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Gulf oil leak causing upheaval in marine ecology

- 18:01 08 June 2010 by **Phil McKenna**

Not looking good (Image: Samantha Joye)

As oil continues to leak out of the collapsed Deepwater Horizon well head, researchers are beginning to collect data on how it is changing life in the Gulf of Mexico.

Earlier today, Samantha Joye of the University of Georgia in Athens spoke of what they are finding. She said that methane concentrations in a giant underwater plume emanating from the well head are as much as 10,000 times higher than background levels. The consequences of this for life in the gulf are unknown.

Joye was one of the first scientists to discover deep-water plumes emanating from the ongoing spill and recently returned from a two-week research expedition on board the research vessel F. G. Walton Smith. "It's an infusion of oil and gas that has never been seen before, certainly not in human history," she said earlier today, as she described her preliminary findings.

The plume is more than 24 kilometres long, 8 kilometres wide and 90 metres thick, and stretches from 700 to 1300 metres below the surface south-south-west of the collapsed Deepwater Horizon well head.

Busy bacteria

Joye's team measured oxygen levels throughout the water column near the plume and found them to be lower than normal, all the way from the sea floor to the surface. She says this is a result of increased activity from bacteria that are digesting the oil.

The Gulf of Mexico is no stranger to decreased oxygen levels: every year, fertilisers pouring off the US coast boost algal growth, which sucks oxygen out of the water and stifles other life forms, creating one of the world's largest known dead zones.

Joye said she did not think the extra microbial activity would be significant enough to create additional dead zones in the gulf, because microbes need nutrients that do not exist in high enough concentrations at depth. But she cautions that the environmental implications are unknown.

"The system as a whole has been substantially perturbed by this event," says Joye. "When you interfere with the natural system, it's likely that problems will cascade up the food web."

No end in sight

One big unknown, she says, is how chemical dispersants that are being injected into the leaking oil to break it up will affect phytoplankton and other organisms at the bottom of the food chain. In fact, it's possible – but difficult to prove at this point – that the dispersants and oil are already killing phytoplankton, which could account for low oxygen levels recorded in near-surface waters.

And the oil and dispersants are likely to be around for a while yet: a seasonal change in surface current flows – from north-east to south-west – that takes effect in August means the mix will continue sloshing around the gulf rather than be pushed out into the open ocean.

http://www.newscientist.com/article/dn19021-gulf-oil-leak-causing-upheaval-in-marine-ecology.html

Grandmother's footsteps

'A foolish story, such as is told by garrulous old women' is how the Oxford dictionary defines an old wives' tale. Despite being treated with contempt over the centuries, these narratives served not only to amaze and appal children but to teach them coded lessons about the realities of life, from toilet training to pregnancy, argues Germaine Greer

- The Guardian, Saturday 15 May 2010

Detail from Snow White Playing with her Father's Trophies (1995) by Paula Rego. Photograph: Courtesy of Marlborough Fine Art, London.

In the 1980s, when I had my little house in the Montanare di Cortona, friends with small children often came to stay. If the nippers hadn't had a rest, the glimmering evenings and long suppers on the terrace were apt to collapse in screaming cacophony. We had no TV and the radio was in Italian, so I had no way of keeping the children still and quiet during the siesta other than to tell them a story. Therefore, after lunch, when the day was at its hottest, I would pile them on to my big bed and, propping myself up with pillows in the middle, I would tell them the story of the most beautiful frog in the world, as, one by one, they fell asleep.

The littlest ones fell asleep first and so missed a good deal of the story. Everybody missed some, because it was hard to tell which of the heap of children was still awake, and I had to keep on with my tale until I was sure everyone was fast asleep. That meant that each time, before I could get going on the next episode, we had to have a synopsis. I would pretend not to remember where we had got to, and bumble and mumble, until the children, desperate to prompt my memory, had retold the story themselves, and the little ones had asked their questions. In this way I learned what they had understood and what misunderstood. What was more, the children's concerns worked their way into the story. Did the beautiful frog enjoy eating live creatures? Did they suffer? Why did the bee have to die after it had stung the stork? Why did the bee beg the frog to eat her before the ants arrived? Why does the spider have such revolting table-manners? Can a frog cry?

What I was doing was as old as the human race, and women have always done it. Even the most refined aristocrat of antiquity would have been told nursery stories by his first attendants, who were illiterate slaves and peasants. When it came to building a fanciful narrative of his own, he would recycle the same elements, changing them fundamentally in the process. The idiom of the original tale had to be standardised, and the events reinterpreted, to make the kind of sense that educated people would recognise, even to the point of ironic subversion of the fantastical elements in the story. Illiterate women went on providing the staple of the repertoire at the same time as educated people were turning their own variants of the tales into literature. As long as neither the women nor the children they told their tales to could read, the two kinds of tale-telling could flourish side by side.

The first collector of popular tales for print is known to us now as Gianfrancesco Straparola, who was connected with the Venetian publisher Comin de Trino. As "Stra-parola" means something like "crazy talk", we may be sure that this was not the real name of the author of the *Piacevoli Notti* (1550–1556). Following the convention established by Boccaccio's *Decamerone* (1353), the Straparola tales are set in a framing narrative, a 13-day party at the palace of the Bishop of Lodi on the island of Murano during *carnevale*; the narrators are 13 ladies. Two of the tales are recounted in dialect, one in Bergamasco and another in Paduan. The Straparola stories are pretty good examples of the kinds of stories old peasant women tell. The fashionable lady who tells the five stories on the second night pretends that the second of her tales is set in Bohemia, but it soon becomes clear that we are dealing with a story about the people living on the shores of the lagoon.

A poor spinner has two daughters, Cassandra and Adamantina. When she dies she has nothing to leave her daughters but a box of tow. Cassandra spins a pound of it into thread and sends Adamantina to market to sell the thread and buy bread with the proceeds. Adamantina meets an old woman who has in her lap a doll, of a kind manufactured in Marghera and Mestre and known as a *poavala*. Adamantina falls in love with the poavala and persuades its owner to take the thread in exchange for it. When she arrives home with the doll and no bread, Cassandra is so disappointed that she flies into a rage and beats Adamantina so soundly that she can barely move. Adamantina does not retaliate. At bedtime she brings the doll close to the fire, takes off its clothes, lays it on a woollen cloth, and, putting a little olive oil in the palm of her hand, gently massages its belly and lower back. Then she wraps it in the softest cloths she can find and lays it in bed beside her. She has not finished her first sleep when the doll begins to cry, "Mamma, mamma, caca!" (The missing "c" in "cacca" betrays Venetian dialect.) Adamantina gently asks the doll to wait until she has spread her apron under its bottom. The doll bears down and fills the apron with gold coins. This she does night after night, and the orphan girls have all their modest needs supplied.

A jealous neighbour steals the doll and tries the same trick, but this time the doll produces a stinking mess of faeces. Infuriated, the neighbour throws the doll out of the window and on to a heap of rubbish in the street. Peasants collecting the refuse to spread on the fields as manure throw the doll on to their cart and carry it off to the mainland. The king, riding by on his way to the hunt, feels a call of nature, gets down from his horse and voids his bowels. His servant can find nothing better to offer his majesty to wipe his behind on than the rag doll. No sooner has the king thrust the doll between his buttocks than it bites him hard and will not let go. Try as they might, the courtiers cannot detach the doll, which not only sinks its teeth deeper and deeper into the royal rear, but uses its hands to twist and wring the king's *sonagli* (his hanging bells) until he sees stars. To cut the old wives' story short, Adamantina hears of the king's plight, comes to fetch her beloved doll, ends the king's agony and marries the king, and they live happily ever after.

This is not one of the Straparola stories that his aristocratic successors chose to imitate. It stems directly from rural living conditions, in which the management of human waste is essential, complex and demanding. Where there are no toilets, no nappies and no piped water, babies' attendants simply hold them clear of tables or chairs or other people as they excrete. When they can toddle, little girls are dressed in skirts with no knickers and little boys in split trousers, as they gradually learn how to tell what they need to do and where to

squat to do it, but there are many accidents along the way. A story like this keys into the manifold anxieties connected with toilet training and with the management of a small baby, which often fell to an older child, when its mother was needed elsewhere. Rubbing a baby's stomach with warm olive oil is a good way to ease gripes and stimulate a bowel movement. As the context of Straparola's retelling is the entertainment of literate people, his version of the tale is self-consciously rustic, while straightforward ribaldry has become suggestion. The framing narrative follows it with a riddle involving *sonagli*, to which there is an obvious, obscene answer. When the lady who offers it is scolded, she turns the tables by providing an equally valid non-obscene answer. Such ironic *jeux d'esprit* are utterly foreign to the old wives' tale.

When the tales collected by Giambattista Basile during his travels in Naples, Crete and Venice were published by his sister, with the title *Lo cunto de li cunti overo lo trattenimiento de peccerille* ("the story of stories or the entertainment of little people") in 1634, two years after his death, they were found in Neapolitan dialect. The collection was later known as the *Pentamerone*. Basile provided his successors with the basic plots of the stories of Cinderella, Rapunzel, Sleeping Beauty and Hansel and Gretel. As he knew that his readers would all be people of his own class, he elaborated his style with purple passages of description, but in a story such as "*La Mortella* (The Myrtle)", we can still discern traits typical of its humble beginning as an old wives' tale.

