will possess, however briefly, from the safe distance of an observer behind a lens. Here I am, forever on the outside, pressing my face against the glass of your life — as you are doubtlessly doing to mine.

The exhibition of Anna Shteynshleyger's photographs runs through Feb. 14 at the Renaissance Society at the University of Chicago, renaissancesociety.org, (773) 702-8670.

http://www.nytimes.com/2010/01/22/arts/design/22cncanna.html?ref=design

A Big Map That Shrank the World

By EDWARD ROTHSTEIN

WASHINGTON — When a map of overwhelming dimensions and detail is presented to the ruler of a land, the homage, surely, is a kind of deference. The map is partly meant to be an illustration of the ruler's powers, the extent of his realm, the range of learning he commands.

And yes, one of the remarkable aspects of the world map on display at the Library of Congress through April 10, is that along with its imposing scale (it is 12.5 feet long and 5.5 feet high) and grand ambitions (it encompasses the known world of the early 17th century), at its very center stands the "Middle Kingdom," as China called itself, its mountains and rivers commanding attention with dense annotation, all of which is in Chinese.

Created by a visiting Italian-born Jesuit priest, Matteo Ricci, and apparently commissioned by the court of Emperor Wanli in 1602 — the year after Ricci became the first Westerner admitted to Peking and then the Forbidden City— this map is indeed partly a tribute to the land in which Ricci had lived since 1582, and in which he would die in 1610.

One of his commentaries on the map (placed just south of the Tropic of Capricorn), declares that he is "filled with admiration for the great Chinese Empire," where he has been treated "with friendly hospitality far above my deserts." Over the landmass of China, he comments: "The Middle Kingdom is renowned for the greatness of its civilization."

That greatness can be sensed in the delicate cartographic detail that had to be meticulously carved onto six wood blocks before being printed on rice paper. Ricci's explanatory Chinese commentary is so extensive in some regions that it seems to cover the terrain. The map was meant to stand on six folding screens and can be imagined engulfing its observer.

Ricci created two earlier versions, beginning in 1584, drawing on atlases and materials he took with him on his journey from Italy. But this third version is the earliest to survive and the first to have combined information from both eastern and western cartography. It is also the oldest surviving map to have given the Chinese a larger vision of the earth.

Even the sturdiest of wall maps tend to have limited life spans, but this large, segmented map is so rare that for centuries it was uncertain if this copy even existed, which is why it has been nicknamed the "impossible black tulip" of maps. It is one of six known copies.

Last October the James Ford Bell Trust paid a million dollars for the map, buying it from a private Japanese owner. It will be permanently displayed at the University of Minnesota in the James Ford Bell Library, which Bell (the founder of General Mills) established to document the impact and history of international trade before 1800.

The Library of Congress does not usually display items from outside its collection, but given the importance of this map, which is also the first eastern map to show the Americas, it arranged for this temporary display, showing the map for the first time in this country. It is also creating a detailed digital scan to be posted online.

The Ricci map is mounted directly opposite the library's own mega-purchase, the $10 million 1507 Waldseemüller World Map, the first map to name America. Each is pioneering in its presentation of the New World, in one case to Europe, in the other to Asia.

According to the library, these are also the two most expensive maps ever bought, and they are temporarily on display together as part of the continuing exhibition "Exploring the Early Americas."

But the library has seriously failed visitors by not including a more extensive explanation of the Ricci map beyond a single panel of text; it does not even provide a translation of the Chinese characters punctuating it. I used a 1918 translation made available by Daniel Crouch, the map specialist at Bernard J. Shapero Rare Books in London, who helped handle the map's purchase and wrote an informative essay for the sale (unfortunately not at the exhibition, but available from the author through an e-mail request to maps@shapero.com).

The map's text is necessary to understand the intricacies of its negotiations and presentations, because it is only partly an act of homage. It was also part of a diplomatic attempt by Ricci to affirm the greatness of his own religion and culture.

He was, after all, a Jesuit priest whose intention was to convert the Chinese to Roman Catholicism. And that was something, he thought, that might be helped by demonstrating the superior understanding of the world that he believed grew out of Christian faith.

Ricci translated Euclid into Chinese, demonstrated Western clocks to the Chinese and created a method for representing Chinese using the Western alphabet. As Jonathan Spence points out in his classic book, "The Memory Palace of Matteo Ricci" (Penguin, 1984), he even gave the Chinese lessons in special techniques of memorization.

This map is an extension of his Jesuitical project, so while paying homage to the Chinese, Ricci was also well aware that the map was partly a demonstration, an argument. It is not decorated with an ornate compass rose or mythological sea creatures, nor does it display terrifying terra incognita. It is devoutly rational, even scientific: it contains descriptions of the world's peoples that may seem wildly fanciful, but are based on the authoritative sources of Ricci's time.

It also incorporates an explanation of parallels and meridians, a proof that the sun is larger than the moon, a table showing the distances of planets from the earth, an explanation of the varying lengths of days and nights, and polar projections of the earth that are unusually consistent with its main map. Ricci declares that it offers testimony "to the supreme goodness, greatness and unity of Him who controls heaven and earth."

The map, then, portrays the crossroads of two great civilizations. Even as Ricci shifted the geographic center of Western global maps, filling in detailed outlines of China and other regions from Chinese cartographers and annotating the whole in Chinese, he also added a frame that was both rationalist and religious, celebrated Western science and faith and created a culturally hybrid vision of the earthly cosmos.

The result may even be a portrait of the earth as a Jesuit would like the Chinese to think a Jesuit would see it. The offering is meant to be both humble and full of pride, deferential and assertive, combining sincere homage and earnest self-affirmation.

On the one hand, Ricci stripped away much detail from his portrayal of Europe, making its "24 countries" seem far less central than they were becoming on the world stage. On the other hand, Ricci's annotations offer grandiose declarations that all Europeans were " reverent adherents of the holy Christian religion," that "all are versed in the elements of astronomy and philosophy," and that its princes and subjects were all wealthy.

Ricci also draws on other sources to give brief portraits of other peoples of the world, and here the descriptions have all the peculiarities of reports from a Chinese Gulliver. In northern Russia, we are told, there is a "Country of Dwarfs" in which "the inhabitants, both male and female, are only about 1 foot high."

"Being constantly devoured by cranes," Ricci explains," they have to live in caves in order to escape," at least until they emerge to "destroy the eggs of their enemies, riding on goats."

In Kanata (Canada), he writes, "inhabitants are kindly and hospitable to strangers," but "the people living in the mountains kill one another all year round and spend their time in fighting and robbery."

"They feed exclusively on snakes, ants, spiders, and other creeping things," he continues. These reports of the exotic characters of other lands (traceable to other period authorities) are meant to contrast with the civilizations of Italy and China. The Arctic may house a people with mouths on top of their heads, but look, Ricci seems to say to the Chinese, look what we both have accomplished.

The 1913 Catholic Encyclopedia quotes Ricci about the map: "This was the most useful work that could be done at that time to dispose China to give credence to the things of our holy Faith. ... Their conception of the greatness of their country and of the insignificance of all other lands made them so proud that the whole world seemed to them savage and barbarous compared with themselves."

Ricci also suggested that the size and format of the map could have an almost magical, seductive effect. It enables the viewer, he wrote on the map, "to travel about, as it were, while reclining at ease in his own study. Lo! To be able to scan all the countries of the world without going out of doors."

Mr. Spence has pointed out that Ricci was a master of a special technique of memory: he would imagine for himself a great palace and within it, he would place objects related to items he was trying to memorize; as he mentally strolled through this palace, each item would have its place, come easily to mind and be seen as part of a harmonious order. A map has more restrictions on it: its spaces must correspond proportionally to the world.

But in Ricci's view, it seems, this enfolding map, too, is a kind of memory palace, reminding its viewers of a real world in which everything is being put in its proper place, a world in which a Chinese emperor and a Jesuit priest might find common ground in a shared embrace of knowledge and faith. The Matteo Ricci World Map is on display until April 10 (except Sundays) at the Library of Congress, 10 First Street SE, Washington; (202) 707-9779; loc.gov.

http://www.nytimes.com/2010/01/20/arts/design/20map.html?ref=design

Destination Phobos: humanity's next giant leap

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Could this be the next outpost in space? (Image: University of Arizona/NASA)

PHOBOS is a name you are going to hear a lot in the coming years. It may be little more than an asteroid - just two-billionths of the mass of our planet, with no atmosphere and hardly any gravity - yet the largest of Mars's two moons is poised to become our next outpost in space, our second home.

Although our own moon is enticingly close, its gravity means that relatively large rockets are needed to get astronauts to and from the surface. The same goes for Mars, making it expensive to launch missions there too - perhaps even prohibitively expensive if President Obama's review of NASA's human space exploration policy is to be believed. Last October, a committee of independent experts chaired by industrialist Norman Augustine concluded that NASA faced a shortfall of around $3 billion a year if it still intends to send astronauts back to the moon - let alone Mars - by 2020. But that doesn't mean that humans have nowhere to go.

One option the Augustine report suggested would take NASA crews to nearby asteroids and to the moons of Mars. "The bulk of the cost of a Mars mission is getting people to the surface and back again," says Pascal Lee, chairman of the Mars Institute in Moffett Field, California. "If you wait for everything to be ready, it will be decades. Phobos offers us a way to get to the very doorstep of Mars."

Because Phobos is so small, the gravitational field it generates is weak, so much so that once you have established yourself in Martian orbit, landing and take-off from Phobos needs only the smallest of impulses. That means it is cheaper and easier to send spacecraft to distant Phobos than to send them to the surface of our own moon.

From Phobos we could easily explore the surface of Mars using telescopes or remote-controlled rovers before making the final descent to the planet's surface when funding allows (see "The Martian night shift").

But there is more to Phobos than just a convenient stopping-off point - much more. Phobos itself is a giant celestial mystery. "We know what all the solar system bodies that we have explored are, except for Phobos," says Lee. "We really do not know how it formed."

Phobos was discovered, along with Mars's smaller moon Deimos, in 1877 by American astronomer Asaph Hall at the US Naval Observatory in Washington DC. For most of their subsequent history, the moons' diminutive size has relegated them to mere footnotes in the astronomical textbooks. Phobos is an irregularly shaped rock just less than 28 kilometres across, while Deimos is even smaller (see diagram). So they were dismissed as being small space rocks that wandered too close to Mars and were unlucky enough to be captured by its gravity.

This view was bolstered by the first measurements of Phobos's composition, taken by the spacecraft Mariner 9 and Vikings 1 and 2 in the 1970s (see *Missions to Phobos*). Sunlight reflecting from the surface showed that Phobos was dark, absorbing more than 90 per cent of the incoming sunlight and resembling the meteorites known as carbonaceous chondrites. These ancient celestial objects are thought to originate in the furthest parts of the asteroid belt, twice as far from the sun as Mars itself. The most recent measurements of Phobos revealed a closer resemblance to even older asteroids found only in the outer solar system beyond the main belt. The same is true for Deimos.

Space oddity

So captured asteroids they are, then? Not quite. The orbits these moons follow are not what you would expect for captured bodies. Instead of orbiting in randomly inclined orbits, as would happen if they were seized at different times, both Phobos and Deimos follow paths that lie close to the equatorial plane of Mars. What is going on?

Equatorial orbits imply that the moons formed in situ from the same coalescing cloud that became Mars. But if this is the case, then the moons' composition makes no sense; Phobos and Deimos should resemble Martian rock, not carbonaceous chondrites. In a bid to understand the composition and thereby the origin of Phobos, the European spacecraft Mars Express has made a daring sequence of fly-bys, swooping to within 460 kilometres of the moon in 2006 and 270 kilometres in 2008.

That close, Phobos's minuscule gravity altered the spacecraft's velocity by just a few millimetres per second. Nevertheless, mission controllers on Earth succeeded in identifying its effect on the radio tracking signal - a variation of just one part in a trillion on the carrier signal.

"It was an incredible achievement on the part of everyone involved," says Martin Pätzold at the University of Cologne in Germany and the leader of the Mars Express Radio Science experiment. It allowed Phobos's mass to be measured 100 times more accurately than before, and also raised the possibility that the moon could become a proxy spacecraft for exploring Mars's internal structure (see "Probing Mars").

During the fly-bys, Mars Express's High Resolution and Stereoscopic Camera mapped the surface of Phobos, which led to the most precise 3D model of the moon so far constructed and a measure of its volume. Although it is much less certain than the mass, knowing the volume allows an average density to be calculated using the ultra-precise mass figure. What emerges is the most interesting paradox of all.

"The mean density is unexpectedly low. It must be a porous body," says Pätzold. So rather than being a single chunk of solid rock, there are probably vast caverns inside the moon, which could shelter future visitors from the ravages of space radiation.

Phobos landing

Without actual samples from the moon, though, its composition remains largely unknown. If it is a captured asteroid, the material it is made from will be less dense than ordinary rock, making the hollow fraction likely to be around 15 per cent. If the moon is made of the equivalent of Martian rocks, however, then the Phobos's void must be much higher: up to 45 per cent.

This in itself is a headache for planetary scientists. If Phobos turns out to be made of Martian rock, the size of the voids means that the moon is unlikely to have formed from tiny dust grains building up in orbit as Mars formed beneath it, as this would lead to a solid body. Instead, Pätzold and Pascal Rosenblatt of the Royal Observatory of Belgium in Brussels favour a sequence of events in which a giant impact on Mars threw large chunks of debris into orbit. These then settled against one another at haphazard angles to form the conglomeration we now call Phobos.

To test this suggestion, Mars Express will be revisiting the moon in March for its closest fly-by yet. The spacecraft will close to within a mere 60 kilometres of the barren surface, supplying the team with the first inklings of Phobos's gravity field.

"The gravity field is related to the internal distribution of mass," says Rosenblatt. So, when Mars Express is over a void it will not be pulled as hard as when it is over solid rock.

They will also be using the Mars Advanced Radar for Subsurface and Ionospheric Sounding (MARSIS) instrument to probe inside Phobos. During previous fly-bys, the MARSIS team learned how to bounce their radar off the moon. Now they plan to use ground-penetrating radar to peer inside. "We hope to see subsurface structure in March but there are a lot of factors in play," says Andrea Cicchetti of the Italian Institute of Physics of Interplanetary Space in Rome who is part of the MARSIS team.

The team is especially keen to nail down the composition of the moon whose spectrum suggests it is a captured asteroid. Rosenblatt thinks there is a get-out clause, however. "The surface spectrum could be the result of billions of years of space weathering," he says. Without an atmosphere to protect them, the Martian rocks that coalesced to form Phobos could have been altered superficially by the charged particles they have been soaking up from the sun for billions of years, disguising their true identity and fooling the spectrometers. The solution? Land on Phobos and bring samples back for us to study here on Earth.

This is exactly what Russia plans to do in late 2011 with the Phobos-Grunt (Phobos-soil in Russian) mission. "We cannot understand the origin of Phobos without knowing what the moon is made from, and Phobos-Grunt will tell us that," says Rosenblatt.

Phobos-Grunt may even provide planetary scientists with crucial information about Mars itself. During the last four billion years, meteorite impacts with Mars will have blown debris into orbit. Phobos must have ploughed through these debris streams, some of which contained large chunks, as demonstrated by the moon's 9-kilometre-wide crater, Stickney.

Most of the impacts would have been much smaller, the probable explanation for the grooves that line the surface of Phobos. Recent mapping by Mars Express has shown that the grooves originate from the leading apex of Phobos, the point that always faces in the direction of the moon's motion and so is the natural bullseye for incoming debris.

The exciting fact is that nature has been collecting samples of Mars for billions of years and storing them on Phobos - one of the easiest places in the entire solar system for us to reach. All we have to do is go and get them. "Phobos is the Library of Alexandria for Mars," says Lee. "Samples from early Mars may be much better preserved on Phobos than on Mars itself." They may even contain the chemical signature of Martian life, though Lee puts a heavy emphasis on the "may" in that statement.

And Phobos-Grunt could just be the first in a line of increasingly ambitious missions to Mars's largest moon. "Mars should remain the ultimate destination for manned exploration," says former astronaut Leroy Chiao and member of the Augustine committee. "But if we [the committee] had asked outright for the money required to land on Mars, we would have lost credibility."

To bridge the gap, Lee envisages Phobos as an ideal stopover while techniques and equipment are developed by NASA to allow us to land on Mars. He has already studied the feasibility of a hypothetical Canadian mission to Phobos. So successfully did he make his case that Lee is now involved in a similar study for NASA.

Home from home

He points out that just getting to Phobos would allow astronauts to practise key techniques for reaching Martian orbit, such as aerobraking, in which a spacecraft loses speed by surfing the planet's atmosphere.

What's more, the moon could host a warehouse of rocket parts and other equipment, built up over time by passing robotic exploration missions. When astronauts arrive, any worn-out or malfunctioning equipment could quickly be replaced.

If the NASA mission goes ahead, it would target an amazing structure on Phobos known as the monolith. This solid slab of rock sticks upwards from the surface and extends 90 metres into space. "It's the Empire State building of Phobos," jokes Lee.

The spacecraft would land close to the monolith, so that it could study the exposed rock, then hop to another part of the moon and collect some more samples. It would then take off and fly to Deimos, to collect samples from the smaller moon. Finally, it would return to Earth. "It would be an exciting mission," says Lee. "We could fly within five years of getting a budget."

It is now in the hands of the White House, as they consider the Augustine Report. Not even Chiao has an inside track on the likely outcome of those deliberations. "Like everybody else, I'm just waiting for the administration to make up its mind about how it wants to respond," he says.

Landing on Phobos is a way of getting close to Mars. But surely it would feel like driving all the way to your destination and then not daring to knock on the door? Not according to Lee. "There are plenty of people who would go, including me," he says. "The view of Mars alone would be staggering."

Chiao, however, says he would find it tough being on a Phobos-only trip. "It's hard for me to imagine going all that way and not getting to the surface of Mars," he says. "But if it were a choice of that or nothing, I'd take Phobos any day!"

Bibliography

1. Stuart Clark is the author of *Deep Space* and *Galaxy* (Quercus). His blog is at stuartclark.com

The Martian night shift

Scott Maxwell works the Martian night shift. He is based at NASA's Jet Propulsion Laboratory in Pasadena, California, and is one of the drivers of the two venerable Martian rovers Spirit and Opportunity. Being solar powered, the rovers shut down every time the sun sets on Mars, which has a "day" of 24.6 hours. The last thing the rovers do before going to sleep is send back pictures of where they are, so that Maxwell and colleagues can figure out what to tell them to do the next day. When they do move, their cautious daily creep is measured in metres.

Driving the rovers interactively from Earth is impossible. Even at Mars's closest approach, the round trip travel time for signals is never shorter than 8 minutes. "By the time you see the cliff coming, you would have driven over it," says Maxwell. So everything is planned out and programmed with safety margins built in. For example, if the rover tilts more than expected or begins slipping in the fine dust, it shuts itself down and the operators reassess the next day.

Such a laborious process would be unnecessary if the rovers were operated by astronauts living on Phobos. Because of its close proximity to Mars, the command signals would take just hundredths of a second to reach the rovers. "It would be more like the navy controlling robotic submarines; it would be a much more efficient way of operating," says Maxwell.

Legions of rovers could scour the surface, protecting the planet from human biological contamination until a thorough search for life had taken place. They could then go on to scout the best places for the eventual crewed landing.

As for whether Maxwell would want to do his job from Phobos rather than Earth, the shout of "yes" is so emphatic that it causes his cellphone to cut out for a moment. "Would I go - are you kidding?" he continues when the line comes back. "It would be amazing. And you know what, if NASA wanted to send me to Mars, they wouldn't even have to bring me back."

Probing Mars

The Mars Express spacecraft has repeatedly taken pictures of Phobos from all distances so that researchers can better understand its orbit. Their plan was to measure the mass of Mars's largest moon more accurately than ever before. Now they are realising that there could be an enormous fringe benefit: Phobos itself could become a proxy space probe.

By watching the quirks in its orbit, we can infer the distribution of mass inside Mars. For example, when Phobos passes over the titanic Tharsis bulge on Mars it dips a little lower because it is being pulled downwards by the mountainous mass beneath.

Existing Martian spacecraft are not so well positioned to do this work because they orbit over the planet's poles. Revealing the internal distribution of Mars's mass is best achieved from the equatorial orbit Phobos follows.

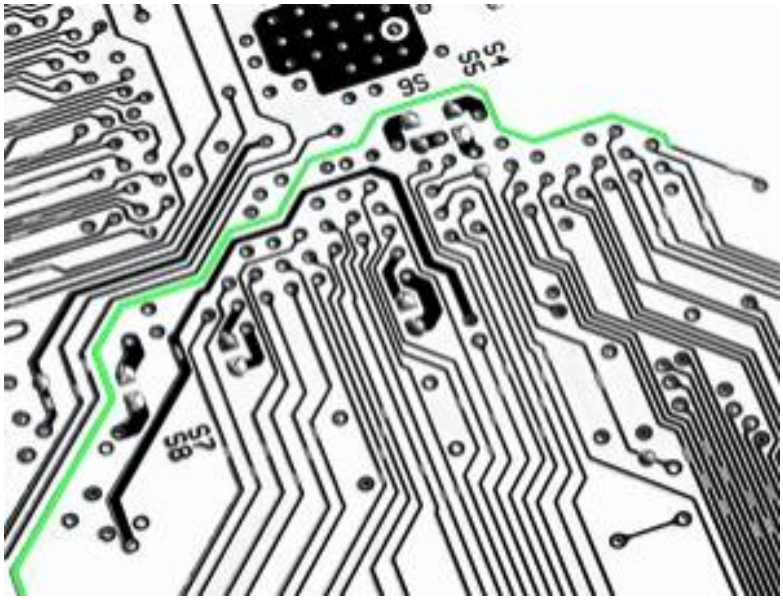
Once the technique is perfected, it will tell us if the core of Mars is molten and help us monitor the planet's seasons. Up to 30 per cent of the Martian atmosphere is locked into the polar icecaps during winter but returns during the summer, which affects Phobos's orbit. Tracking the seasons will help us understand the past climate of Mars and give important clues about the nature of its watery history. It could also tell us about present weather patterns and point to regions future landers should steer clear of to avoid ferocious dust storms.

But there is still a lot of work to be done. "It is possible to do these things but very challenging," says Pascal Rosenblatt of the Royal Observatory of Belgium in Brussels. Our measurements of Phobos's orbit need to be five or 10 times more accurate yet, he says.

http://www.newscientist.com/article/mg20527451.100-destination-phobos-humanitys-next-giant-leap.html?DCMP=NLC-nletter&nsref=mg20527451.100

Spasers set to sum: A new dawn for optical computing

- 25 January 2010 by **Justin Mullins**
- Magazine issue 2744



Making optical computing a possibility again? (Image: Jeffrey Coolidge/Getty)

IT'S a laser, but not as we know it. For a start, you need a microscope to see it. Gleaming eerily green, it is a single spherical particle just a few tens of nanometres across.

Tiny it might be, but its creators have big plans for it. With further advances, it could help to fulfil a long-held dream: to build a super-fast computer that computes with light.

Dubbed a "spaser", this minuscule lasing object is the latest by-product of a buzzing field known as nanoplasmonics. Just as microelectronics exploits the behaviour of electrons in metals and semiconductors on micrometre scales, so nanoplasmonics is concerned with the nanoscale comings and goings of entities known as plasmons that lurk on and below the surfaces of metals.

To envisage what as plasmon is, imagine a metal as a great sea of freely moving electrons. When light of the right frequency strikes the surface of the metal, it can set up a wavelike oscillation in this electron sea, just as the wind whips up waves on the ocean. These collective electron waves - plasmons - act to all intents and purposes as light waves trapped in the metal's surface. Their wavelengths depend on the metal, but are generally measured in nanometres. Their frequencies span the terahertz range - equivalent to the frequency range of light from the ultraviolet right through the visible to the infrared.

Gleaming eerily green, this laser is a single spherical particle just tens of nanometres across

In 2003, their studies of plasmons led theorists Mark Stockman at Georgia State University in Atlanta and David Bergman at Tel Aviv University in Israel to an unusual thought. Plasmons behaved rather like light, so could they be amplified like light, too? What the duo had in mind was a laser-like device that multiplied single plasmons to turn them into powerful arrays of plasmons all oscillating in the same way (see "From laser to spaser").

The mathematics of it seemed to work. By analogy with the acronym that produces the word laser, they dubbed their brainchild "surface plasmon amplification by the stimulated emission of radiation" - spaser - and published a paper about it (*Physical Review Letters*, vol 90, p 027402).

The spaser might have remained just a theoretical curiosity. Around the same time, however, physicists were waking up to the potential of plasmonics for everything from perfect lenses to sensitive biosensors (see "What have plasmons ever done for us?"). The spaser idea was intriguing enough that Mikhail Noginov, an electrical engineer at Norfolk State University in Virginia, and some of his colleagues set out to build one.

It was not an easy task. Light is long-lived, so it is relatively easy to bounce it around in a mirrored chamber and amplify it, as happens inside a laser. Plasmons, by contrast, are transient entities: they typically live for mere attoseconds, and cannot travel more than a few plasmon wavelengths in a metal before their energy is absorbed by the ocean of non-oscillating electrons around them. It was not at all clear how we might get enough of a handle on plasmons to amplify them at all.

In August 2009, Noginov and his colleagues showed how. Their ingenious solution takes the form of a circular particle just 44 nanometres across. It consists of a gold core contained within a shell of silica, speckled with dye molecules that, excited initially by an external laser, produce green light. Some of that light leaks out to give the nanoparticles their characteristic green glow; the rest stimulates the generation of plasmons at the surface of the gold core.

In the normal way of things, these plasmons are absorbed by the metal almost as soon as they are produced. But their tickling influence also stimulates the dye molecules in the silica shell to emit more light, which in turn generates more plasmons, which excites more light and so on. With a sufficient supply of dye, enough plasmons can exist at the same time that they start to reinforce each other. The signature of a laser-like multiplication of plasmons within the device is a dramatic increase in green laser light emitted from the nanoparticle after only a small increase in the energy supplied from the external laser - the signature Noginov and his colleagues reported last year (*Nature*, vol 460, p 1110).

And they were not the only ones. In October 2009, Xiang Zhang, a mechanical engineer at the University of California, Berkeley, and his colleagues unveiled a similarly tiny device that exploits plasmons to produce laser light (*Nature*, vol 461, p 629).

These innovations generated headlines at the time as an entirely new type of lasing device more compact than any yet seen and which, in theory, required a lot less power than a conventional device. That's an exciting development in its own right, but just one in a list of promising advances in the bustling business of laser technology.