The story begins with a woman wishing for a child, any kind of child, even if it is only a sprig of myrtle. She does give birth – to a sprig of myrtle. She and her husband put the sprig in a pot, set it in the window and love it more than a daughter. The prince riding by sees it and coaxes them to sell it to him. He tends to the plant's every need with his own hands. One night, a woman comes unseen to his bed; in the morning she is gone. She comes again the next and every night thereafter. After seven nights the prince ties her hair to his arm so that she cannot escape, and she has no choice but to confess that by day she is his myrtle bush. She and the prince pledge their love. One day, the prince tells her that he has to go on a boar hunt, and asks her to turn herself back into a myrtle bush for the duration. She tells him to hang a bell on her and ring it when he wants her back in human form. While he is gone seven wicked sisters break into his apartment, see the myrtle and ring the bell. When the bush turns into a beautiful young woman, they tear her to pieces, all except the youngest of them, who does not join in. The prince's chamberlain puts the pieces of her body back into the pot; they sprout and, when the prince returns, his beloved reappears and he gets permission from his father to marry her. At the wedding, he asks the congregation what punishment they think appropriate for anyone who would tear his wife to pieces. The seven sisters suggest live burial, and so are walled up in an underground dungeon, all except the youngest, whom the prince marries to his loyal chamberlain.

Basile elaborates his story in a very adult way: here is his description of the prince's discovery of a woman in his bed:

Instead of the prickles of a hedgehog in his hand, he found a sweet thing finer and softer than barbary wool, more supple and tender than a marten's tail, more delicate than thistledown . . .

The ur-tale as told by women is innocent of such embellishments. It offers no explanations of events and makes no attempt to moralise. The object is to amaze and appal, to stretch the limits of the child's imagination. The story often turns on preoccupations of women – impregnation, pregnancy, childbirth, childloss, rape and domestic violence – in various coded forms. In "*La Mortella*", we begin with a woman longing for a child, which turns into a variant of monstrous birth, and then into an inversion of the Cupid and Psyche theme, in which it is the female lover who comes unseen by night. The miscreants who enact the sparagmos of the heroine by tearing her into a hundred pieces are also female. The sheer preposterousness of the idea of a woman's giving birth to a sprig of myrtle is typical of the naive tale. If it is to enjoy the tale, the child must not balk at this initial impossibility. The mystic significance of the myrtle is irrelevant to the tale-teller and the tale, however important it may be for academics.

Even a tale with a male hero, such as Jack and the Beanstalk, is centered in the female world. Jack's most important relationship is with his mother, who resorts to violence to discipline him, without success. His climbing the beanstalk can be seen as an attempt to escape to the superior masculine world, which turns out to be the realm of an ogre, whose wife is Jack's only ally. The world at the top of the beanstalk is a mirror image of the world below, except that it is dominated by a destructive male who is eventually made to crash to the ground when Jack cuts down the beanstalk. The old wives who first told the story cast themselves in the story in two familiar roles, the bad mother (Jack's lone parent) and the good mother (the brutal father figure's gentle wife).

It is easy to see how the expression "old wives' tale" could come to mean a superstitious, irrational and untrue statement, which is to be rejected out of hand. Even the Oxford dictionary defines an old wife's fable, story or tale as "a foolish story, such as is told by garrulous old women". I dare say my story of the most beautiful frog in the world was foolish; the frog in question was far too like a human child, but it isn't foolish to tell a story in which the frog heroine is in constant danger of being eaten and keeps making friends with the very animals that are most likely to eat her. Like most tales of its foolish kind, my story was didactic but it did not moralise. The little frog is exposed to terrible dangers but I made no attempt to make it seem her own fault. Meanwhile, the children squealed and cried and clapped and cheered, and fell asleep. If the child's imagination is to work, the story must not be explained away, nor should the child intuit what the grown-up's reason for telling such a tale might be. Cautionary tales emerge from a very different mindset.

Women teach babies and children to speak, which is the same as teaching them to think. An integral part of this activity is waking up their imagination, to see the numinousness of the real world, giving them, to adapt Wordsworth's phrase, glimpses that would make them less forlorn. Wordsworth gives examples of two fables from antiquity, Proteus rising from the sea, and Triton blowing his wreathed horn. The old wife who lives by the sea is more apt to tell the tale of the silkie, or the miraculous catch of the fish with a ring in its mouth, or the little mermaid. The old woman who lives in the woods will tell a tale of bears and pixies. When I lived in Calabria, the peasant children would put out food for the *monachicchi*, the spirits of children who had died unbaptised, whose cold baby fingers caressed your face as you walked through the olive groves at night. When they gathered up the empty plates in the morning, maybe the children and their mothers felt a little closer to the ones they had lost – not so foolish after all. We knew that the cold fingers were gossamer and not baby fingers; we believed even as we disbelieved.

Most of women's poetry and story-telling has been swallowed up in the maw of time. Because the authors of old wives' tales tales were not literate, because the tales were variants of traditional themes, because the people who told them were women and the people who heard them were children, they were phenomena of no account. From the earliest times, such narratives have been treated with contempt. Educated people were only too happy to forget them, and to embrace the culture associated with the elite. If the old tales were ever remembered by the masculine elite, they were parodied as rustic and absurd. There are a very few exceptions. One of them is George Peele, a university man, who translated Euripides and could turn his hand to almost any kind of writing.

In 1593 or so Peele wrote an odd play called *The Old Wives' Tale*, which gives us a rare insight into the tales told by old women. It opens with three little pages who have lost their way in the forest, trying to keep up their spirits as they prepare to see out the long, cold night sheltering in a tree. Then Clunch the smith turns up. Though his cottage has only one sleeping place and he is too poor to afford spare bedding, he offers them shelter and takes them home with him. The smith's old wife, Madge, offers them her home-made meat pudding and cheese but the little boys, aware that their hosts can ill afford to give away any of their slender provisions, refuse the over-generous offer. One of them begs her to give them a story instead.

Methinks, Gammer, a merry winter's tale would drive away the time trimly. Come, I am sure you are not without a score.

An old wives' tale is the same thing as a winter's tale. Winter was the season of long, dark evenings, when most peasant families had to huddle together indoors with no light but what came from the fire. When Shakespeare called his play *The Winter's Tale*, he was deliberately invoking the imaginative realm of the rambling tales told by firelight, of the jealous husband, the rejected child, the princess brought up as a peasant, and the king's son in disguise. The play is an old wives' tale about an old wife, who endures long separation from her husband and the death of her son, and is reunited with her husband at the end. (Any parallel with the career of Ann Shakespeare may not be entirely coincidental.) Because it is an old wives' tale, the play can roam from Bohemia to Sicily and back again, and encompass 16 years.

In Peele's play the pages begin to clamour for just such a tale.

Look you, Gammer, of the giant and the king's daughter, and I know not what. I have seen the day when I was a little one, you might have drawn me a mile after you with such a discourse.

Her story begins as you would expect:

Once upon a time, there was a king, a lord or a duke that had a fair daughter, the fairest that ever was, as white as snow and as red as blood, and once upon a time his daughter was stolen away, and he sent all his men to seek out his daughter, and he sent so long that he sent all his men out of the land.

One of the pages makes a smart remark, and Madge replies: "Nay, either hear my tale or kiss my tail."

The old wife's rather confused narrative is interrupted by the entrance of characters from her repertoire. What follows is a portmanteau fairy tale, which plaits together familiar themes, the shape-changing sorcerer (Sacrapant), the enchanted man at the crossroads who begs from all the other characters and foresees their fates, which he expresses in rhyming riddles – one who turns into a bear at night, the brothers seeking their stolen sister, the wandering knight, the braggart, the grateful dead, the two sisters, one fair and ill-natured, one "black" and sweet-natured, the head in the well. The play could only have worked because Peele's audience recognised the motifs and appreciated his ingenuity in reconciling themes from so many different types of tale and from so many versions of those types.

The French *salonnières* who began telling highly wrought *contes des fées* in the 1670s were unlikely to have read Straparola, Basile, Peele or Shakespeare. The story motifs used by all the collectors of tales could be found in parallel versions all over Europe. The challenge was to spin the basic tale into an artifice that displayed enough verve, charm and elegance to impress a coterie of connoisseurs. Even so, the roots of the salon fairy tale in the old wives' tale are fairly easy to trace. The version of the Cinderella story told by Marie-Catherine, Baronne d'Aulnoy, for example, is uncompromisingly sinister.

A king and a queen have three daughters. When they lose their kingdom and fall into poverty, the queen says that she can make nets so that the king can catch birds and fish for the two of them to eat, but they will have to get rid of their daughters. The youngest, Finette, hears her parents talking and resolves to visit her fairy godmother. Her godmother gives her a ball of magic thread to help her find her way back from anywhere her mother might take her. The next day the mother takes the girls to a meadow. When they lie down to sleep, she sneaks off and leaves them there. Finette leads her sisters home again and their mother pretends that she had meant to return for them all along. The next day she takes them further away, and abandons them again, and again Finette leads them home. The third time the mother succeeds in shaking them off, and they are left to fend for themselves. Finette is a courageous and resourceful girl who succeeds in various exploits, including cutting an ogress's head off while she is dressing her hair, but because she offends her fairy godmother by not rejecting her sisters she loses her support. Her sisters, who are as hostile to her as her mother was, rob her and

beat her. When her foot fits the slipper and she marries the prince and her adventurous career is over, we are almost disappointed.

In modern versions of ancient tales, the tension that characterises the relationship of mother and daughter is usually encoded. The father's sexual partner is more likely to be presented as a stepmother than a mother, for example, but it is a ruse that should fool no one. In cruder versions of fairy tales, the monstrous mother is a regular presence. Snow-White-Fire-Red, for example, has an ogress for a mother, who wants to eat her young lover. The witches too are mother figures, even when they are cannibals (especially when they are cannibals). Every mother is a giant witch to her small child sometimes.