Crucially, though, the development of spasers has sparked the hope that one of the great scientific disappointments of the past decades - the unfulfilled promise of optical computing - may yet be turned into triumph.

On the face of it, optical computers, which use light rather than currents of electrons to process information, are a great idea. Electrons are easy to manipulate and process, but they tend to get bogged down as they pass through metals and semiconductors, colliding with atoms and bouncing off them in ways that limit the speed and fidelity of information transmission. Photons, by contrast, can withstand interference, and are above all fast, in theory zipping around a chip at close to the cosmic speed limit.

In the 1990s, various groups claimed to be getting close to making the dream of optical computing a reality. That included a concerted effort at the world-famous Bell Laboratories in Murray Hill, New Jersey, where the building block of microelectronic circuits, the transistor, was invented in 1947. Researchers there and elsewhere hit a snag, however. The very fleet-footedness that made photons perfect

for high-speed communications made them almost impossible to pin down and use for sensible processing of data.

"Optical computing has a chequered history, particularly the boondoggle at Bell Labs," says Harry Atwater, a physicist at the California Institute of Technology in Pasadena. All the efforts foundered when it came to producing anything like a transistor: a tiny, low-power device that could be used to toggle light signals on and off reliably.

In theory, a controllable laser would do this trick, if not for one problem - lasers devour power. Even worse, they are huge, relatively speaking: they work by bouncing photons around a mirrored cavity, so the very smallest they can be is about half the wavelength of the light they produce. For green light, with a wavelength of 530 nanometres, that means little change from 300 nanometres. Electrical transistors, meanwhile, are approaching one-tenth that size.

You see where this is leading. Spasers are a tiny source of light that can be switched on and off at will. At a few tens of nanometres in size, they are just slightly bigger than the smallest electrical transistors. The spaser is to nanoplasmonics what the transistor is to microelectronics, says Stockman: it is the building block that should make optical information-processing possible.

The spaser is to plasmonics what the transistor is to microelectronics

Inevitably, there will be many hurdles to overcome. For a start, Noginov's prototype spaser is switched on and off using another laser, rather than being switched electrically. That is cumbersome and means it cannot capitalise on the technology's low-power potential. It is also unclear, when it comes to connecting many spasers together to make a logic gate, how input and output signals can be cleanly separated with the resonant spherical spasers that have so far been constructed.

Mutual benefit

The most intriguing aspect of spasers, however, is the one that could make or break them as the basis of a future computing technology: they are made of metal. In one sense, that is a bad thing, because making a plasmonic chip would require a wholly different infrastructure to that used to make silicon chips - an industry into which billions in research money has been poured.

Silicon's predominance has not necessarily been a bar to other technologies establishing themselves: the radio signals used for cellphone communication, for example, are of a frequency too high for silicon chips to cope with, so an entirely separate manufacturing process grew up to make the gallium arsenide chips that can. To justify the initial investment costs, another upstart chip-architecture needs a similar "killer application": something it can do that silicon cannot.

Stockman reckons the extra processing speed promised by plasmonic devices will generate such applications in areas like cryptography. "Having faster processors than everyone else will be a question of national security," he says. And he points to another reason why the spooks might be interested. One problem with semiconductors is that their delicate conduction capabilities are vulnerable to ionising radiation. Such rays can send avalanches of electrons streaming through delicate electronic components. At best, this corrupts data and halts calculations. At worst, it fries transistors, permanently disabling them.

This is where the metallic nature of a plasmonic chip would come into its own. The extra electrons that ionising radiation can produce are mere drops in the ocean of free electrons from which plasmons are generated in a metal. A plasmonic device would be able to process and store information in the harshest radioactive environments: in orbiting satellites, in nuclear reactors, during nuclear conflict.

Perhaps the most likely outcome, though, is that rather than the one superseding the other, plasmonics and electronics come to coexist to mutual advantage in a single chip. As the transistors in chips become

smaller, the wires that connect them over distances of just a few nanometres become a significant bottleneck for data. That is one reason why chips are currently spinning their wheels at speeds of about 3 gigahertz. "Wires limit the speed at which electrons can deliver information," says Atwater. "So an obvious solution is to replace them with photonic connections."

The problem with such connections to date has been converting electronic signals into photonic ones and back again with a speed and efficiency that makes it worthwhile. Plasmons, which owe their existence to the easy exchange of energy between light and electrons, could be just the things for the job, making a hybrid electrical-optical chip a genuine possibility.

As well as that, says Atwater, we should work out how to manipulate plasmons using devices that can be made in the same way, and on the same fabrication lines, as ordinary silicon chips. Early last year, he and his colleagues at Caltech revealed an electrically controlled device dubbed the plasmostor that can vary the intensity of plasmons as they pass through it, and which has an architecture very similar to that of conventional transistors (*Nano Letters*, vol 9, p 897). Just this month, a Dutch group has announced that they have produced an electrically powered source of plasmons fully compatible with existing silicon chip fabrication technology (*Nature Materials*, vol 9, p 21).

It's very early days, so such innovations have yet to match the performance of purely electronic components. The plasmostor, for instance, flips between its on and off states more slowly than a conventional transistor, and the signals have an annoying tendency to leak out of the device and get lost. There is still a long way to go to a computer that runs on anything other than electrons. But it is a start, says Atwater. "You're challenging a hugely successful technology. It's audacious to think that you can just replace it."

But if a tiny round green light isn't a signal to go ahead and give it a try, what is?

From laser to spaser

This year marks the golden jubilee of a ruby trailblazer: it was on 16 May 1960 that Theodore Maiman of Hughes Research Laboratories in Malibu, California, coaxed a synthetic ruby to produce the first ever laser light. The first laser to produce light from gas - a mixture of helium and neon - followed later that same year.

Half a century later, and there's hardly an area of human endeavour that doesn't depend on lasers in some way or another: CD and DVD players, metal cutting and welding, barcode scanners and corrective eye surgery to name but a few.

Early lasers were essentially made up of a mirrored box containing a "gain medium" such as a crystal or gas. Zapped with light or an electric current, electrons in this medium absorb energy, releasing it again as photons. These photons bounce around the box and stimulate further electrons to emit more photons. This self-reinforcing increase in light energy is "light amplification by the stimulated emission of radiation" - laser action, for short.

Spasers use the same principle, except rather than amplifying light directly, they amplify surface plasmons - the wavelike movements of free electrons on and near the surfaces of metals - using that in turn to emit light.

What have plasmons ever done for us?

Plasmons might sound esoteric, but it is not just with spasers (see main story) that they are seeing practical application.

Take molecular sensing. The amount and colour of light absorbed by a plasmonic nanoparticle is extremely sensitive to the surrounding molecular environment. This property has been exploited to build sensing devices that detect levels of anything from the protein casein, an indicator of the quality of milk products, to glucose in the blood.

What's significant about these plasmonic sensors is that they can make continuous measurements, unlike chemical tests which usually give a single snapshot. A plasmonic implant could one day help diabetics to monitor and control their blood glucose levels in real time.

Plasmons should also be useful for increasing the efficiency of certain kinds of flat-screen displays. In June 2009, Ki Youl Yang and his colleagues at the Korea Advanced Institute of Science and Technology in Daejeon showed how silver nanoparticles deposited onto organic light-emitting diodes used in some displays increases the amount of light they emit.

More impressive yet, plasmonic devices might also help to tackle cancer, if tests in mice are anything to go by. Plasmonic nanoparticles laced with antibodies can be made to latch onto tumours. When blasted with a focused beam of infrared light precisely tuned to the plasmon frequency, the nanoparticles heat up, killing the attached cancer cells while leaving the surrounding healthy tissue unharmed (*Accounts of Chemical Research*, vol 41, p 1842).

Justin Mullins is a consultant editor for New Scientist

http://www.newscientist.com/article/mg20527441.600-spasers-set-to-sum-a-new-dawn-for-optical-computing.html

Pebble splashes break the speed of sound

- 24 January 2010
- Magazine issue 2744.

Pressure changes cause a jet of air to be expelled at supersonic speeds (Image: Stephan Gekle/PRL)

IS IT a bird, is it a plane? No, it's a rock falling into a pool of water, but the jet of air it produces flies faster than a speeding bullet.

When an object such as a pebble drops into water, an air-filled cavity is created which ejects air at supersonic speeds, discovered Stephan Gekle at the University of Twente in the Netherlands, and colleagues.

Using high-speed photography, the team spotted a cavity of air forming in an hourglass shape - with the top of the hourglass at the surface of the water and its base at the sinking object. To measure the speed of air rushing out upwards, they marked the air with smoke before the splash.

Even though their camera took 15,000 frames per second, they still couldn't measure the fastest speeds directly, so they simulated the behaviour they had observed. They found that shortly before the cavity closes, the pressure of the air at the bottom of the hourglass becomes higher relative to the "neck". This difference pushes the air out at speeds faster than sound (*Physical Review Letters*, DOI: 10.1103/PhysRevLett.104.024501).

Jeffrey Aristoff of Princeton University is impressed by the research. The presence of supersonic flow was far from obvious, he says.

http://www.newscientist.com/article/mg20527444.700-pebble-splashes-break-the-speed-of-sound.html

Feathered dinosaurs show their true colours

- 27 January 2010 by **James O'Donoghue**
- Magazine issue 2745.

Spot the stripy tail (Image: Chuang Zhao and Lida Xing)

MEET *Sinosauropteryx*, a cousin of *T. rex* and the first dinosaur whose plumage has been brought into dazzling full-colour focus.

The discovery comes thanks to a technique devised last year at Yale University to establish the colour of fossilised bird feathers. It has now been applied to a dinosaur fossil in a breakthrough study that offers the prospect of finally working out what some of the feathered dinos of prehistoric Earth really looked like.

The Yale team used a form of scanning electron microscopy to reveal the iridescent, starling-like colours of feathers from a 47-million-year-old fossil bird (*Biology Letters*, DOI: 10.1098/rsbl.2009.0524). Now Michael Benton of the University of Bristol, UK, and colleagues have applied the technique to *Sinosauropteryx* fossils from the Jehol formation in Liaoning province, China. This showed the presence of microscopic colour-bearing cell structures known as melanosomes in the 125-million-year-old fossil's feathers (*Nature*, DOI: 10.1038/nature08740).

The melanosomes had previously been mistaken for the bacteria that often colonise the soft tissues of well-preserved fossils. But Benton's team found that the pattern of these spherical and sausage-shaped structures was identical to that of melanosomes in modern bird feathers.

The 1.2-metre-long, flightless, meat-eating *Sinosauropteryx* is the most primitive known feathered dinosaur. It sported a Mohican-style bristly feather crest along the top of its head and down the middle of its back. The new study shows that the feathers on its lemur-like tail formed broad orange and white stripes.

Benton hopes further studies will work out what the head and back feathers look like. He says it should be possible to see melanosomes for many different colours in fossilised dinosaur feathers. "I think we will see a mad rush of work where people will observe fossilised melanosomes all over the place," he says.

So will Hollywood have to remake *Jurassic Park* in more accurate colours? Probably not. Feathers are extremely rare in the fossil record, and sampling them for melanosomes does irreversible damage to the fossil. It is therefore likely that only a select few dinosaur fossils will ever be subjected to the technicolor screen test.

http://www.newscientist.com/article/mg20527454.000-feathered-dinosaurs-show-their-true-colours.html

Why older brains stand to lose more

- 22:00 26 January 2010 by **Ewen Callaway**

Ageing may cloud your financial judgement, thanks to "noise" in an area of the brain critical for predicting pay-offs, suggests a study of people who played an investment game in a brain scanner.

Gregory Samanez-Larkin and Brian Knutson of Stanford University in California, scanned the brains of 110 men and women aged 19 to 85 with functional MRI as they played 100 rounds of a game in which they had to choose one of three possible investments.

One was in a safe bond that always delivers $1, another was a stock twice as likely to pay off $10 than to lose $10. The third was a highly risky stock with those odds flipped. "What we're doing is trying to get closer and closer to real investing," Samanez-Larkin says.

Shrewd investors will keep picking bonds until they figure out which is the profitable stock. The researchers found that volunteers between 67 and 85 took longer to figure this out than their younger counterparts. "When older adults are choosing risky assets they make more errors," says Samanez-Larkin.

Reward sensor

What's more activity in the striatum, a region critical to sensing reward, was more sporadic in these older volunteers – this area only lit up strongly in some rounds, whereas in younger volunteers activation was consistent.

Samanez-Larkin suggests the fluctuating activity could act like noise, clouding someone's ability to work out the best investment.

"This part of the brain seem to be very important for learning from past history about whether something that happens is good or bad," says Scott Huettel, a neuroscientist at Duke University in Durham, North Carolina.

When Samanez-Larkin repeated the game but this time told elderly volunteers what the stakes were, this prompted them to invest just like younger players.

Journal Reference: *The Journal of Neuroscience*, DOI: 10.1523/jneurosci.4902-09-2010

http://www.newscientist.com/article/dn18435-why-older-brains-stand-to-lose-more.html

US babies mysteriously shrinking

- 16:15 26 January 2010 by **Ewen Callaway**

Magazine issue 2745.

Getting lighter, but why? (Image: Mauro Fermariello/SPL)

Birthweights in the US are falling but no one knows why, according to a study of 36.8 million infants born between 1990 and 2005.

A 52-gram drop in the weight of full-term singletons – from an average of 3.441 to 3.389 kilograms – has left Emily Oken's team at Harvard Medical School scratching their heads. It can't be accounted for by an increase in caesarean sections or induced labours, which shorten gestation. What's more, women in the US now smoke less and gain more weight during pregnancy, which should make babies heavier. Oken suggests that unmeasured factors, such as diet or exercise, could explain why babies are being born lighter.

"For your average baby, 50 grams probably makes no difference at all," she stresses. But those born substantially lighter could be at increased risk of heart disease and diabetes later in life.

Journal reference: *Obstetrics & Gynecology*, DOI: 10.1097/aog.0b013e3181cbd5f5

http://www.newscientist.com/article/dn18434-us-babies-mysteriously-shrinking.html

Horizontal and vertical: The evolution of evolution

- 26 January 2010 by **Mark Buchanan**

Magazine issue 2744.

Another kind of evolution (Image: Richard Borge)

JUST suppose that Darwin's ideas were only a part of the story of evolution. Suppose that a process he never wrote about, and never even imagined, has been controlling the evolution of life throughout most of the Earth's history. It may sound preposterous, but this is exactly what microbiologist Carl Woese and physicist Nigel Goldenfeld, both at the University of Illinois at Urbana-Champaign, believe. Darwin's explanation of evolution, they argue, even in its sophisticated modern form, applies only to a recent phase of life on Earth.

At the root of this idea is overwhelming recent evidence for horizontal gene transfer - in which organisms acquire genetic material "horizontally" from other organisms around them, rather than vertically from their parents or ancestors. The donor organisms may not even be the same species. This mechanism is already known to play a huge role in the evolution of microbial genomes, but its consequences have hardly been explored. According to Woese and Goldenfeld, they are profound, and horizontal gene transfer alters the evolutionary process itself. Since micro-organisms represented most of life on Earth for most of the time that life has existed - billions of years, in fact - the most ancient and prevalent form of evolution probably wasn't Darwinian at all, Woese and Goldenfeld say.

Strong claims, but others are taking them seriously. "Their arguments make sense and their conclusion is very important," says biologist Jan Sapp of York University in Toronto, Canada. "The process of evolution just isn't what most evolutionary biologists think it is."

Vertical hegemony

How could modern biology have gone so badly off track? According to Woese, it is a simple tale of scientific complacency. Evolutionary biology took its modern form in the early 20th century with the establishment of the genetic basis of inheritance: Mendel's genetics combined with Darwin's theory of evolution by natural selection. Biologists refer to this as the "modern synthesis", and it has been the basis for all subsequent developments in molecular biology and genetics. Woese believes that along the way biologists were seduced by their own success into thinking they had found the final truth about all evolution. "Biology built up a facade of mathematics around the juxtaposition of Mendelian genetics with Darwinism," he says. "And as a result it neglected to study the most important problem in science - the nature of the evolutionary process."

In particular, he argues, nothing in the modern synthesis explains the most fundamental steps in early life: how evolution could have produced the genetic code and the basic genetic machinery used by all organisms, especially the enzymes and structures involved in translating genetic information into proteins. Most biologists, following Francis Crick, simply supposed that these were uninformative "accidents of history". That was a big mistake, says Woese, who has made his academic reputation proving the point.

In 1977, Woese stunned biologists when his analysis of the genetic machinery involved in gene expression revealed an entirely new limb of the tree of life. Biologists knew of two major domains: eukaryotes - organisms with cell nuclei, such as animals and plants - and bacteria, which lack cell nuclei. Woese documented a third major domain, the Archaea. These are microbes too, but as distinct from bacteria genetically as both Archaea and bacteria are from eukaryotes. "This was a enormous discovery," says biologist Norman Pace of the University of Colorado in Boulder. Woese himself sees it as a first step in getting evolutionary biology back on track. Coming to terms with horizontal gene transfer is the next big step.

In the past few years, a host of genome studies have demonstrated that DNA flows readily between the chromosomes of microbes and the external world. Typically around 10 per cent of the genes in many bacterial genomes seem to have been acquired from other organisms in this way, though the proportion can be several times that (*New Scientist*, 24 January 2009, p 34). So an individual microbe may have access to the genes found in the entire microbial population around it, including those of other microbe species. "It's natural to wonder if the very concept of an organism in isolation is still valid at this level," says Goldenfeld.

Lateral thinking

This is all very different from evolution as described by Darwin. Evolution will always be about change as a result of some organisms being more successful at surviving than others. In the Darwinian model, evolutionary change occurs because individuals with genes associated with successful traits are more likely to pass these on to the next generation. In horizontal gene transfer, by contrast, change is not a function of the individual or of changes from generation to generation, but of all the microbes able to share genetic material. Evolution takes place within a complex, dynamic system of many interacting parts, say Woese and Goldenfeld, and understanding it demands a detailed exploration of the self-organising potential of such a system. On the basis of their studies, they argue that horizontal gene transfer had to be a dominant factor in the original form of evolution.

Evidence for this lies in the genetic code, say Woese and Goldenfeld. Though it was discovered in the 1960s, no one had been able to explain how evolution could have made it so exquisitely tuned to resisting errors. Mutations happen in DNA coding all the time, and yet the proteins it produces often remain unaffected by these glitches. Darwinian evolution simply cannot explain how such a code could arise. But horizontal gene transfer can, say Woese and Goldenfeld.

The essence of the genetic code is that sequences of three consecutive bases, known as codons, correspond to specific amino acids (see diagram). Proteins are made of chains of amino acids, so when a gene is transcribed into a protein these codons are what determines which amino acid gets added to the chain. The codon AAU represents the amino acid asparagine, for example, and UGU represents cysteine. There are 64 codons in total and 20 amino acids, which means that the code has some redundancy, with multiple codons specifying the same amino acid.

This code is universal, shared by all organisms, and biologists have long known that it has remarkable properties. In the early 1960s, for example, Woese himself pointed out that one reason for the code's deep tolerance for errors was that similar codons specify either the same amino acid or two with similar chemical properties. Hence, a mutation of a single base, while changing a codon, will tend to have little effect on the properties of the protein being produced.

In 1991, geneticists David Haig and Lawrence Hurst at the University of Oxford went further, showing that the code's level of error tolerance is truly remarkable. They studied the error tolerance of an enormous number of hypothetical genetic codes, all built from the same base pairs but with codons associated randomly with amino acids. They found that the actual code is around one in a million in terms of how good it is at error mitigation. "The actual genetic code," says Goldenfeld, "stands out like a sore thumb as being the best possible." That would seem to demand some evolutionary explanation. Yet, until now, no one has found one. The reason, say Woese and Goldenfeld, is that everyone has been thinking in terms of the wrong kind of evolution.

Working with Kalin Vetsigian, also at the University of Illinois at Urbana-Champaign, Woese and Goldenfeld set up a virtual world in which they could rerun history multiple times and test the evolution of the genetic code under different conditions (*Proceedings of the National Academy of Sciences*, vol 103, p 10696). Starting with a random initial population of codes being used by different organisms - all using the same DNA bases but with different associations of codons and amino acids - they first explored how the code might evolve in ordinary Darwinian evolution. While the ability of the code to withstand errors improves with time, they found that the results were inconsistent with the pattern we actually see in two ways. First, the code never became shared among all organisms - a number of distinct codes remained in use no matter how long the team ran their simulations. Second, in none of their runs did any of the codes evolve to reach the optimal structure of the actual code. "With vertical, Darwinian evolution," says Goldenfeld, "we found that the code evolution gets stuck and does not find the true optimum."

Horizontal is optimal

The results were very different when they allowed horizontal gene transfer between different organisms. Now, with advantageous genetic innovations able to flow horizontally across the entire system the code readily discovered the overall optimal structure and came to be universal among all organisms. "In some sense," says Woese, "the genetic code is a fossil or perhaps an echo of the origin of life, just as the cosmic microwave background is a sort of echo of the big bang. And its form points to a process very different from today's Darwinian evolution." For the researchers the conclusion is inescapable: the genetic code must have arisen in an earlier evolutionary phase dominated by horizontal gene transfer.

Goldenfeld admits that pinning down the details of that early process remains a difficult task. However the simulations suggest that horizontal gene transfer allowed life in general to acquire a unified genetic machinery, thereby making the sharing of innovations easier. Hence, the researchers now suspect that early evolution may have proceeded through a series of stages before the Darwinian form emerged, with the first stage leading to the emergence of a universal genetic code. "It would have acted as an innovation-sharing protocol," says Goldenfeld, "greatly enhancing the ability of organisms to share genetic innovations that were beneficial." Following this, a second stage of evolution would have involved rampant horizontal gene transfer, made possible by the shared genetic machinery, and leading to a rapid, exponential rise in the complexity of organisms. This, in turn, would eventually have given way to a third stage of evolution in which genetic transfer became mostly vertical, perhaps because the complexity of organisms reached a threshold requiring a more circumscribed flow of genes to preserve correct function. Woese can't put a date on when the transition to Darwinian evolution happened, but he suspects it occurred at different times in each of the three main branches of the tree of life, with bacteria likely to have changed first.

Early evolution may have proceeded through a series of stages before the Darwinian form emerged

Today, at least in multicellular organisms, Darwinian evolution is dominant but we may still be in for some surprises. "Most of life - the microbial world - is still strongly taking advantage of horizontal gene transfer, but we also know, from studies in the past year, that multicellular organisms do this too," says Goldenfeld. As more genomes are sequenced, ever more incongruous sequences of DNA are turning up. Comparisons of the genomes of various species including a frog, lizard, mouse and bushbaby, for example, indicate that one particular chunk of DNA found in each must have been acquired

independently by horizontal gene transfer (*Proceedings of the National Academy of Sciences*, vol 105, p 17023). "The importance of this for evolution has yet to be seriously considered."

No doubt there will be resistance in some quarters, yet many biologists recognise that there must be a change in thinking if evolution is finally to be understood in a deep way. "The microbial world holds the greatest biomass on Earth," says Sapp, "but for most evolutionists it's a case of 'out of sight, out of mind'. They tend to focus on visible plants and animals."

If a paradigm shift is pending, Pace says it will be in good hands. "I think Woese has done more for biology writ large than any biologist in history, including Darwin," he says. "There's a lot more to learn, and he's been interpreting the emerging story brilliantly."

Mark Buchanan is a writer based in Oxford, UK

http://www.newscientist.com/article/mg20527441.500-horizontal-and-vertical-the-evolution-of-evolution.html

Drug could turn soldiers into super-survivors

- 27 January 2010 by **Linda Geddes**
- Magazine issue 2745.

Keeping a solider alive long enough to reach hospital (Image: Roberto Schmidt)

A LUCKY few seem to be able to laugh in the face of death, surviving massive blood loss and injuries that would kill others. Now a drug has been found that might turn virtually any injured person into a "super-survivor", by preventing certain biological mechanisms from shutting down.

The drug has so far only been tested in animals. If it has a similar effect in humans, it could vastly improve survival from horrific injuries, particularly in soldiers, by allowing them to live long enough to make it to a hospital.

Loss of blood is the main problem with many battlefield injuries, and a blood transfusion the best treatment, although replacing lost fluid with saline can help. But both are difficult to transport in sufficient quantities. "You can't carry a blood bank into the battlefield," says Hasan Alam of Massachusetts General Hospital in Boston. "What we're looking for is a pill or a shot that would keep a person alive for long enough to get to them to a hospital."

We're looking for a pill that would keep a person alive for long enough to get them to hospital

When the body loses a lot of blood, it tries to compensate by going into shock. This is a set of emergency measures to raise blood pressure and conserve energy, such as increasing heart rate and shutting down expression of some proteins. However, if the body stays in shock for more than a short time, it can lead to organ failure, and death soon follows.

Recent studies have suggested that around 6 or 7 per cent of genes change their expression in response to shock, via the removal of "epigenetic", chemical additions to the genome called acetylations. As histone deacetylase (HDAC) inhibitors can prevent the removal of such acetylations, Alam wondered if these drugs might improve survival after blood loss.

His team previously showed that valproic acid, an HDAC inhibitor already used to treat epilepsy, increased survival rates in rats that had lost a lot of blood. It seemed to be doing this by preventing acetylation, causing certain "survival pathways" to remain switched on.

Now Alam has repeated the study in pigs. He anaesthetised the animals, drained 60 per cent of their blood, and subjected them to other injuries before giving them a saline transfusion. He then injected some of the pigs with valproic acid, gave others a blood transfusion and left the remainder untreated.

Just 25 per cent of the pigs receiving only saline survived for 4 hours - the typical time it takes to get hospital treatment - while 86 per cent of those injected with valproic acid survived. All those that had a blood transfusion lived (*Surgery*, DOI: 10.1016/j.surg.2009.04.007).

Alam is currently repeating the trial to make sure valproic acid does not hinder survival in the longer term. If so, he will apply for permission to do human trials by the end of the year.

"It's exciting," says John Holcomb of the Center for Translational Injury Research at the University of Texas in Houston. "They're looking at resuscitation in a different way."