The elegant female authors of the rococo fairy tale, Madame D'Aulnoy, Madame de Murat and the Mesdemoiselles L'Héritier de Villandon, Bernard, and de la Force would all have been horrified to be called old wives. They were youngish ladies, whose versions of old themes are encrusted with rococo artifice. The spectre of the old wife was still close enough for Charles Perrault to issue *Histoires et Contes du Temps Passé, Avec des Moralités* or *Contes de ma Mere l'Oye* in 1697 under his son's name rather than his own.

Though Perrault presents himself as an antiquarian collector, he is no more content simply to record the story as it was told to him than any of his female counterparts. His versions are meant to inculcate in well brought up young women of the urban middle class a clear understanding of the right way to behave; in his version, the story of Little Red Riding Hood displays the folly of talking to strangers. The tale has endured over centuries in oral form because it teases out fears and desires deeply embedded in children's fantasies. The human world of Red Riding Hood is usually entirely female; the only male is an animal. The many versions contain some or all of the following elements. A girl is sent by her mother to visit her sick grandmother. She meets a wolf on the way and tells him exactly where she is going. The wolf gets there first, eats the grandmother and takes her place in the bed. The wolf tells the little girl to eat the blood and meat he has left for her, that is to share his crime by eating her grandmother, to take off her clothes, throw them in the fire, and to get into bed with him. In some versions she outwits him and escapes, and in others the wolf eats her too, and sometimes the wolf is cut open and she and her grandmother are reborn by Caesarean section, while the wolf's belly is filled with stones and it is thrown in the river. All of these themes have to do with being a wombed creature, inside whom other creatures may dwell. Children who regularly witnessed pregnancy and birth, both animal and human, would obviously have puzzled over the bloodiness, the danger and the mystery of both. The person who sat by the fire and retold the old story had every opportunity to tailor her tale to the emotional context, the better to help the child deal with whatever was toward, but her primary aim was to stimulate the child's sense of wonder and its awareness of vulnerability, both essential to survival in the rural world. The explicit moral drawn by Perrault is sexist, urban and bourgeois. The core story is none of those.

When the Brothers Grimm collected the story from German sources, it had already been influenced by Perrault's literary version, which was the first to specify that the heroine's hood was red. Jeanette Hassenpflug is supposed to have told the tale of Little Red Riding Hood to the elder Grimm, and Marie Hassenpflug to the younger. For the first edition of their collection *Kinder- und Hausmärchen* (1812), the brothers used both versions, turning the second story into a sequel to the first and calling it *Rotkäppchen*. They revised the story several times, using supplementary material, some of it told them by Henriette Dorothea Wild, who married Wilhelm Grimm in 1825. By degrees the monstrous fantasy that underlies the core story was exorcised and it became a mere cautionary tale. The old wife did not need to point her moral; if she wished her hearers to judge the events she was describing in her story and come to specific conclusions, she had only to stress different elements in it. If she wanted children to think that the wolf got to her grandmother because Little Red Riding Hood was indiscreet, she had only to tell the story that way. If, on the other hand, she wanted to make them aware of wolves as a constant danger, she told the story in a different way again.

Little Red Riding Hood is an outgrowth of the motif of the woman coupled with a carnivorous beast, which is what we would expect of a culture in which women married young and husbands were more likely than wives

to survive. Every child attending a parish church would have witnessed the burial of women who had died in childbirth, some with their newborns in their arms, others with babies not yet born. The fact that nobody discussed such matters with children would have made the events all the more frightening. Evidence of the terror of virgins marrying men who had buried several wives can be found only rarely, and then in devotional literature. The only other place it could be expressed was in encoded form in fantastic fables. Charles Perrault is credited with the invention of the story of Bluebeard, which is clearly indebted to folk tales. If we consider that a nobleman was more likely to have married very young wives than a peasant (who needed a grown woman with her full complement of skills) and that these women endured their first pregnancies at the ages of 14 and 15, we can see at once that marriage to a nobleman was a high-risk business. Rumours ossify into legends. In some versions of the tale, as in the tale of Conomor the Accursed, the Bluebeard figure kills his wives when they become pregnant.

There are thousands of learned discussions of fairy tales but very few that approach them from the old wives' perspective, with the result that the obvious goes unnoticed. The theme of the father who wants to marry his daughter, for example, can be seen both as a coded version of the daughter's desire for the father and of her anxiety about possible abuse by her father. The fatal mother – aka the witch, aka the ogress – is an aspect of motherhood itself. Fear and loathing and mother love inhabit the same body. The nexus is nowhere more obviously or more profoundly expressed than in the paintings of Paula Rego, which return again and again to the visceral reality behind the fantastic narrative. Rego was told stories from the time she was a child, because she was afraid of the dark. As she explained in a recent interview, "Most of the things I do are based on Portuguese folk tales, which are not folksy. They were jotted down at the turn of the century by anthropologists, who would go into the villages and the mountains and take down these stories, which are brutal and magical as well. And it is those stories that I have adored and revered all my life." Her interlocutors can barely grasp what she is saying, because she is an old wife herself, and old wives neither explain nor moralise. "There is nothing more violent or tender than old Portuguese tales. This is what we must preserve. This is the truth in us all," she says. Every long-gone old wife, who sat by the fire, shelling chestnuts for the littl'uns, and spinning her tale through the long, dark winter evening, would know what Rego means.

http://www.guardian.co.uk/books/2010/may/15/germaine-greer-old-wives-tales

Stress link to financial squeeze
By Jane Hughes
Health correspondent, BBC News

Work pressures during the recession have caused a big rise in mental health problems, the charity says.

A survey for Mind suggests that one in 11 British workers has been to the GP for stress and anxiety from the financial squeeze.

And 7% said they were prescribed medicines to help them cope.

The Confederation of British Industry said employers were improving at caring for workers' mental health, but it was important to increase understanding.

The last couple of years have been an anxious time, even for those who have not found themselves out of work.

Many have had overtime cut, worked longer hours, or worried about job security.

" **It felt like there was a big black cloud over me** "
Carlene Brown

For some people, the pressure it causes can feel uncontrollable, and MIND believes mental health issues will soon become the biggest cause of work-related absence.

Their survey of 2,050 workers found that about a third were working harder and nearly half worried about the security of their jobs because of the recession.

Nine per cent had been to their GP as a direct result of pressure related to the financial squeeze, and 7% were prescribed medicines like anti-depressants to help them cope.

One in five said work stress had made them physically ill, and one in four had been reduced to tears at work because of unmanageable pressure.

Carlene Brown found herself under pressure to work hours of overtime every week in her sales job in Birmingham.

She found herself struggling to cope and slipping more and more deeply into depression.

"It felt like there was a big black cloud over me," she said.

Her company was unsympathetic when she took time off, and eventually made her redundant.

"It was such a relief," she said, "I don't think you ever get over depression, and I felt very bitter, but I have learned to live with it."

Stress relief

Mind is calling on companies to improve the atmosphere in workplaces and show more understanding about mental health problems.

"Working conditions have been incredibly tough for the last couple of years, " said Mind's chief executive, Paul Farmer.

"It's more important than ever that businesses look at how they can manage stress levels and improve the working environment for all their employees."

Some companies have cut back on the support they offer workers because of the financial squeeze, but British Telecom has taken the opposite approach.

More employees than ever have been using its counselling service, and it has been improving back-up for stressed workers.

"Mental health is one of the biggest issues for us," said Paul Litchfield, the company's chief medical officer.

"People in good mental health are productive and engaged. It makes good sense to support people's mental and physical health."

As well as more conventional support, BT has introduced an indoor vegetable garden to help improve the atmosphere at work.

It is the kind of innovation MIND wants to see in other companies.

"It doesn't have to be costly," said Paul Farmer, "and it can really improve the morale of a workplace. There's a strong business case to take these measures."

The CBI said companies take mental health seriously and have already improved workers' support.

Neil Carberry, head of employment policy, said: "The key thing is developing understanding among fellow employees and line managers on the issues."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8683184.stm

Published: 2010/05/17 01:09:15 GMT

Mums-to-be rate mothers' wisdom

Mothers-to-be think their own mothers know better than the medical profession when it comes to health advice, researchers say.

A University of London team talked to women who gave birth in the 1970s, 1980s and the 2000s.

Modern women were more likely to take a mixture of advice - but were still more likely to follow family wisdom.

One baby charity said family tips were useful, but medical advice should be sought if mothers-to-be had worries.

The researchers talked about pregnancy and childbirth advice to seven women who gave birth in the 1970s and 12 of their daughters who had babies in the 2000s.

They then also analysed interviews on the same topic which had been carried out with 24 women in the 1980s.

The 1970s women were most likely to take advice from family members.

But researchers found that women who had babies between 2000 and 2010 had to evaluate a wide range of information from doctors, midwives, books, magazines and, latterly, the internet - as well as that from their families.

In these women, it tended to be family advice that won out - particularly if a mother-to-be was dealing with a specific symptom.

One woman, Hetty, from the 2000s generation, said she had tried to stop drinking tea because she had read on the internet that caffeine could cause miscarriages in the first few weeks of pregnancy.

But she then added she had taken her grandmother's advice that tea could help relieve morning sickness.

"She just used to stay in bed and have a cup of tea. And that did help actually."

'Strike a balance'

Professor Paula Nicolson from Royal Holloway, University of London, who led the study, said: "When it comes to the crunch - if women feel sick for example - they will take their mother's or their grandmother's advice.

"They wouldn't necessarily recognise how important it was to them, but it would override the science."