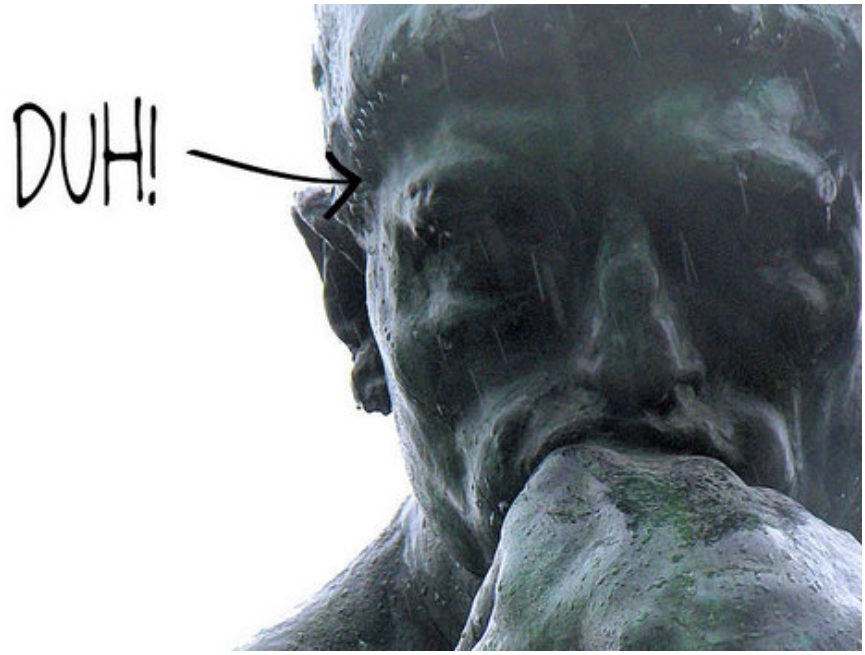
Earlier studies by Alam's team showed that rats that naturally survive traumatic blood loss also experience fewer changes in gene expression than those that die or suffer complications. He thinks the same might be true in humans. "Every person has this capacity to survive a huge insult, but most of the time it's dormant," he says. "That's why the same insult kills some people while others laugh and move on. What we're trying to do is make you super-resistant using the pathways and proteins that already exist."

However, Graham Packham of Southampton General Hospital, UK, who is investigating the use of HDAC inhibitors to treat cancer, says it isn't yet clear how valproic acid, which reacts with a wide range of molecules, is actually prolonging survival. "It's not clear whether this is driven by valproic acid's epigenetic activity," he says.

http://www.newscientist.com/article/mg20527454.200-drug-could-turn-soldiers-into-supersurvivors.html

Willpower And The 'Slacker' Brain

by Robert Krulwich



January 26, 2010

This time, you say to yourself, *this time* I will do 50 chin-ups every day or skip dessert or call my mother every Friday. It's time to do those things that I know, *I really, really know* I should do.

And then you don't.

According to British psychologist Richard Wiseman, 88 percent of all resolutions end in failure. Those are his findings from a 2007 University of Hertfordshire study of more than 3,000 people.

How come so many attempts at willpower lose both their will and their power?

In our Radiolab excerpt on *Morning Edition*, with my co-host, Jad Abumrad, we propose an answer ...

Jonah Lehrer, one of our regular reporters (he writes all the time about the brain), told Jad and me about an experiment involving the prefrontal cortex, located just behind the forehead. It's the brain area largely responsible for willpower. This hunk of brain tissue, he says, has greatly expanded over the last few hundred-thousand years, but "it probably hasn't expanded enough." The reason our willpower is so often weak, he suggests, is because this bit of brain lacks a certain (how shall we put this?) ... muscularity.

The Experiment

In his book *How We Decide*, and in a recent *Wall Street Journal* article, Jonah writes about an experiment by Stanford University professor Baba Shiv, who collected several dozen undergraduates and divided them into two groups.

In the *WSJ* article, Jonah writes:

"One group was given a two-digit number to remember, while the second group was given a seven-digit number. Then they were told to walk down the hall, where they were presented with two different snack options: a slice of chocolate cake or a bowl of fruit salad."

And then he writes:

"Here's where the results get weird. The students with seven digits to remember were nearly twice as likely to choose the cake as students given two digits. The reason, according to Professor Shiv, is that those extra numbers took up valuable space in the brain — they were a "cognitive load" — making it that much harder to resist a decadent dessert. In other words, willpower is so weak, and the prefrontal cortex is so overtaxed, that all it takes is five extra bits of information before the brain starts to give in to temptation."

It turns out, Jonah explains, that the part of our brain that is most reasonable, rational and do-the-right-thing is easily toppled by the pull of raw sensual appetite, the lure of sweet. Knowing something is the right thing to do takes work — brain work — and our brains aren't always up to that. The experiment, after all, tells us brains can't even hold more than seven numbers at a time. Add five extra digits, and good sense tiptoes out of your head, and in comes the cake. "This helps explain why, after a long day at the office, we're more likely to indulge in a pint of ice cream, or eat one too many slices of leftover pizza," Lehrer writes.

http://www.npr.org/templates/story/story.php?storyId=122781981

Family rows 'threat to childhood'

Unhappiness in children is more likely to be influenced by conflict in their family than the family's structure, research suggests.

A study by the Children's Society says family arguments are more damaging for children than factors such as whether they live with married parents.

This survey of well-being was based on the views of 7,000 children in England aged between 10 and 15.

It found that about 7% of children were "significantly" unhappy.

Among a cohort of 1.8 million children - this would mean there are 140,000 deeply unhappy children in these age groups.

Image anxiety

The charity wanted to investigate how children experienced unhappiness and happiness - asking them to record their feelings on a scale of 0 to 10.

" **This report is a stark reminder that our actions as adults can have a profound impact on our children's well-being** "
Bob Reitemeier, Children's Society

It found that living in a happy household, where people got along together, was a major positive factor in children's sense of well-being.

But when children were in a home where people were fighting there was a sharply negative impact - calculated as representing 20% of the variation between happiness and unhappiness.

In contrast, the type of family structure - such as whether children were living in a single-parent family - had a more marginal impact, calculated as a 2% disadvantage for those not living with both parents.

But the experience of separation - and changes in the adults living with children - did reduce happiness, pushing down the sense of happiness to 6.8 out of 10, below the overall average of 7.7.

Children also reported that anxiety about their appearance made them unhappy.

In particular, girls were worried about how they looked - being twice as likely to be unhappy about their appearance than boys.

Overall, boys were found to be happier than girls.

'Well-being index'

Asked about their level of happiness, a large proportion of children were broadly positive - averaging 7.7 out of 10 - but more children reported feelings of unhappiness as they grew older and entered their teenage years.

Other factors identified as potentially causing unhappiness were the areas where the children lived and their schools.

The charity wants to use this large-scale study to create a benchmark for a "well-being index" - so that the impact of future changes in policy can be measured.

The research is published a week after both Labour and the Conservatives launched plans to support the family - with promises to back marriage and stable relationships.

And updated guidelines for sex education in schools in England, published on Monday, emphasised the importance of marriage and strong relationships.

"Family conflict emerges in this study as a major cause of childhood unhappiness, and so it is vital that families can get the sort of family mediation and counselling the Children's Society offers to help them resolve and avoid conflicts," said the Children's Society's chief executive, Bob Reitemeier.

"This report is a stark reminder that our actions as adults can have a profound impact on our children's well-being and the importance of listening to what children are telling us."

The study was produced with the University of York and the survey's co-author, Jonathan Bradshaw, said it "establishes a valuable benchmark that we can use to track changes in well-being over time".

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/uk_news/education/8481773.stm

Published: 2010/01/27 01:06:47 GMT

'Echoes' in bat and dolphin DNA
By Jonathan Amos
Science correspondent, BBC News

Scientists have found a striking similarity in the DNA that enables some bats and dolphins to echolocate.

A key gene that gives their ears the ability to detect high-frequency sound has undergone the same changes over time in both creatures.

The researchers report their findings in the journal Current Biology.

It may be the first time that identical genetics has been shown to underpin the evolution of similar characteristics in very different organisms.

Nature is full of cases where the path taken by evolution has resulted in the same traits, or phenotypes, developing independently in diverse animal groups.

Examples would include the tusks displayed by elephants and walruses, or the bioluminescence seen in fireflies and jellyfish.

"It's common on a morphological scale but it's assumed not to occur at a DNA level because there are so many different ways to arrive at the same solution," explained Dr Stephen Rossiter of Queen Mary's School of Biological and Chemical Sciences.

"The fact that we're able to link convergence of the DNA with a phenotype I think is unique, and in such a complex phenotype as hearing as well," he told BBC News.

Animal and human

Many bats and toothed whales like dolphins have exceptional hearing, and are able to track down their prey by emitting high-frequency noises and then listening for the echoes that bounce back.

Critical to echolocation are tiny hairs in the inner ear that move in response to sound.

Their keen performance is driven by a particular protein known as prestin, which in turn is encoded by a gene, also known as prestin.

Two studies published this week in Current Biology find that this gene in bats and dolphins has picked up the same mutations over time.

"We've found a whole suite of amino acid changes that are common to these two groups that have evolved in parallel, convergently," Dr Rossiter said.

Both research teams also have evidence showing that these changes to prestin were selected for, suggesting that they must be critical for the animals' echolocation for reasons the researchers do not yet fully understand.

"The results imply that there are very limited ways, if not only one way, for a mammal to hear high-frequency sounds," said Professor Jianzhi Zhang of the University of Michigan, US, who led the other study.

This type of research is a beneficiary of the immense and ongoing effort to understand human genetics, which finds interesting targets for biologists from many fields to follow up.

Mutations in the prestin gene in humans have been shown to be associated with the loss of high-frequency hearing. It was this revelation that initiated the study of prestin's role in echolocation.

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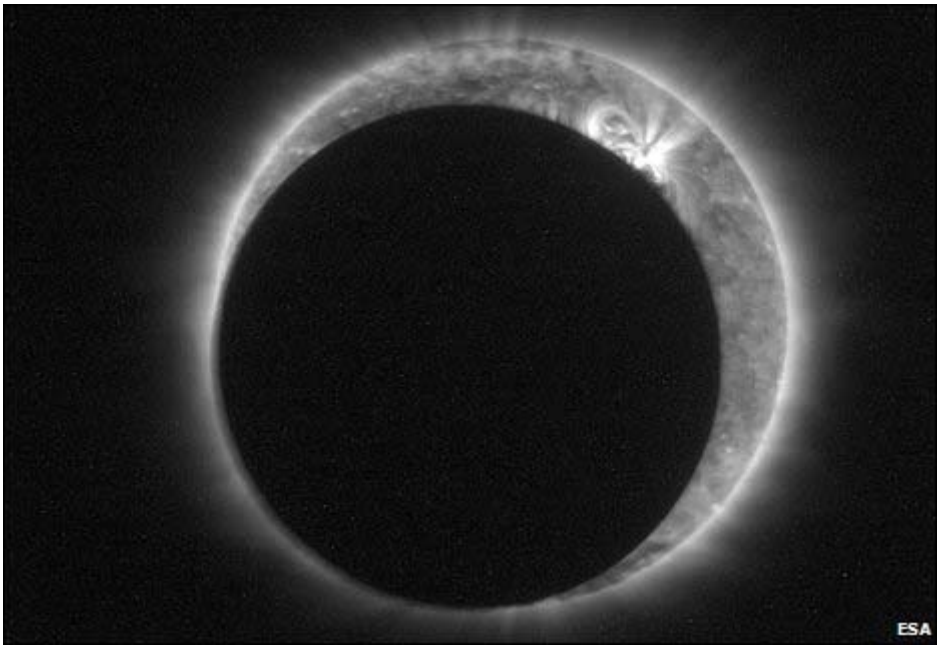
Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8478566.stm

Published: 2010/01/26 13:41:44 GMT

Esa tech satellite views eclipse

One of smallest satellites ever flown by the European Space Agency (Esa) has returned its first images of the Sun.



On Tuesday, mission managers hailed the excellent performance of the Proba-2 technology demonstration spacecraft.

The PRoject for OnBoard Autonomy satellite is intended to test hardware and software that might be incorporated into future Esa missions.

The 0.6m by 0.6m by 0.8m box includes new computer, battery, thruster, and solar panel systems.

It also carries some instruments to study the Sun and the space environment.

At a press conference at the Royal Observatory of Belgium in Brussels, the Proba team unveiled the spacecraft's first solar observations.

These included pictures of the annular solar eclipse on 15 January, which was seen from the Earth's surface across much of Africa and Asia.

Proba-2 was a secondary payload on the rocket which launched Esa's flagship "water mission" - the Soil Moisture and Ocean Salinity (Smos) Earth Explorer.

Future Proba missions will be used by Esa to test new Earth observation techniques and the technology to fly spacecraft in formation.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8481321.stm

Published: 2010/01/26 15:43:09 GMT

C-sections 'do not harm feeding'

Having a Caesarean or instrumental birth does not appear to impact upon how long a mother breastfeeds, British research suggests.

A study of 2,000 mothers who received breastfeeding support also found little association with how soon after birth the baby was put to the breast.

What did have an impact was ethnicity, and the number of previous births, the study in BMC Pediatrics reported.

White mothers were 70% more likely to stop than non-White contemporaries.

The Department of Health recommends exclusive breastfeeding for the first six months of a baby's life, but the majority of UK mothers have abandoned it altogether by this point - giving the country one of the lowest breastfeeding rates in Europe.

There have been a series of measures aimed at increasing prevalence, from better support to a ban on any promotion of infant milks.