She added: "Taking all the guidelines too seriously leads to anxieties. Lack of self-confidence also can lead to worry about 'doing the wrong thing' which is potentially more harmful than taking the odd glass of wine or eating soft cheese."

Jane Brewin, chief executive of baby charity Tommy's, said women had to "strike a balance" about what advice they took.

"It's only natural to want to talk about the significant changes that happen to a woman's body and how she feels; mums and close friends often have first-hand experience and tips that are helpful.

"However we always stress that if any mum-to-be is worried about anything during their pregnancy they should seek medical advice without delay."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8683089.stm

Published: 2010/05/14 23:10:46 GMT

DNA clue to life at high altitude
By Helen Briggs
Health reporter, BBC News

The ability of Tibetans to live on the "roof of the world" may be down to their DNA, US researchers say.

University of Utah researchers found 10 genes which help Tibetans thrive at heights where others get sick.

Two of the genes are linked to haemoglobin - the substance in blood that transports oxygen round the body.

Doctors say the research, published in Science, could lead to treatments for severe forms of altitude sickness and other illnesses.

Altitude sickness is the name given to ill-effects caused by the body's struggle to deal with a lack of oxygen at high altitude.

" **It helps us understand how patients cope with low oxygen levels** "
Prof Hugh Montgomery, UCL

It can lead to brain and lung complications, which can threaten even the fittest mountaineers.

People native to high altitudes appear to be immune to such effects, through thousands of years of genetic selection.

Tibetans have evolved genes that others living at high altitudes - such as in the Andes - have not.

Professor Lynn Jorde, of the University of Utah School of Medicine, said: "For the first time, we have genes that explain that adaptation."

Therapies

The study looked at DNA extracted from blood samples taken from 75 villagers living at 15,000ft (4,500m).

The Utah team, in collaboration with the Qinghai University Medical School, China, compared stretches of their genetic code with that of lowland Chinese and Japanese populations.

A handful of genes turned up, including 10 unique oxygen-processing genes.

Two appear to contribute to lower levels of haemoglobin in the blood, which may help the body fight altitude sickness.

Prof Josef Prchal of the University of Utah said the work could help in developing treatments for illnesses that affect people everywhere.

He said: "What's unique about Tibetans is they don't develop high red blood cells counts.

"If we can understand this, we can develop therapies for human disease."

Darwinism

Professor Hugh Montgomery is a geneticist and director of the UCL Institute for Human Health and Performance at University College London.

He said the study helped in the understanding of how patients with the likes of heart failure and lung disease cope with low oxygen in the blood.

He told the BBC: "It's important clinically because it helps us understand how patients cope with low oxygen levels.

"There are opportunities here for developing new drug therapies."

He said the work was also important scientifically, by showing how Darwin's science coupled with modern technology could be used to identify beneficial genes.

"It's a lovely example of Darwinism," he added.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8680503.stm

Published: 2010/05/13 23:53:34 GMT

Martian moon probably pretty porous

Phobos may be a mass of rocky rubble, not a captured asteroid
By Sid Perkins
June 5th, 2010; Vol.177 #12 (p. 11)

Martian swiss?Recent flybys suggest that Mars' larger moon Phobos could be a porous amalgamation of space rubble, with as much as 30 percent of the moon's interior being empty space. N (upper left) marks the moon's north pole.G. Neukum/FU Berlin, ESA, DLR

The interior of Mars' moon Phobos could be as much as 30 percent empty space, new observations suggest. Though it's still not clear how the object formed, the finding means it is probably not an asteroid that was captured by the Red Planet's gravity, researchers say.

Scientists have long debated the origin of Phobos, and these new findings narrow down the possibilities, says Tom Andert, a planetary geophysicist at the University of the German Armed Forces in Munich. He and his colleagues report in the May 16 *Geophysical Research Letters* that Phobos almost certainly isn't a single solid object.

"Finally we're drifting away from the idea that the Martian moons are captured asteroids," says Tom Duxbury, a planetary scientist at George Mason University in Fairfax, Va., who was not part of the new study.

Phobos, the larger of Mars' two moons, is a cratered, irregularly shaped object just 27 kilometers long. Andert and his colleagues collected the best measurements ever of Phobos' mass by looking at perturbations in the orbit of Mars Express, a Mars-orbiting spacecraft, caused by the moon's gravitational tug.

Based on the measurements, the researchers estimate that Phobos contains about 10.7 quadrillion metric tons of material — making the lumpy moon about a billionth the mass of Earth. That, plus the improved volume

estimate of the moon gleaned from radar measurements, indicates that Phobos' overall density is about 1.87 grams per cubic centimeter, much less than the 3 g/cm^3 average density of the rocks in Mars' crust.

The density of Phobos is similar to that of some asteroids. However, Andert says, there aren't many scenarios that would allow Mars to capture an asteroid in a circular orbit without breaking it to pieces.

It's also unlikely Phobos is made solely of Mars crust blasted into space by an extraterrestrial impact and then reassembled by gravity, as some studies have suggested, because the spectral characteristics of the moon's rocks don't match those of the Red Planet.

The truth of Phobos' origins might be a blend of those scenarios, the team suggests. Phobos may be the remnants of Martian crust blasted into space, reassembled over time by mutual gravitational attraction, and then struck by a passing asteroid that added enough material to change the moon's spectral characteristics.

Duxbury, who long studied those moons while at NASA's Jet Propulsion Laboratory in Pasadena, Calif., is "happy to see that Phobos and Deimos are getting a lot of attention these days."

In the next couple of years, Duxbury says, analysis of radar data gathered during the recent flybys should help scientists discern whether Phobos is a solid body of relatively light rock or a porous amalgamation of dense rubble.

http://www.sciencenews.org/view/generic/id/59214/title/Martian_moon_probably_pretty_porous

Planets in nearby system are off-kilter, measurements show

Discovery of mismatched orbits hints at a violent past
By Ron Cowen
Web edition : Friday, May 14th, 2010

Like bugs glued to a phonograph record, the solar system's planets all orbit the sun in nearly the same plane. A new finding shatters the notion that planetary systems around other stars all have a similarly flattened arrangement. Newly reported measurements reveal that the two outermost planets known to circle a nearby sunlike star called Upsilon Andromedae are wildly misaligned, orbiting the star in different planes separated by 30 degrees.

The observations include ground-based measurements of the back-and-forth motion, or wobble, of Upsilon Andromedae due to the tug of its orbiting planets. But most critical were Hubble Space Telescope observations that tracked the two-dimensional motion of the star as it pirouetted across the sky, orbiting the center of mass of its planetary system.

The new measurements are the first to accurately determine the angle between the orbits of two extrasolar planets circling a sunlike star, says Barbara McArthur of the University of Texas at Austin. She and her colleagues describe the findings in the June 1 *Astrophysical Journal.* The researchers are also scheduled to describe their study May 24 at a meeting of the American Astronomical Society in Miami.

The finding, says theorist Greg Laughlin of the University of California, Santa Cruz, is yet another reminder that the architecture of the solar system, while not necessarily rare, may be downright foreign compared to the arrangement of planets around other stars.

"A lot of things had to go right in our solar system to lead to the kind of environment that we have today," says Laughlin.

The observations suggest that something violent must have happened early in the history of the Upsilon Andromedae system, notes McArthur. Theorists believe that planets form as gravity gathers together gas and dust within a flattened disk of material circling a young star. Gravitational interactions between the two massive outer planets of Upsilon Andromedae, or between one of them and a more remote body, could have stirred up a planetary system that was initially as flat as the solar system's, she and her colleagues conjecture.

Alternatively, a complicated dance between one of the planets, Upsilon Andromedae, and a third object — perhaps a companion star — "could have pumped up the mutual inclinations of the planets," says astrophysicist Sara Seager of MIT. Indeed, McArthur's team notes that Upsilon Andromedae posseses such a companion.

Residing about 45 light-years from Earth, Upsilon Andromedae was the first multiplanet system found around a sunlike star and has been studied extensively since its discovery in the 1990s. The innermost planet lies too close to the star for the inclination of its orbit to be determined; the two outer, giant planets are those whose orbits lie in planes that are 30 degrees apart.

McArthur and her colleagues have obtained new, more accurate mass measurements for both of the massive outer bodies. The closer one to Upsilon Andromedae weighs the equivalent of 13.98 Jupiters and lies slightly farther from its star than Mars' average distance from the sun. The second orb weighs the equivalent of 10.25 Jupiters and lies a little closer to the star than Jupiter's distance from the sun.

NASA's Kepler spacecraft, which hunts for planets that pass in front of a parent star, is likely to produce "a burst of new data" on the orbits of extrasolar planetary systems, McArthur says.

In the meantime, says Seager, the Upsilon Andromedae planetary system "will continue to be a feast for theorists."

http://www.sciencenews.org/view/generic/id/59211/title/Planets_in_nearby_system_are_off-kilter%2C_measurements_show

Art Means Books and Tattoos at New Paris Gallery

By ALICE PFEIFFER

Jordi Gourbeix The "Art, Ink and Rock and Roll" inaugural exhibition at the new Le Pied de Biche gallery in Paris.

"Art doesn't go to sleep in the bed made for it. What it likes is to be incognito. Its best moments are when it forgets what its own name is," once said Jean Dubuffet, founder of the Art Brut movement, who sought creativity anywhere but in museums. This is precisely the challenge that the new gallery Le Pied de Biche ("The Crowbar") has picked: Who says galleries ought to show strictly art? Don't books, tattoo drawings and toys also deserve an outlet? Their inaugural exhibition, "Art, Ink and Rock and Roll," which runs through June 2, addresses just these questions.