This latest study, conducted by the University of Manchester and East Lancashire Primary Care Trust, followed more than 2,000 mothers who all received breastfeeding help from the same peer support group, to enable a fair comparison of other factors.

Bucking the trend

On average these supported mothers were giving some breastmilk for 21 weeks, and half of them for more than 27 weeks, markedly higher than the national average. But there were differences between sub-groups.

" **What is really exciting about this research is the rates of breastfeeding - both exclusive and mixed - that have been achieved among all groups** "
Professor Mary Renfrew, infant feeding expert

White women tended to stop a number of weeks before non-white, with mothers of black and Indian ethnic origin breastfeeding the longest, closely followed by Pakistani.

But the relative economic status of the women made no difference, with the poorest as likely to continue or abandon breastfeeding as the wealthiest, nor did it matter whether the mothers were married.

Having an instrumental or Caesarean birth had no statistically significant impact on the duration of breastfeeding, contrary to some suggestions that a "non-natural" birth, possibly as a result of the analgesics used, may hamper feeding.

Also babies who were put to the breast within an hour of being born - as recommended by the World Health Organisation - were not breastfed any longer than those with whom breastfeeding was initiated within 48 hours.

Previous deliveries

The study did however find that the number of babies a mother had previously delivered impacted upon breastfeeding duration, with women having their third or fourth baby more likely to continue than those having their first.

The study's authors noted that while breastfeeding support was clearly important in mitigating a number of obstacles to prolonged feeding, there were other factors at play.

Dr Gabriel Agboado of East Lancashire PCT said: "The results suggest that infant feeding practices associated with maternal ethnicity and previous experience of having children may be more difficult to influence by peer support interventions.

"Peer support programs, particularly those in multi-ethnic settings, will need to identify the needs of their various client groups in order to appropriately support them to breastfeed longer".

Professor Mary Renfrew, who researches infant feeding practices, said: "We know that rates are higher among ethnic minority groups and that previous experience of breastfeeding has an effect on whether the mother does it again, and the study confirms this.

"But what is really exciting about this research is the rates of breastfeeding - both exclusive and mixed - that have been achieved among all groups. They are doing something right in this area, and it does seem to point to peer support, although there may be other factors involved.

"Tailored support is recommended for all mothers, but some places have been much more pro-active on this front than others. When people say you simply cannot get breastfeeding rates up, it's clear there are policies which can have an effect."

Sue Ashmore, head of Unicef's UK Baby Friendly Initiative said: "evidence shows that women are more likely to breastfeed if they are supported by someone who believes they can do it. This is the point of peer support programs.

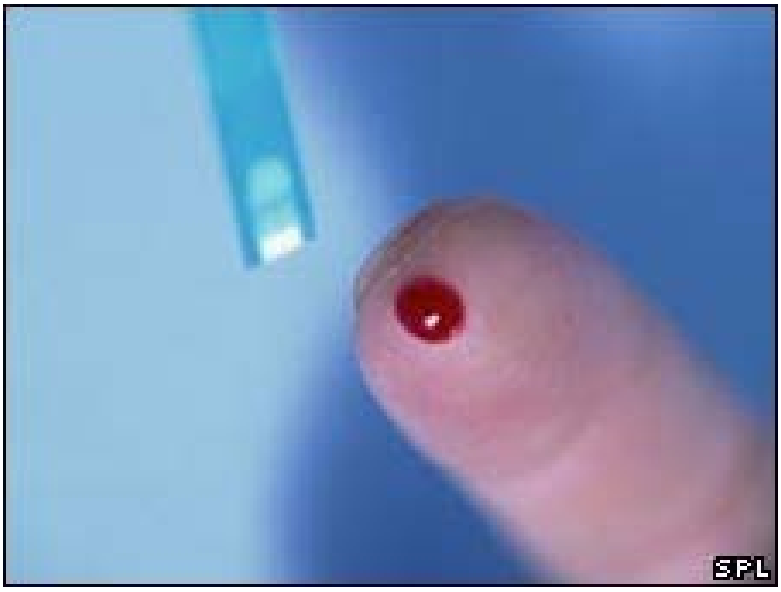
"In the UK peer support work is varied, and therefore the results are varied. It is vital that robust monitoring and evaluation processes are in place so that strengths and weaknesses can be identified and addressed; this would lead to a more successful peer support programs nationwide."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8480778.stm

Published: 2010/01/27 00:31:07 GMT

Diabetes sugar 'can go too low'

Intense treatment to lower blood sugar in patients with diabetes could prove nearly as harmful as allowing glucose levels to remain high, a study says.



Cardiff researchers looked at nearly 50,000 patients with type 2 diabetes and found the lowest glucose levels linked to a heightened risk of death.

Significant differences in death rates between patients on insulin and those taking tablets are also flagged up.

But there could be various explanations for this, experts noted.

Patients taking insulin-based treatments have been urged not to stop taking their medication as a result of the Cardiff University study, which is published in The Lancet.

Changing treatments

Using data from GPs, the team identified 27,965 patients aged 50 and above with type 2 diabetes whose treatment had been intensified to include two oral blood glucose lowering agents - metformin and sulphonylurea.

" **It is crucial to remember that blood glucose targets should always be agreed by the person with diabetes and their healthcare team according to individual needs and not according to a blanket set of rules** "
Dr Iain Frame Diabetes UK

A further 20,005 patients who had been moved on to treatment which included insulin were added to the study.

Patients whose HbA1c levels - the proportion of red blood cells with glucose attached to them - were around 7.5%, ran the lowest risk of dying from any cause.

For both groups this risk went up by more than half if levels dropped to 6.4%, the lowest levels recorded. For those with the highest levels the risk of death increased by nearly 80%.

But the risks appeared to be particularly pronounced among those on the insulin-based regimen than those on the combined treatment.

Irrespective of whether their HbA1c levels were low or high, there were 2,834 deaths in the insulin-taking group between 1986 and 2008, nearly 50% more than in the combined group.

'Don't stop'

The authors acknowledged there could be various factors associated with this, such as these being older patients with more health problems, who perhaps had had diabetes for a longer period of time. They also make reference to a possible link between use of insulin and cancer progression that had been reported in a different study.

"Whether intensification of glucose control with insulin therapy alone further heightens risk of death in patients with diabetes needs further investigation and assessment of the overall risk balance," wrote lead author Dr Craig Currie.

"Low and high mean HbA1c values were associated with increased all-cause mortality and cardiac events. If confirmed, diabetes guidelines might need revision to include a minimum HbA1c value."

These findings were in line with those of a major ongoing trial in the US, which pulled patients off a regimen of intensive blood sugar management after noting an unexpected increase in total deaths among this arm of its study.

Dr Iain Frame, head of research at Diabetes UK, described this latest study as "potentially important" but stressed it had limitations.

"It is not clear what the causes of death were from the results reported. Furthermore, when it comes to the suggestion made in this research that insulin could increase the risk of death, we must consider important factors such as age, the duration of their diabetes and how the participants managed their condition."

While people would be able to manage their condition for a period with diet, exercise and even tablets, many would eventually have to move on to insulin, he noted.

"We would advise people with type 2 diabetes who use insulin not to stop taking their medication. However, if they are worried about blood glucose targets, they should discuss this with their healthcare team."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8481770.stm

Published: 2010/01/27 12:56:44 GMT

Economic growth 'cannot continue'

Continuing global economic growth "is not possible" if nations are to tackle climate change, a report by an environmental think-tank has warned.

The New Economics Foundation (Nef) said "unprecedented and probably impossible" carbon reductions would be needed to hold temperature rises below 2C (3.6F).

Scientists say exceeding this limit could lead to dangerous global warming.

"We urgently need to change our economy to live within its environmental budget," said Nef's policy director.

Andrew Simms added: "There is no global, environmental central bank to bail us out if we become ecologically bankrupt."

None of the existing models or policies could "square the circle" of economic growth with climate safety, Nef added.

'No magic bullets'

In the report, Growth Isn't Possible, the authors looked at the main models for climate change and energy use in the global economy.

" **Magic bullets - such as carbon capture and storage, nuclear or even geo-engineering - are potentially dangerous distractions** "
Dr Victoria Johnson, Report's co-author

They then considered whether economic growth could be maintained while "retaining a good likelihood" of limiting the global average temperature to within 2C of pre-industrial levels.

The report concluded that a growth rate of just 3%, the "carbon intensity" of the global economy would need to fall by 95% by 2050 from 2002 levels. This would require an average annual reduction of 6.5%.

However, the authors said that the world's carbon intensity had "flatlined" between 2000 and 2007.

"For each year the target was missed, the necessary improvements would grow higher still," they observed.

The findings also suggested that there was no proven technological advance that would allow "business as usual" to continue.

"Magic bullets - such as carbon capture and storage, nuclear or even geo-engineering - are potentially dangerous distractions from more human-scale solutions," said co-author Victoria Johnson, Nef's lead researcher for the climate change and energy programme.

She added that there was growing support for community-scale projects, such as decentralised energy systems, but support from governments was needed.

"At the moment, magic bullets... are getting much of the funding and political attention, but are missing the targets," Dr Johnson said.

"Our research shows that to prevent runaway climate change, this needs to change."

The report concluded that an economy that respected environmental thresholds, which include biodiversity and the finite availability of natural resources, would be better placed to deliver human well-being in the long run.

Tom Clougherty, executive director of the Adam Smith Institute, a free-market think-thank, said Nef's report exhibited "a complete lack of understanding of economics and, indeed, human development".

"It is precisely this economic growth which will lift the poor out of poverty and improve the environmental standards that really matter to people - like clean air and water - in the process, as it has done throughout human history," he told BBC News.

"There's only one good thing I can say for the Nef's report, and that's that it is honest. Its authors admit that they want us to be poorer and to lead more restricted lives for the sake of their faddish beliefs."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8478770.stm

Published: 2010/01/25 14:00:32 GMT

Smoke 'harms baby blood pressure'

Smoke exposure during pregnancy damages a baby's blood pressure control, which may explain why such babies' risk of cot death is higher, say experts.

Maternal smoking remains one of the biggest risk factors for cot death.

A team at Sweden's Karolinksa Institute found smoke-exposed babies had abnormal surges in blood pressure, even when sleeping undisturbed in their cots.

These surges put extra demand on the heart, making it pump faster and harder, the journal Hypertension says.

The study suggests damage to the circulation may be a factor in sudden infant death syndrome (SIDS), although it set out to look at the effects of smoking on the newborn rather than cot death per se.

" **We have known for some time that there is a cardiovascular element to sudden infant death** "
Lead researcher Dr Gary Cohen

Dr Gary Cohen and his team studied 36 newborn babies - 17 of whom had mothers who smoked during the pregnancy.

When they examined the babies they found the ones that had been exposed to cigarette smoke showed abnormal heart rate and blood pressure responses.

And these abnormal responses got worse throughout their first year of life.

Dramatically different

At one week of age the smoke-exposed babies showed abnormally large blood pressure rises as they were lifted up from lying down.

By the age of one, the same babies appeared to have adapted to this and now showed abnormally low blood pressure responses to the same posture change.

" **The hypothesis presented here is highly plausible and agrees with work from other research groups** "
Professor George Haycock Foundation for the Study of Infant Deaths adviser

Usually, when a person stands the heart rate increases and the blood vessels tighten, raising blood pressure slightly, to keep up the blood flow to the heart and brain.

Dr Cohen said: "Babies of smokers have evidence of persistent problems in blood pressure regulation that start at birth and get worse over time.

"This study reveals for the first time that early life exposure to tobacco can lead to long-lasting reprogramming of the infant blood pressure control mechanism."

He said this might explain why babies of women who smoke are at increased risk of cot death.

"We have known for some time that there is a cardiovascular element to sudden infant death.

"It's not just breathing, but blood pressure control and heart rate control.

"This is another piece of the jigsaw."

He plans to continue to study the babies as they grow up to see if the damage is lasting and whether it leads to problems, such as high blood pressure, in later life.

Professor George Haycock, scientific adviser for the Foundation for the Study of Infant Deaths (FSID), said: "The hypothesis presented here is highly plausible and agrees with work from other research groups.

"FSID's top piece of advice remains, cut smoking in pregnancy - fathers too, and don't let anyone smoke in the same room as your baby."

Experts say a third of cot deaths could be avoided if mothers-to-be did not smoke.

Janet Fyle, Professional Policy Advisor at the Royal College of Midwives, said: "These findings support what we know; that smoking during pregnancy can harm the developing foetus.

"The RCM would urge pregnant women who smoke to seek advice and support from their midwife about stopping smoking, for the benefit of their own long-term health.

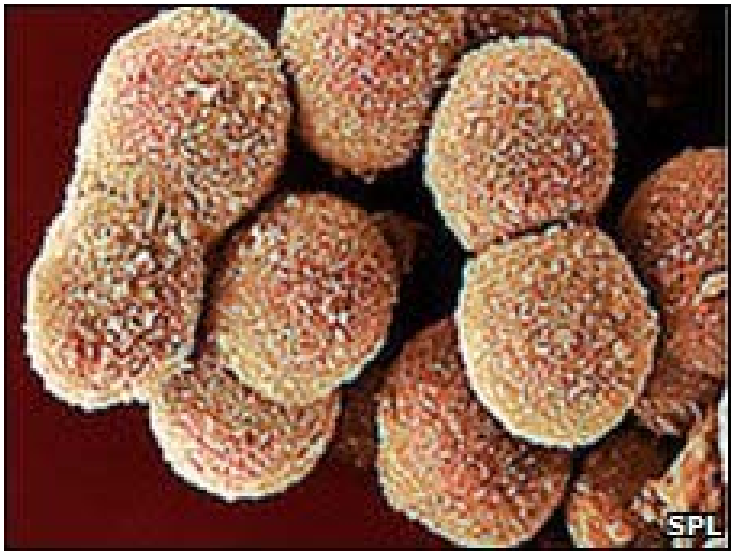
"This would also benefit the health of their child."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8478690.stm

Published: 2010/01/26 00:00:26 GMT

Lab advance aids hepatitis fight

Scientists looking for a treatment for a dangerous liver virus have found new ways to study it in the laboratory.