The gallery (86 rue Charonne; 33-9-81-71-32-09; www.lepieddebiche.com) simultaneously publishes, prints and shows its own limited series of books. The pieces are numbered, displayed and sold as artworks in the space.

"Books are art too," said Tiffany Khalil, the gallery's founder. "Le Pied de Biche is a move away from the classical, sanitized gallery. The aim is to create an uninhibited space, and put forward young, sprouting creativity."

The gallery-bookshop is filled to the brim with various underground cartoons, rare books, fanzines, but also theatrical jewelry and toys for grown-ups. It is also showing an exhibition of three tattoo artists — Easy Sasha, Navette and Nicoz Balboaz — who, though well-known in their own field, rarely show in typical galleries.

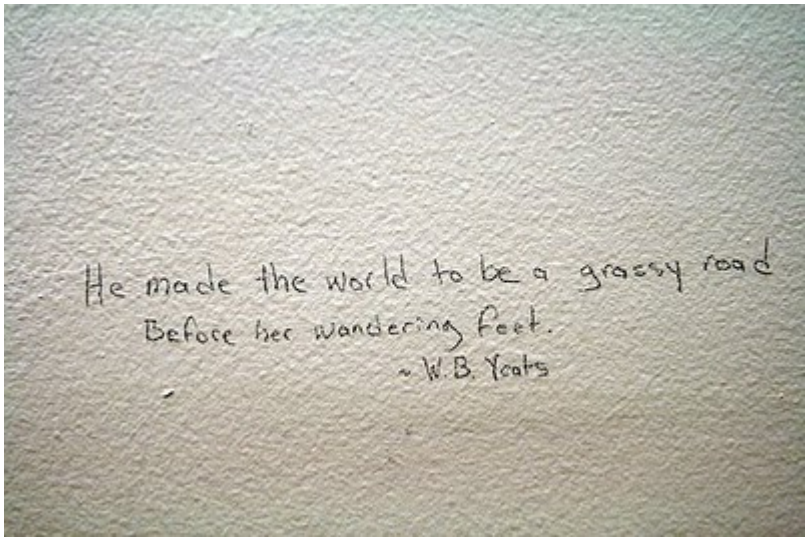
"Tattoo used to have violent associations because historically it was a way of marking a marginal life, from sailing to prison," Ms. Khalil said. "But today, there is a new generation of tattooists who define themselves as artists before anything. That's what I want to defend and represent."

And why a crowbar? "It is a metaphor about creeping into a crack and forcing your way in," Ms. Khalil said. "It's also an ideal weapon to fight zombies," she added with a laugh.

http://intransit.blogs.nytimes.com/2010/05/24/art-means-books-and-tattoos-at-new-paris-gallery/?src=tptw

Library Graffiti

Posted: 24 May 2010 09:26 PM PDT



In the summer of 2007 Quinn Dombrowski started documenting the graffiti she encountered on her visits to the Regenstein Library at the University of Chicago. She began posting the images on Flickr and by 2009 she had amassed a collection of over 700 pieces of graffiti.

In the summer of 2009 the project got helped along by a story on Jacket Copy, the book blog of the Los Angeles Times, and by the time time the year was out Quinn published *Crescat Graffiti, Vita Excolatur: Confessions of the University of Chicago*, a book containing many of the highlights of the collection.

The Flickr set is broken into sections to help you quickly find the graffiti that best suits your mood. From Advice to Sex, Drugs to Despair, Politics to Logic; all the bases are covered.

This begs for some sort of national competition.

http://feedproxy.google.com/~r/BookPatrol/~3/NMAVIoN82k0/library-graffiti.html?utm_source=feedburner&utm_medium=email

Cory Doctorow: Publish books free online

The author and blogger explains why he publishes his books free online

- Aleks Krotoski
- The Observer, Sunday 23 May 2010

Cory Doctorow has released all his fiction simultaneously in bookshops and online. Photograph: Bart Nagel

Politically engaged and disarmingly geeky, Cory Doctorow is one of the better-known faces of the digital revolution: co-editor of the celebrated blog Boing Boing ("a directory of wonderful things"), he is also author of half-a-dozen science fiction novels and a journalist. Born in Canada, the 38-year-old writer now lives in London, although when we speak, he's in the US, promoting his latest book, *For the Win.* This tells a story of teens rebelling against global corporations and is pitched at the "young adult" market. As with all his fiction, the book has been released simultaneously in bookshops and, for free, online.

You've released *For the Win* using a Creative Commons licence, giving it away for free. Why?

I give away all of my books. [The publisher] Tim O'Reilly once said that the problem for artists isn't piracy – it's obscurity. I think that's true. A lot of people have commented: "You can't eat page views, so how does being well-known help you earn a living as a writer?" It's true; however, it's very hard to monetise fame, but impossible to monetise obscurity. It doesn't really matter how great your work is; if no one's ever heard of it, you'll never make any money from it. That's not to say that if everyone's heard of it, you'll make a fortune, but it is a necessary precursor that your work be well-known to earn you a living. As far as I can tell, these themes apply very widely, across all media.

As a practical matter, we live in the 21st century and anything anybody wants to copy they will be able to copy. If you are building a business model that says that people can only copy things with your permission, your business is going to fail because whether or not you like it, people will be able to copy your product without your permission. The question is: what are you going to do about that? Are you going call them thieves or are you going to find a way to make money from them?

The only people who really think that it's plausible to reduce copying in the future seem to be the analogue economy, the people who built their business on the idea that copying only happens occasionally and usually involves a giant machine and some lawyers. People who are actually doing digital things have the intuitive knowledge that there's no way you're going to stop people from copying and they've made peace with it.

Your young adult novels are concerned with the political issues surrounding new technologies, such as questions of privacy. Why?

Kids' relationship with privacy is really confused; they're told by teachers and adults that their privacy is paramount, that they should stop disclosing so much information on Facebook and so on. And then they go to schools where everything they do is monitored; there's mandatory spyware that takes every click they make, every word they utter and sends it back to teachers and headmasters for disciplinary purposes.

When they go out in public, they're photographed every five minutes and there are signs that prohibit taking any affirmative step to hide themselves from scrutiny or maintain any privacy.

So on the one hand, we're telling kids that their privacy is the most important thing in the world and that they have to guard it as jealously as anything that matters to them. On the other hand, we're systematically depriving them of their privacy and punishing them for asserting it.

The problem with privacy is the same problem as with smoking: the consequences of doing something that's bad for you are a long way from the action itself and so you don't learn.

If we want kids to give less information to Facebook, then we should start by having them give less information to everybody. That means giving them the tools that help them to understand that privacy really matters and that giving up your privacy is something that's hard to stop doing once you start.

Do you see young adult fiction as an effective way of getting a message across?

Young adults treat literature with a lot more seriousness and often see literature as a call to action – whether that's to go to the library or to try to write some software or even to found a protest group. I do hope to have this alerting presence about the risks of technology. I want to inspire kids and adults to ask how we can start seizing the means of information again, how we can use technology to liberate us as it did when I was an adolescent.

http://www.guardian.co.uk/technology/2010/may/23/cory-doctorow-my-bright-idea

Two Peas in an Irregular Pod: How Binary Stars May Form

New evidence from NASA's Spitzer Space Telescope is showing that tight-knit twin stars might be triggered to form by asymmetrical envelopes like the ones shown in this image. (Credit: NASA/JPL-Caltech/Univ. of Michigan)

ScienceDaily (May 24, 2010) — Our sun may be an only child, but most of the stars in the galaxy are actually twins. The sibling stars circle around each other at varying distances, bound by the hands of gravity.

How twin stars form is an ongoing question in astronomy. Do they start out like fraternal twins developing from two separate clouds, or "eggs"? Or do they begin life in one cloud that splits into two, like identical twins born from one egg? Astronomers generally believe that widely spaced twin, or binary, stars grow from two separate clouds, while the closer-knit binary stars start out from one cloud. But how this latter process works has not been clear.

New observations from NASA's Spitzer Space Telescope are acting like sonograms to reveal the early birth process of snug twin stars. The infrared telescope can see the structure of the dense, dusty envelopes surrounding newborn stars in remarkable detail. These envelopes are like wombs feeding stars growing inside -- the material falls onto disks spinning around the stars, and then is pulled farther inward by the fattening stars.

The Spitzer pictures reveal blob-like, asymmetrical envelopes for nearly all of 20 objects studied. According to astronomers, such irregularities might trigger binary stars to form.

"We see asymmetries in the dense material around these proto-stars on scales only a few times larger than the size of the solar system. This means that the disks around them will be fed unevenly, possibly enhancing

fragmentation of the disk and triggering binary star formation," said John Tobin of the University of Michigan, Ann Arbor, lead author of a recent paper in the *The Astrophysical Journal*.

All stars, whether they are twins or not, form from collapsing envelopes, or clumps, of gas and dust. The clumps continue to shrink under the force of gravity, until enough pressure is exerted to fuse atoms together and create an explosion of energy.

Theorists have run computer simulations in the past to show that irregular-shaped envelopes may cause the closer twin stars to form. Material falling inward would be concentrated in clumps, not evenly spread out, seeding the formation of two stars instead of one. But, until now, observational evidence for this scenario was inconclusive.

Tobin and his team initially did not set out to test this theory. They were studying the effects of jets and outflows on envelopes around young stars when they happened to notice that almost all the envelopes were asymmetrical. This led them to investigate further -- 17 of 20 envelopes examined were shaped like blobs instead of spheres. The remaining three envelopes were not as irregular as the others, but not perfectly round either. Many of the envelopes were already known to contain embryonic twin stars -- possibly caused by the irregular envelopes.