For the first time, a US team managed to watch the progress of a rare strain of hepatitis C among liver cells kept alive in a lab dish.

In the journal, the Proceedings of the National Academy of Sciences, they say it could lead to easier drug testing.

However, a UK expert said the method needed to work with more common hepatitis strains.

Hundreds of millions of people worldwide are thought to be infected with hepatitis C.

For most, it is an asymptomatic infection, but a small percentage, often many years later, develop liver cancer or failure.

" **This is a tool which can be used to study hepatitis C in more detail, and with greater accuracy, than existing culture systems** "
Professor William Rosenberg, UCL

One of the obstacles to the disease's study is that while many types of human cells can be grown successfully in the laboratory, liver cells have always been problematic.

After a very short while in a lab dish, the cells normally change or "differentiate" into forms which no longer behave in the same way.

The researchers from Massachusetts Institute of Technology (MIT) were able to extend their useful life by weeks by using a lab dish with a tiny pattern on its base.

This directed the cells to exactly the right place, and allowed other types of cells, called fibroblasts, to align with the liver cells.

This was important because fibroblasts are known to support the growth of liver cells.

Drug testing

Professor Sangeeta Bhatia, who led the research alongside scientists from Rockefeller University in New York, said: "If you just put cells on a surface in an unorganised way, they lose their function very quickly - if you specify which cells sit next to each other, you can extend the lifetime of the cells and help them maintain their function."

In addition, the team managed to infect their cells with a strain of hepatitis C, opening the opportunity for potential drugs to be tested over a two or three-week period.

William Rosenberg, a professor of hepatology at University College London, said that the research represented a "significant advance".

He added: "This is a tool which can be used to study hepatitis C in more detail, and with greater accuracy, than existing culture systems."

However, the cells were infected with a strain of hepatitis C responsible for a very small number of very severe cases of the illness, and Professor Roger Williams, also from University College London.

He said that the success would have to be repeated using more common strains.

"What they have managed to do is interesting, but this is a very unusual strain, and patients with this form of 'fulminant hepatitis' are very different to those with other strains of the virus."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8479301.stm

Published: 2010/01/26 00:00:54 GMT

The Night Belongs to Us

By TOM CARSON

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JUST KIDS

By Patti Smith

Illustrated. 284 pp. Ecco/HarperCollins Publishers. $27

Apart from a certain shared apprehension of immortality — complacent in one case, but endearingly gingerly in the other — the skinny 28-year-old on the cover of Patti Smith's seismic 1975 album, "Horses," doesn't look much at all like Picasso's portrait of Gertrude Stein. But because the shutterbug was Robert Mapplethorpe, who was soon to become fairly legendary himself, that exquisite photograph of Smith on the brink of fame is as close as New York's 1970s avant-garde ever came to a comparable twofer. The mythmaking bonus is that the latter-day duo were much more genuinely kindred spirits.

Born weeks apart in 1946, Smith and Mapplethorpe played Mutt and Jeff from their first meeting in 1967 through his death from AIDS more than 20 years later. They were lovers as well until he came out of the closet with more anguish than anyone familiar with his bold later career as gay sexuality's answer to Mathew Brady (and Jesse Helms's N.E.A. nemesis) is likely to find credible. Yet his Catholic upbringing had been conservative enough that he and Smith had to fake being married for his parents' sake during their liaison.

Though Smith moved on to other partners, including the playwright Sam Shepard and the Blue Oyster Cult keyboardist-guitarist Allen Lanier, her attachment to Mapplethorpe didn't wane. After years of mimicking her betters at poetry, she found her calling — "Three chords merged with the power of the word," to quote the memorable slogan she came up with — at around the same time he quit mimicking his betters at bricolage to turn photographer full time. "Patti, you got famous before me," he half-moped and half-teased when "Because the Night," her only genuine hit single, went Top 20 in 1978. Even so, his "before" turned out to be prescient.

All this is the subject of “Just Kids,” Smith’s terrifically evocative and splendidly titled new memoir. At one level, the book’s interest is a given; to devotees of downtown Manhattan’s last momentous period of 20th-century artistic ferment, Patti Smith on Robert Mapplethorpe is like Molly Pitcher on Paul Revere. The surprise is that it’s never cryptic or scattershot. In her rocker incarnation, Smith’s genius for ecstatic racket has generally defined coherence as the rhythm section’s job. The revelation that she might have made an ace journalist had she felt so inclined isn’t much different from the way the lucidity of “The Autobiography of Alice B. Toklas” upended everything Stein was renowned for.

Nonetheless, she can’t help being the Patti Smith her fans know and love. If a given event occurs within hailing distance of Arthur Rimbaud’s or some other demigod’s birthday, she won’t fail to alert us. Just as predictably, her reverential visit to Rimbaud’s grave on a 1973 trip to France is only a warm-up for the main event: visiting Jim Morrison’s. For that matter, anyone willing to buy her claim that she learned of Mapplethorpe’s death as “Tosca” played on early-morning TV — and not just any old bit of “Tosca,” but the heroine declaiming “her passion for the painter Cavaradossi” — lives in a happier, sweeter world than mine.

The reason nobody will care about Smith’s occasional fatuities — except to decide they add period flavor, which by my lights they do — is that “Just Kids” is the most spellbinding and diverting portrait of funky-but-chic New York in the late ’60s and early ’70s that any alumnus has committed to print. The tone is at once flinty and hilarious, which figures: she’s always been both tough and funny, two real saving graces in an artist this prone to excess. What’s sure to make her account a cornucopia for cultural historians, however, is that the atmosphere, personalities and mores of the time are so astutely observed.

No nostalgist about her formative years, Smith makes us feel the pinched prospects that led her to ditch New Jersey for a vagabond life in Manhattan. Her mother’s parting gift was a waitress’s uniform: “You’ll never make it as a waitress, but I’ll stake you anyway.” That prediction came true, but Smith did better — dressed as “Anna Karina in ‘Bande à Part,’ ” a uniform of another sort — clerking at Scribner’s bookstore. That job left Mapplethorpe free to doodle while she earned their keep, which she didn’t mind. “My temperament was sturdier,” she explains, something her descriptions of his moues confirm. Even when they were poor and unknown, he spent more time deciding which outfit to wear than some of us do on our taxes.

Soon they were ensconced at “a doll’s house in the Twilight Zone”: the Chelsea Hotel, home to a now fabled gallery of eccentrics and luminaries that included Harry Smith, the compiler of “The Anthology of American Folk Music” and the subject of some of her most affectionately exasperated reminiscences. For respite, there was Coney Island, where a coffee shack gives Smith one of her best time-capsule moments: “Pictures of Jesus, President Kennedy and the astronauts were taped to the wall behind the register.” That “and the astronauts” is so perfect you wouldn’t be sure whether to give her more credit for remembering it or inventing it.

Valhalla for them both was the back room at Max’s Kansas City, where Andy Warhol, Mapplethorpe’s idol, once held court. By the time they reached the sanctum, though, Warhol was in seclusion after his shooting by Valerie Solanas in 1968, leaving would-be courtiers and Factory hopefuls “auditioning for a phantom.” Smith also wasn’t as smitten as Mapplethorpe with Warhol’s sensibility: “I hated the soup and felt little for the can,” she says flatly, leaving us not only chortling at her terseness but marveling at the distinction. Yet Pop Art’s Wizard of Oz looms over “Just Kids” even in absentia, culminating in a lovely image of a Manhattan snowfall — as “white and fleeting as Warhol’s hair” — on the night of his death.

Inevitably, celebrity cameos abound. They range from Smith’s brief encounter with Salvador Dalí — “Just another day at the Chelsea,” she sighs — to her vivid sketch of the young Sam Shepard, with whom she collaborated on the play “Cowboy Mouth.” Among the most charming vignettes is her attempted pickup in an automat (“a real Tex Avery eatery”) by Allen Ginsberg, who buys the impoverished Smith a sandwich under the impression she’s an unusually striking boy. The androgynous and bony look she was to make so charismatic with Mapplethorpe’s help down the road apparently confused others as well: “You don’t shoot up and you’re not a lesbian,” one wit complains. “What do you actually do?”

Even when Smith tempts a skeptical reader to say “Uh-huh” to anecdotes like the one implying she was the first to call Janis Joplin “Pearl,” her forthright presentation of herself as the minor hanger-on she then was restores our trust. “I was there for these moments, but so young and preoccupied with my own thoughts that I hardly recognized them as moments,” she writes. Most often, you’re simply struck by her intelligence, whether she’s figuring out why an acting career doesn’t interest her — actors are soldiers, and she’s a born general — or sizing up the ultra-New York interplay between the city’s fringe art scenes and the high-society sponsorship to which Mapplethorpe was drawn. “Like Michelangelo,” she sweetly but not unshrewdly comments, “Robert just needed his own version of a pope” — which he found, more or less, in the form of the art collector Samuel Wagstaff, who became his lover and patron.

Peculiarly or not, the one limitation of “Just Kids” is that Mapplethorpe himself, despite Smith’s valiant efforts, doesn’t come off as appealingly as she hopes he will. When he isn’t candidly on the make — “Hustler-hustler-hustler. I guess that’s what I’m about,” he tells her — his pretension and self-romanticizing can be tiresome. Then again, the same description could apply to the young Smith, and we wouldn’t have the older one if she’d been more abashed in her yearnings. This enchanting book is a reminder that not all youthful vainglory is silly; sometimes it’s preparation. Few artists ever proved it like these two.

Tom Carson is the movie critic for GQ and the author of “Gilligan’s Wake,” a novel.

http://www.nytimes.com/2010/01/31/books/review/Carson-t.html?nl=books&emc=booksupdateema1

The Way We Learn

By MICHAEL BÉRUBÉ
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THE MARKETPLACE OF IDEAS

By Louis Menand

174 pp. W. W. Norton & Company. $24.95

In the four rigorously reasonable essays in "The Marketplace of Ideas," Louis Menand takes up four questions about American higher education: "Why is it so hard to institute a general education curriculum? Why did the humanities disciplines undergo a crisis of legitimation? Why has 'interdisciplinarity' become a magic word? And why do professors all tend to have the same politics?"

Menand, a professor of English at Harvard and a staff writer for The New Yorker, offers answers notable in part for what they don't contain: namely, the complaint that it's all been downhill since 1970 because of feminism, multiculturalism, postmodernism, deconstruction and queer theory. Yes, humanities enrollments have declined since 1970, as have enrollments in the social and natural sciences. But as Menand points out, that's partly because departments of business administration and computer science have drawn students away from all fields in the liberal arts and sciences and partly because the decades following World War II were anomalous in the history of American higher education — a "Golden Age" of tremendous expansion, when the number of undergraduates increased fivefold and the number of graduate students ninefold. To assess the American university by starting from 1970 is to take the high--water mark as if it were the mean.

Menand's discussion of general education starts on a wry note: "The process of designing a new general education curriculum and selling it to the faculty has been compared to a play by Samuel Beckett, but the comparison is inapt. Beckett's plays are short." One usually hears that general education courses are in a parlous state because hyperspecialized professors disdain teaching broad introductory courses. But the real story is more complicated.

Menand shows that general education curriculums have been criticized since their inception less for being too broad in focus than for being too narrow in intent, more invested in making education socially "relevant" than in encouraging the pursuit of knowledge for its own sake. The earliest exponents of general education — John Erskine, Jacques Barzun, Lionel Trilling, Mortimer Adler — believed in teaching students the wisdom of the ages to prepare them to confront the pressing issues of the day, and

their critics considered the enterprise at once dilettantish and crudely instrumentalist. In other words, it's not just that faculty members don't agree on the content of a gen-ed curriculum; they don't agree that universities should offer a "general" education in the first place.

Menand argues plausibly enough that the crisis of confidence in the humanities, together with demographic changes in the professoriate and the student body, has "helped to make the rest of the academic world alive to issues surrounding objectivity and interpretation, and to the significance of racial and gender difference," and that interdisciplinarity actually relies on and reinforces disciplinary knowledge.

Things get more interesting in the final chapter, where Menand explains how academe's training and hiring system works and suggests, unconvincingly, that the preponderance of liberals in academe is partly a function of "increased time to degree." It now takes a decade on average to get a Ph.D. in English, and surely that fact discourages risk-taking. But it does not explain, say, why Democrats outnumber Republicans 10 to 1 in departments of physics. Along the way, Menand notes that most graduate students don't earn Ph.D.'s, and that most Ph.D.'s don't get tenure-track jobs: "There is a sense in which the system is now designed to produce ABDs" — graduate students who have completed all but their dissertations — who can teach introductory courses for a pittance.