"We were really surprised by the prevalence of asymmetrical envelope structures," said Tobin. "And because we know that most stars are binary, these asymmetries could be indicative of how they form."

Spitzer was able to catch such detailed views of these stellar eggs because it has highly sensitive infrared vision, which can detect the faint infrared glow from our Milky Way galaxy itself. The dusty envelopes around the young stars block background light from the Milky Way, creating the appearance of a shadow in images from Spitzer."Traditionally, these envelopes have been observed by looking at longer infrared wavelengths where the cold dust is glowing. However, those observations generally have much lower resolution than the Spitzer images," said Tobin.

Further study of these envelopes, examining the velocity of the material falling onto the forming stars using radio-wavelength telescopes, is already in progress. While the researchers may not yet be able to look at a picture of a stellar envelope and declare "It's twins," their work is offering important clues to help solve the mystery of how twin stars are born.Other authors of this study include Lee Hartmann of the University of Michigan, Ann Arbor; and Hsin-Fang Chiang and Leslie Looney of the University of Illinois, Urbana-Champaign. The observations were made before Spitzer ran out its liquid coolant in May 2009, beginning its "warm" mission.

Story Source:

Adapted from materials provided by NASA/Jet Propulsion Laboratory.

Journal Reference:

1. John J. Tobin, Lee Hartmann, Leslie W. Looney, Hsin-Fang Chiang. **Complex Structure in Class 0 Protostellar Envelopes**. *The Astrophysical Journal*, 2010; 712 (2): 1010 DOI: 10.1088/0004-637X/712/2/1010

http://www.sciencedaily.com/releases/2010/05/100521205606.htm

Danger in the Internet Cafe? New Computer Security Threat for Wireless Networks: Typhoid Adware

John Aycock (left) and student Daniel Medeiros Nunes de Castro have predicted a new computer security threat: Typhoid adware. (Credit: Leanne Yohemas, University of Calgary)

ScienceDaily (May 24, 2010) — There's a potential threat lurking in your internet café, say University of Calgary computer science researchers. It's called Typhoid adware and works in similar fashion to Typhoid Mary, the first identified healthy carrier of typhoid fever who spread the disease to dozens of people in the New York area in the early 1900s.

"Our research describes a potential computer security threat and offers some solutions," says associate professor John Aycock, who co-authored a paper with assistant professor Mea Wang and students Daniel Medeiros Nunes de Castro and Eric Lin. "We're looking at a different variant of adware -- Typhoid adware - which we haven't seen out there yet, but we believe could be a threat soon."

Adware is software that sneaks onto computers often when users download things, for example fancy tool bars or free screen savers, and it typically pops up lots and lots of ads. Typhoid adware needs a wireless internet café or other area where users share a non-encrypted wireless connection.

"Typhoid adware is designed for public places where people bring their laptops," says Aycock. "It's far more covert, displaying advertisements on computers that don't have the adware installed, not the ones that do."

The paper demonstrates how Typhoid adware works as well as presents solutions on how to defend against such attacks. De Castro recently presented it at the EICAR conference in Paris, a conference devoted to IT security.

Typically, adware authors install their software on as many machines as possible. But Typhoid adware comes from another person's computer and convinces other laptops to communicate with it and not the legitimate access point. Then the Typhoid adware automatically inserts advertisements in videos and web pages on the

other computers. Meanwhile, the carrier sips her latté in peace -- she sees no advertisements and doesn't know she is infected ¬- just like symptomless Typhoid Mary.

U of C researchers have come up with a number of defenses against Typhoid adware. One is protecting the content of videos to ensure that what users see comes from the original source. Another is a way to "tell" laptops they are at an Internet café to make them more suspicious of contact from other computers.

"When you go to an Internet café, you tell your computer you are there and it can put up these defenses. Anti-virus companies can do the same thing through software that stops your computer from being misled and re-directed to someone else," says Aycock.

Why worry about ads? Aycock explains it this way: "Not only are ads annoying but they can also advertise rogue antivirus software that's harmful to your computer, so ads are in some sense the tip of the iceberg."

The paper Typhoid Adware can be found: http://pages.cpsc.ucalgary.ca/~aycock/papers/eicar10.pdf

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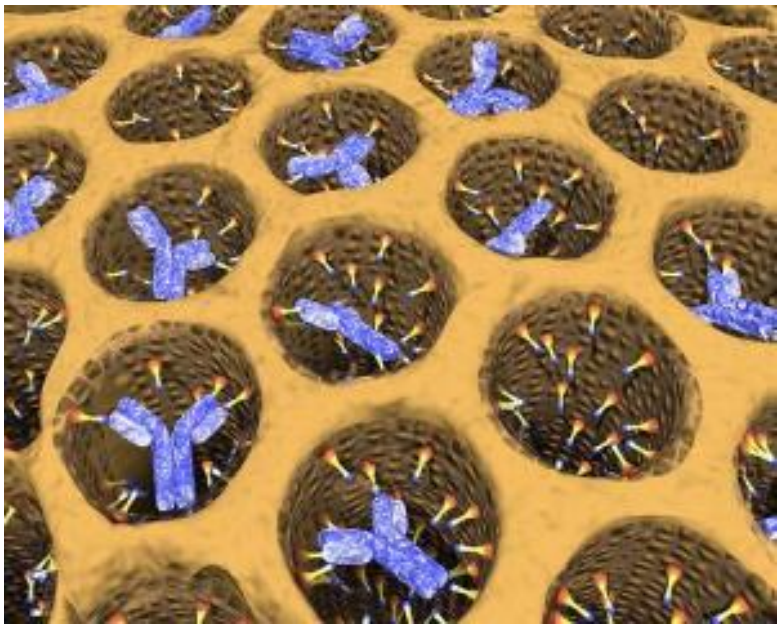
Story Source:

Adapted from materials provided by University of Calgary.

http://www.sciencedaily.com/releases/2010/05/100521191436.htm

Silica Cages Help Anti-Cancer Antibodies Kill Tumors in Mice



Small chemical ornaments (cones) slow the release of anti-cancer antibodies (blue) from this functionalized mesoporous silica (orange). Artist's rendering; not to scale. (Credit: Image courtesy of DOE/Pacific Northwest National Laboratory)

ScienceDaily (May 24, 2010) — Packaging anti-cancer drugs into particles of chemically modified silica improve the drugs' ability to fight skin cancer in mice, according to new research. Results published May 3 in the *Journal of the American Chemical Society* online show the honeycombed particles can help anti-cancer antibodies prevent tumor growth and prolong the lives of mice.

"We are very excited by our preliminary results," said biochemist Chenghong Lei of the Department of Energy's Pacific Northwest National Laboratory, part of the team of PNNL and University of Washington scientists. "We plan to do some additional, larger studies with animals. We hope the results hold up well enough to take it to clinical trials somewhere down the road."

Anti-cancer antibodies are some of the most promising types of cancer therapies. The antibodies target a particular protein on cancer cells and -- in a poorly understood way -- kill off the cells. Examples include herceptin for one form of breast cancer and cetuximab for colon cancer.

Unlike popping a pill, however, antibody-based treatments require patients to go in for intravenous drips into the arm. These sessions cost time and money, and expose healthy tissue to the antibody, causing side effects.

Packaging antibodies into particles would concentrate them at the tumor and possibly reduce side effects. Other research has shown silicon to be well tolerated by cells, animals and people. So, in collaboration with tumor biologist Karl Erik Hellstrom's group at UW, the scientists explored particles made from material called mesoporous silica against cancer in mice.

"The silica's mesoporous nature provides honeycomb-like structures that can pack lots of individual drug molecules," said PNNL material scientist Jun Liu. "We've been exploring the material for our energy and environmental problems, but it seemed like a natural fit for drug delivery."

In previous work, the team created particles that contain nano-sized hexagonal pores that hold antibodies, enzymes or other proteins. In addition, adorning the silica pores with small chemical groups helps trap proteins inside. But not permanently -- these proteins slowly leak out like a time-release capsule.

The researchers wanted to test whether anti-cancer antibodies packaged in modified mesoporous silica would be more effective against tumors than free-flowing antibodies.

To do so, they first chemically modified mesoporous silica particles of about six to 12 micrometers (about 1/10 the diameter of human hair). These particles contained pores of about 30 nanometers in diameter. They found that the extent and choice of chemical modification -- amine, carboxylic acid or sulfonic acid groups -- determined how fast the antibodies leaked out, a property that can be exploited to fine tune particles to different drugs.

Additional biochemical tests showed that the antibodies released from the silica cages appeared to be structurally sound and worked properly.

They then tested the particles in mouse tumors at UW, filling them with an antibody called anti-CTLA4 that fights many cancers, including melanoma, a skin cancer. The team injected these packaged antibodies into mouse tumors. The team also injected antibodies alone or empty particles in other mouse tumors.

The packaged antibodies slowed the growth of tumors the best. Treatment started when tumors were about 27 cubic millimeters. Untreated tumors grew to 200 cubic millimeters about 5 days post-treatment. Tumors treated with antibodies alone reached 200 cubic millimeters on day 9, showing that antibodies do slow tumor growth. But tumors treated with packaged antibodies didn't reach 200 cubic millimeters until day 30, a significant improvement over antibodies alone.

The team repeated the experiment and found the treatment also prolonged the lives of diseased mice. Of five mice that had been treated with particles alone, all died within 21 days after treatment. But of five mice treated with the packaged antibodies, three were still alive at 21 days, and two at 34 days, when the experiment ended.

The team also measured how much antibody remained in the tumors. Two and four days after injection, the researchers found significantly more antibody in tumors when the antibodies had been encased in the silica particles than when the antibodies had been injected alone.

The team is testing other antibody-cancer pairs in mice, especially other cancers that form solid tumors such as breast cancer. They are also going to explore how the antibodies delivered this way induce the immune system to better fight cancer.

"We want to understand the mechanism, because not much is known about how the slowly leaked antibodies induce changes in the immune system or in the micro-environment of the tumor," said Hellstrom.

This work was supported by PNNL, Washington Research Foundation, UW Institute of Translational Health Sciences, the NIH, and the U.S. Department of Energy Office of Basic Energy Sciences in the Office of Science.

Story Source:

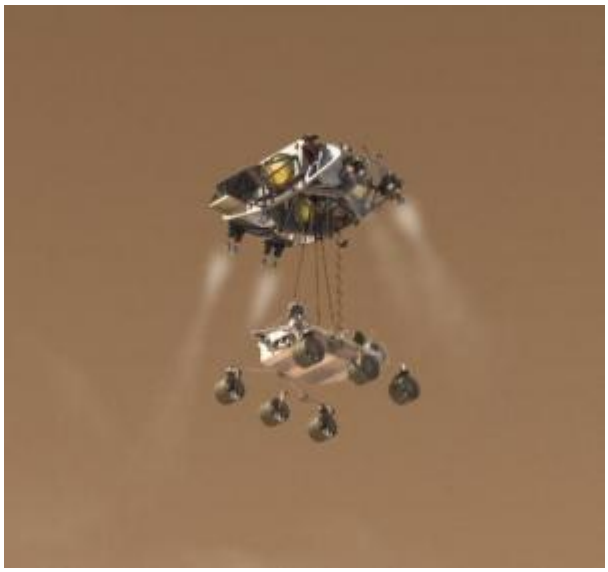
Adapted from materials provided by DOE/Pacific Northwest National Laboratory.

Journal Reference:

1. Chenghong Lei, Pu Liu, Baowei Chen, Yumeng Mao, Heather Engelmann, Yongsoon Shin, Jade Jaffar, Ingegerd Hellstrom, Jun Liu, Karl Erik Hellstrom. **Local Release of Highly Loaded Antibodies from Functionalized Nanoporous Support for Cancer Immunotherapy**. *Journal of the American Chemical Society*, 2010; 132 (20): 6906 DOI: 10.1021/ja102414t

http://www.sciencedaily.com/releases/2010/05/100521191237.htm

Geometry Drives Selection Date for 2011 Mars Launch



This artist's concept from an animation depicts Curiosity, the rover to be launched in 2011 by NASA's Mars Science Laboratory, as it is being lowered by the mission's rocket-powered descent stage during a critical moment of the "sky crane" landing in 2012. (Credit: NASA/JPL-Caltech)

ScienceDaily (May 24, 2010) — Planners of NASA's next Mars mission have selected a flight schedule that will use favorable positions for two currently orbiting NASA Mars orbiters to obtain maximum information during descent and landing.

Continuing analysis of the geometry and communications options for the arrival at Mars have led planners for the Mars Science Laboratory, or Curiosity, to choose an Earth-to-Mars trajectory that schedules launch between Nov. 25 and Dec. 18, 2011. Landing will take place between Aug. 6 and Aug. 20, 2012. Due to an Earth-Mars planetary alignment, this launch period actually allows for a Mars arrival in the earlier portion of the landing dates under consideration.

"The key factor was a choice between different strategies for sending communications during the critical moments before and during touchdown," said Michael Watkins, mission manager at NASA's Jet Propulsion Laboratory in Pasadena, Calif. "The shorter trajectory is optimal for keeping both orbiters in view of Curiosity all the way to touchdown on the surface of Mars. The longer trajectory allows direct communication to Earth all the way to touchdown."

The simplicity of direct-to-Earth communication from Curiosity during landing has appeal to mission planners, in comparison to relying on communications relayed via NASA's Mars Odyssey, which has been orbiting Mars since 2001, and NASA's Mars Reconnaissance Orbiter, in operation since 2006. However, the direct-to-Earth option allows a communication rate equivalent to only about 1 bit per second, while the relay option allows about 8,000 bits or more per second.

Landing on Mars is always difficult, with success uncertain. After an unsuccessful attempted Mars landing in 1999 without definitive information on the cause of the mishap, NASA put a high priority on communication during subsequent Mars landings.

"It is important to capture high-quality telemetry to allow us to learn what happens during the entry, descent and landing, which is arguably the most challenging part of the mission," said Fuk Li, manager of NASA's Mars Exploration Program at JPL. "The trajectory we have selected maximizes the amount of information we will learn to mitigate any problems."

Curiosity will use several innovations during entry into the Martian atmosphere, descent and landing in order to hit a relatively small target area on the surface and set down a rover too heavy for the cushioning air bags used in earlier Mars rover landings. In a "sky-crane" maneuver during the final minute of arrival, a rocket-powered descent stage will lower Curiosity on a tether for a wheels-down landing directly onto the surface.

Even though Curiosity won't be communicating directly with Earth at touchdown, data about the landing will reach Earth promptly. Odyssey will be in view of both Earth and Curiosity, in position to immediately forward to Earth the data stream it is receiving during the touchdown. Odyssey performed this type of "bent-pipe" relay during the May 25, 2008, arrival of NASA's Phoenix Mars Lander.

Curiosity will rove extensively on Mars, carrying an analytical laboratory and other instruments to examine a carefully selected landing area. It will investigate whether conditions there have favored development of microbial life and its preservation in the rock record. Plans call for the mission to operate on Mars for a full Martian year, which is equivalent to two Earth years.

Consideration of landing sites for the mission narrowed to four finalist candidates in November 2008. The candidate sites are still being analyzed for safety and science attributes.

Curiosity is managed by JPL for NASA's Science Mission Directorate in Washington. JPL also manages the Mars Odyssey and Mars Reconnaissance Orbiter missions, in partnership with Lockheed Martin Space Systems, Denver.

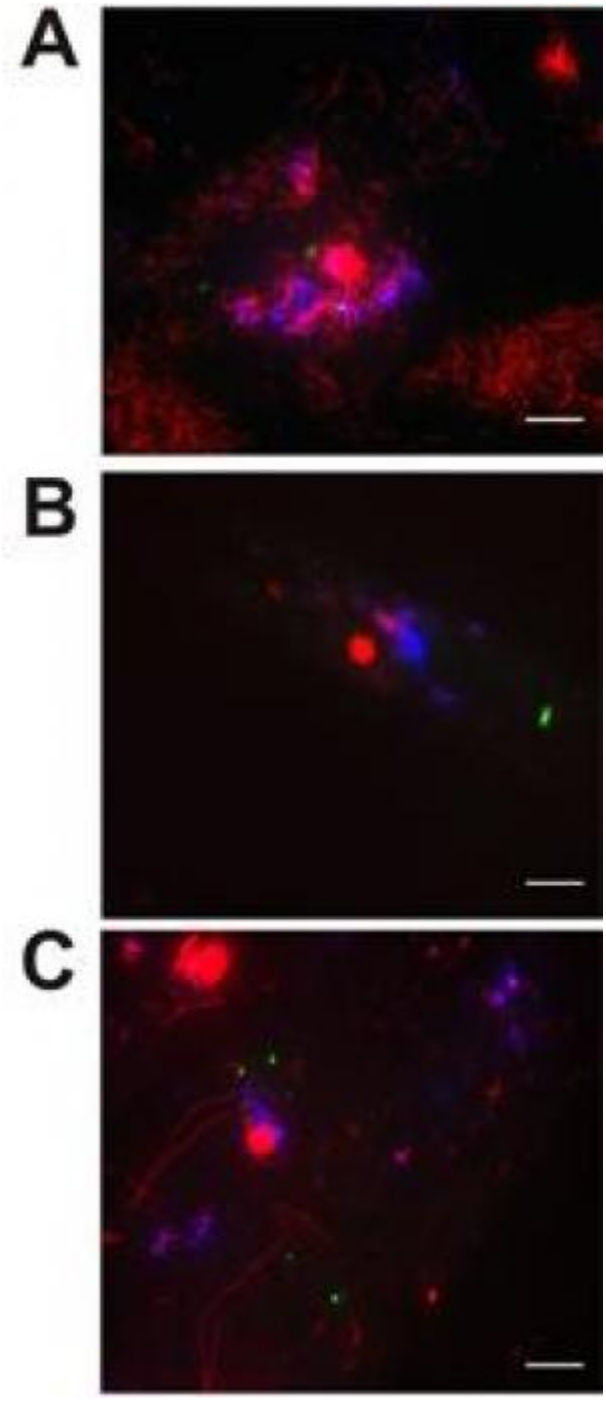
More information about NASA's Mars Science Laboratory is at: http://www.nasa.gov/msl.

Story Source:

Adapted from materials provided by NASA/Jet Propulsion Laboratory.

http://www.sciencedaily.com/releases/2010/05/100521205942.htm

Switch Protein Also Influences the Cytoskeleton



It is also possible to demonstrate the dependence of the synthesis of microtubules on Ras within the cell. The microtubules in WI-38 cells, discernible as red filaments (A), were made visible by immunofluorescence microscopy. They are no longer visible (B) if activated Ras is artificially inserted into the cell. A similar effect is attained if one ensures that there is no NORE1A within the cell (C). This implies that NORE1A is necessary for the cells to be able to synthesize microtubules, whereas Ras can inhibit this process. (Credit: Image courtesy of Ruhr-Universitaet-Bochum)

ScienceDaily (May 24, 2010) — The protein Ras is known as the switch for cell division when it is activated. Mutations in Ras and its interaction partners can thus lead to the development of cancer. Researchers in Bochum have now discovered another unexpected capability of Ras, namely that it, by interacting with another protein, controls the synthesis of the cytoskeleton responsible for the structure and stability of the cell.