Students (and parents) who may not notice the creation of a new Interdisciplinary Institute on campus may well wonder whether a system in which instructors' annual reappointments are dependent on student evaluations is likely to produce professors willing to challenge their students and uphold high academic standards. But that is a question for another book, perhaps, a book less sanguine and more pugnacious than "The Marketplace of Ideas."

Michael Bérubé is a professor of English at Pennsylvania State University and the author, most recently, of "The Left at War."

http://www.nytimes.com/2010/01/31/books/review/Berube-t.html?nl=books&emc=booksupdateema3

Smiley's People

By BEN MACINTYRE

DEFEND THE REALM

The Authorized History of MI5

By Christopher Andrew

Illustrated. 1,032 pp. Alfred A. Knopf. $40

Twenty years ago, the subject of this vast and fascinating book did not, officially speaking, exist at all. The Security Service, better known as MI5, is the domestic arm of British intelligence. While its sister organization, MI6, supplies the British government with foreign intelligence, MI5 is responsible for counterintelligence, countersubversion, counterterrorism and security within the United Kingdom.

For most of its unofficial life, MI5 was shrouded in the sort of impenetrable secrecy we British relish. Its officers swore never to reveal what they knew, on pain of prosecution. Since MI5's activities were mysterious and hidden, they were the subject of endless speculation, rumor and myth. That an authorized history of this shadowy organization should be published represents a remarkable change of attitude on the part of British officialdom.

In order to write this compendious but highly readable book, Christopher Andrew, a professor of modern and contemporary history at Cambridge University, and his team of researchers plowed through some 400,000 MI5 files. Marking the 100th anniversary of the service, "Defend the Realm" shines a penetrating light into some of the darkest corners of a secret world. It is not only a work of meticulous scholarship but also a series of riveting and true spy stories.

At 1,032 pages, it is slightly too short. Andrew was given unique access to the material, but not full disclosure, for some aspects of the work of MI5 are still too sensitive to be revealed. Secret services do not work unless they remain, at least in part, secret, and since Andrew cannot identify his official sources, anything from the files is simply noted as "Security Service Archives."

"Striking the balance in the text between openness and the protection of national security has been a complex and demanding exercise," Jonathan Evans, the current director general of MI5, writes in a foreword. Inevitably, this leaves gaps.

MI5 was a key player in Britain's bloody war against the Irish Republican Army in Northern Ireland, but with that complex, often covert, conflict still fresh in memory, the account given here is tantalizingly spare on operational details. In the modern age, MI5 has transformed itself from a counterespionage organization into one dedicated to battling terrorism, and the facts of this campaign, for obvious security reasons, grow even sparser.

The richest sections of the book cover the early years, when Britain forged a security service out of a strange mixture of amateurism, adventurism and natural guile. The service started in 1909 with two men in a single room in central London; a year later, it split in two, foreign and domestic.

By 1917, as wartime spy-fever gripped Britain, roughly a quarter of a million people had been filed into MI5's card index as suspicious persons. Potential German spies, referred to as the "Boche" in both official and unofficial correspondence, were divided into subcategories: AA ("Absolutely Anglicised"), BA ("Boche-Anglo") and the most dangerous species of all, BB ("Bad Boche").

That taxonomy perfectly reflects the flavor of MI5 — chummy, clubby, quintessentially English and suffused with a sense of its own comedy. Most MI5 officers were recruited through the old-boy network, men (principally men, although two of the last four MI5 chiefs have been women) who had been to the right schools, had the right accents and belonged to the right clubs. Until recently, recruitment to the service was largely by personal recommendation.

Inevitably, this sense of belonging to a secret brotherhood instilled a feeling of camaraderie, and a certain snobbery. It also ensured that when the Soviet Union successfully recruited its own spies from exactly the same talent pool, they were all but invisible inside the secret services.

In the early years, the task of spy catching and rooting out subversives was seen as a game, an intellectual challenge, deadly but honorable. The first German spy to be captured was Carl Lody, "a really fine man" in the estimation of Vernon Kell, head of MI5. Lody was tried and sentenced to death. "I suppose you will not shake hands with a spy?" he remarked to the officer commanding the firing squad. The officer responded, "No, but I will shake hands with a brave man."

Andrew has a keen eye for the absurd. Perhaps inevitably, in an organization relying on imagination and subterfuge, the ranks of MI5 included more than a fair share of eccentrics and fantasists. Among the most notable of these was one Maxwell Knight, whose agents successfully penetrated both Fascist and Communist networks in London. He was also a passionate naturalist who went on to become "Uncle Max," a much loved children's broadcaster on the BBC.

Knight could often be seen taking his pet bear, Bessie, for walks around London. He published the definitive book on how to keep a domesticated gorilla. He also wrote a delightful internal MI5 memo, "On the Subject of Sex, in connection with using women as agents." This declares: "It is difficult to imagine anything more terrifying than for an officer to become landed with a woman agent who suffers from an overdose of Sex." (Knight consistently capitalizes "Sex," of which he was plainly terrified.)

MI5's finest hour came during World War II. In large part thanks to the decryption of German wireless codes, the British were able to intercept almost all the German spies sent to Britain: many of these were turned, and then used to feed false and damaging information back to their German handlers.

Perhaps the greatest of all was Juan Pujol Garcia, "Agent Garbo," a Spaniard who had been recruited by the Germans but had always intended to defect to the British. From a safe house in North London, Garbo and his MI5 handler forged a network of bogus spies that eventually extended to 28 subagents, all entirely fictitious. The Garbo network would play a crucial role in the run-up to D-Day, helping to convince the Germans that Calais and not Normandy would be the target.

Having outwitted the Germans during the war, MI5 was itself comprehensively infiltrated by the Soviets after it. Andrew offers a deep-mine account of the way the K.G.B. successfully penetrated the British secret services, poisoning relations between Britain and America and provoking a long-term crisis of confidence in British intelligence.

Many long-running myths can now be consigned to the dustbin of history: Prime Minister Harold Wilson was not the target of an MI5 plot, despite his paranoid convictions; Roger Hollis, MI5's chief from 1956 to 1965, was not a Soviet spy. Equally, Andrew is prepared to give discredit where it is due: he damns as "inexcusable" MI5's postwar policy preventing the recruitment of Jews on the grounds that they might feel dual loyalty to Britain and Israel. The service was slow to appreciate the threat of Islamist terrorism, and it was confused in its initial response to the Troubles in Northern Ireland.

For all the narrative excitement in parts of its story, MI5's role over the course of a century has been principally preventative, and thus doubly invisible. "The success of a security service is better judged by things that do not happen," Andrew writes, "than by things that do." The heroes of this book are the decent, dedicated and often odd people who ensured that what might have gone wrong did not.

"Defend the Realm" fills in a chapter of history that has been unjustly neglected, in part because that history has been unjustifiably secretive. Andrew may not silence the conspiracy theorists, but he performs the inestimably valuable job of making their theories a great deal harder to sustain. If this important book required a degree of compromise in order to be published, that is hardly surprising. For the work of a security service in every democracy involves a delicate balance between openness and secrecy, a bargain between the public's right to know and its need for protection.

Ben Macintyre is the author of "Agent Zigzag: A True Story of Nazi Espionage, Love, and Betrayal."

http://www.nytimes.com/2010/01/31/books/review/MacIntyre-t.html?nl=books&emc=booksupdateema3

Postcolonial Everyman
By KAIAMA L. GLOVER
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THE EDUCATION OF A BRITISH-PROTECTED CHILD

Essays

By Chinua Achebe

172 pp. Alfred A. Knopf. $24.95

Chinua Achebe has a real knack for titles. With its simple assertion that “Things Fall Apart,” Achebe’s now classic 1958 novel took Yeats’s horrified imaginings of Christian Europe’s apocalyptic end and made them resonate within the space of precolonial black Africa. Now, some 50 years later, Achebe has given this volume of autobiographical essays its own Pandora’s box of a title. Deceptively disarming, “The Education of a British-Protected Child” belies the complexity of what he calls the “strongly multiethnic, multilingual, multireligious, somewhat chaotic” situation he was born into as a colonial subject whose first passport described him as a “British Protected Person.” As the 16 essays in this collection reveal, the “education” Achebe and his fellow Nigerians received from their exploitative and racist self-proclaimed protectors “would not be a model of perfection.” Indeed.

That said, Achebe isn’t one to hold grudges. As he makes clear in the title essay, he has no scores to settle and isn’t out to lay the blame for history’s wounds at the feet of any one nation or people. While he very clearly — though without any particular drama — denounces colonialism, Achebe is equally clear in his intention not to be reactionary in his reactions, to concern himself with individuals rather than ideologies. This personal and political position, which he calls the “middle ground,” is defined as “the home of doubt and indecision, of suspension of disbelief, of make-believe, of playfulness, of the unpredictable, of irony.” It is the place from which he strives to act and to write with empathy and nuance rather than with fanaticism — to resist the entrenched oppositions of “a world in which easy sloganeering so quickly puts the critical faculty to flight.” Of course, for a postcolonial intellectual, even one heralded as the father of modern African literature, the middle can be a rather tricky space to navigate.

Achebe takes on this challenge in his characteristically gentle narrative style, that way he has of seeming to be in casual conversation, discussing matters big and small with an interested and sympathetic companion. Simply and directly, he addresses many of the most fraught realities of colonial and postcolonial existence for the 20th- and 21st-century West African. The tone of his book is patient and measured, his voice personable and welcoming. Playfully deflating his own narrative authority by allowing admittedly shaky memories to stand as fact, Achebe juxtaposes ostensibly mild personal anecdotes with serious political reflections. He moves adroitly from the particular to the general, humbly revealing the greatness in each one of his small stories.

In one instance, he evokes the biblical tale of the infant Moses and the pharaoh’s daughter to describe his own cultural adoption by the guardians of the “alien palace” that was the British Empire, but then quickly retreats, calling this allusion the “sheer effrontery” of “the glowworm comparing itself to the full moon.” Later, in “Traveling White,” he tells of an excursion to Victoria Falls on a segregated bus in the Northern Rhodesia of the early 1960s. Not noticing that there were separate entrances for blacks and whites, he’d sat down at the front among the Europeans — and remained with them, despite their obvious hostility, even after realizing his mistake. Playing down his part in this Rosa Parks moment, Achebe merely relates

the bare facts of the incident, emphasizing instead his despair when the black passengers rushed to congratulate him after they all disembarked at the falls. “I was not elated,” he recalls. “A monumental sadness descended on me. I could be a hero because I was in transit, and these unfortunate people, more brave by far than I, had formed a guard of honor for me!”

The collection is filled with scenes like this, in which Achebe insists on an Everyman status. While from many other writers, this might come off as false modesty, Achebe’s middle-grounded stance turns it into something else — an opportunity to make individual acts speak to larger human truths. This emphasis on personal accountability and responsibility determines, for example, his response to the racism he finds in children’s literature: “I learned that if I wanted a safe book for my child I should at least read it through and at best write it myself.” (Which is, of course, what he went on to do.)

These principles also motivate Achebe’s efforts to set the record straight on matters both political and personal. In “Politics and Politicians of Language in African Literature,” he takes to task those of his countrymen who, in positions of power, either deliberately or unconsciously erect obstacles to Nigeria’s healing. Gracefully accepting the rather dubious obligation to defend and explain his choice to write of Africa in English, he denounces African intellectuals who insist on “playing politics” with issues of language. In “The University and the Leadership Factor in Nigerian Politics,” he offers a brilliant analysis of the word “elite,” arguing that while the concept has certainly been corrupted in postcolonial Africa by self-interested cultural and political leaders, elite systems are not in and of themselves reprehensible.

As this essay demonstrates, Achebe can be harshly critical of his fellow Nigerians; he assumes personal responsibility for “setting down beside the glories” of the Nigerian past “every inconvenient fact.” At the same time, though, he doesn’t shy away from implicating European actors in Africa’s contemporary misfortunes. In the powerful essay “Africa’s Tarnished Name,” for example, he returns to his highly polemical 1975 assessment of Joseph Conrad’s racism in “Heart of Darkness.” Adamantly refusing the notion that the British writer’s portrayal of African barbarity might be excused by his socio-historical context, Achebe makes Conrad, the man, answerable for the offensive stereotypes he promulgates as a writer. Comparing Conrad’s novel to other European portraits of Africa and its peoples, Achebe concludes that “without doubt, the times in which we live influence our behavior, but the best or merely the better among us . . . are never held hostage by their times.”

Paradoxically, this essay illuminates both the strength and the weakness of the entire collection. While the inclusion of these comments on Conrad underscores the coherence and consistency of Achebe’s thought over the last several decades, it also reminds us that much of the work collected here was originally aimed at smaller, more specific audiences. Achebe has lived in the United States for the past 20 years, and almost half of these essays are transcriptions of lectures he has given at universities and conferences in America, Europe and Africa from the late 1980s onward. In addition, then, to a certain dated quality, the book has something of a recycled feel. This is not helped by the fact that several of Achebe’s more affecting anecdotes are repeated from one essay to another.

“The Education of a British-Protected Child” does, however, succeed in presenting an eclectic and thorough view of Achebe in his longtime roles as writer, father and teacher. With the same generosity and humility that have always distinguished his work, Achebe once again shares his thoughtful perspective on a world about which, despite his privileged placement in the “luxurious” space of the middle, he remains more than a little wary.

Kaiama L. Glover teaches French and Francophone literature at Barnard College.

http://www.nytimes.com/2010/01/31/books/review/Glover-t.html?nl=books&emc=booksupdateema3