Prof. Christian Herrmann's team managed to demonstrate Ras-controlled synthesis of the cytoskeleton in a test tube. The scientists have reported their findings in the current edition of the *Journal of Biological Chemistry*.

Ras mutations often lead to cancer

The Ras molecule is a member of a family of proteins that has a number of important cell functions. The molecules are either in an active or in an inactive state and are thus regarded as molecular switches. In the "on" state, Ras can interact with a further family of proteins, the so-called effectors, which in turn can result in the triggering of basic processes within the cell, such as cell division. Mutations in Ras and its effectors are a common reason for the development of cancer. The interest in research into this protein is thus commensurately high. By now scientists all over the world have highly detailed knowledge of its mode of action.

Entirely new function of Ras identified

Biochemists from the Ruhr-University in Bochum have supplemented this data with a totally unexpected function. The research group under the auspices of Prof. Christian Herrmann (Faculty of Chemistry and Biochemistry) have published a report on the Ras effector NORE1A (Novel Ras Effector 1). The scientists were able to demonstrate that NORE1A, in contrast to the well-known effectors, is not required to control cell division, but involved in the synthesis of the cytoskeleton. The cytoskeleton, which is responsible for the structure and stability of the cell, is composed of the protein tubulin, amongst others. The tubulin molecules cluster as bases. They develop into nanotubes, i.e. microtubules, and give the cell an internal structure. The Ras effector NORE1A is involved at exactly this point, the so-called nucleation of tubulin.

Prof. Herrmann pointed out that it is particularly surprising that this process can be directly regulated via the molecular switch Ras. The research group managed to simulate the reaction in a test tube. The addition of Ras impedes the synthesis of the cytoskeleton.

Experimentally difficult to access

The investigation of the NORE1A-induced tubulin nucleation was experimentally difficult to access. Prof. Hermann and his research group worked with experts from the National Institute for Medical Research in London and the University of Virginia. He emphasized, that this proof that Ras amazingly enough exerts a direct regulatory effect on the microtubule cytoskeleton, could never have been attained without this close international collaboration.

Story Source:

Adapted from materials provided by Ruhr-Universitaet-Bochum, via AlphaGalileo.

Journal Reference:

1. C. Bee, A. Moshnikova, C. D. Mellor, J. E. Molloy, Y. Koryakina, B. Stieglitz, A. Khokhlatchev, C. Herrmann. **Growth and Tumor Suppressor NORE1A Is a Regulatory Node between Ras Signaling and Microtubule Nucleation**. *Journal of Biological Chemistry*, 2010; 285 (21): 16258 DOI: 10.1074/jbc.M109.081562

http://www.sciencedaily.com/releases/2010/05/100521092755.htm

Odd Geometry of Bacteria May Provide New Way to Study Earth's Oldest Fossils

Microbial mats growing in hot spring-fed streams offer insights into the evolution of life on early Earth. As mineral-laden water flow over the mat, silica crystals grow, and the mat eventually turns into stone. The lithified mat is an analogue of conical stromatolites that are found in sedimentary rocks that are billions of years old. (Credit: Kate Harris)

ScienceDaily (May 23, 2010) — One way that geologists try to decipher how cells functioned as far back as 3 billion years is by studying modern microbial mats, or gooey layers of nutrient-exchanging bacteria that grow mostly on moist surfaces and collect dirt and minerals that crystallize over time. Eventually, the bacteria turn to stone just beneath the crystallized material, thereby recording their history within the crystalline skeletons. Known as stromatolites, the layered rock formations are considered to be the oldest fossils on Earth.

Deciphering the few clues about ancient bacterial life that are seen in these poorly preserved rocks has been difficult, but researchers from MIT's Department of Earth, Atmospheric and Planetary Sciences (EAPS) and the Russian Academy of Sciences may have found a way to glean new information from the fossils. Specifically, they have linked the even spacing between the thousands of tiny cones that dot the surfaces of stromatolite-forming microbial mats -- a pattern that also appears in cross-sectional slices of stromatolites that are 2.8 billion years old -- to photosynthesis.

In a paper published May 17, 2010 in the *Proceedings of the National Academy of Science*, the researchers suggest that the characteristic centimeter-scale spacing between neighboring cones that appears on modern microbial mats and the conical stromatolites they form occurs as a result of the daily competition for nutrients between neighboring mats.

In addition to helping scientists put a better range on when photosynthesis started, the research provides a new technique for interpreting the patterns of these ancient fossils. By analyzing the length of the triangular

patterns seen in an ancient stromatolite, for example, geologists can now infer more details about the environment in which the microbial mat lived, such as whether it lived in still or turbulent water.

Until now, no one had explored the consistent one-centimeter spacing that appears between the tiny cones featured on microbial mats and conical stromatolites that grow in the hot springs of Yellowstone National Park, and at other locations around the world. Lead author and EAPS graduate student Alexander Petroff and EAPS professors Daniel Rothman and Tanja Bosak proposed that the pattern was not coincidental and could pertain to a biophysical process, such as how the bacteria compete for nutrients.

By studying the physics of photosynthesis, the researchers formed a better understanding of how a mat consumes nutrients from its surroundings over the course of a day, and then metabolizes, or breaks down, those nutrients for energy.

During the daytime, a mat takes in nutrients like inorganic carbon from its immediate surroundings and uses energy from sunlight to build sugars and new bacteria. As these nutrients become locally depleted, the mat starts to consume nutrients from larger distances. At nighttime when it is dark and photosynthesis is not possible, nutrients return to the water immediately surrounding the mat.

The researchers reasoned that in order to avoid direct competition for nutrients, the spacing between mats must be influenced by diffusion, or how molecules spread out over time. In this case, diffusion is itself influenced by the amount of time a mat is metabolically active, which varies over the course of a day due to changes in sunlight. Therefore, the spacing between cones records the maximum distance that mats can compete with one another to metabolize nutrients that are spread by diffusion and later replenished at night. After testing this theory on cultures in the lab, the researchers confirmed their hypothesis through fieldwork in Yellowstone, where the centimeter spacing between mats corresponds to their metabolic period of about 20 hours.

That the spacing pattern corresponds to the mats' metabolic period -- and is also seen in ancient rocks -- shows that the same basic physical processes of diffusion and competition seen today were happening billions of years ago, long before complex life appeared. Petroff and his colleagues are currently researching why biological stromatolites form cones instead of other shapes.

Story Source:

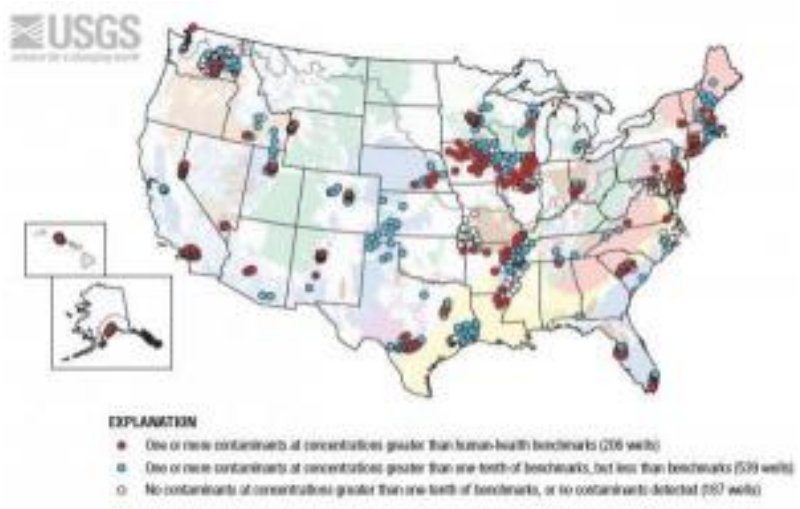
Adapted from materials provided by Massachusetts Institute of Technology. Original article written by Morgan Bettex, MIT News Office.

Journal Reference:

1. Alexander P. Petroff, Min Sub Sim, Andrey Maslov, Mikhail Krupenin, Daniel H. Rothman, and Tanja Bosak. **Biophysical basis for the geometry of conical stromatolites**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.1001973107

http://www.sciencedaily.com/releases/2010/05/100517152520.htm

Large Number of Public Wells in U.S. Have Potentially Harmful Contaminants in Source Water, Study Finds



Twenty-two percent of 932 source-water samples from public wells contained one or more chemical contaminants at concentrations greater than Maximum Contaminant Levels or Health-Based Screening Levels. (Credit: USGS)

ScienceDaily (May 23, 2010) — More than 20 percent of untreated water samples from 932 public wells across the nation contained at least one contaminant at levels of potential health concern, according to a new study by the U.S. Geological Survey.

About 105 million people -- or more than one-third of the nation's population -- receive their drinking water from one of the 140,000 public water systems across the United States that rely on groundwater pumped from public wells

The USGS study focused primarily on source (untreated) water collected from public wells before treatment or blending rather than the finished (treated) drinking water that water utilities deliver to their customers.

"By focusing primarily on source-water quality, and by testing for many contaminants that are not regulated in drinking water, this USGS study complements the extensive monitoring of public water systems that is routinely conducted for regulatory and compliance purposes by federal, state and local drinking-water programs," said Matthew C. Larsen, USGS Associate Director for Water. "Findings assist water utility managers and regulators in making decisions about future monitoring needs and drinking-water issues."

Findings showed that naturally occurring contaminants, such as radon and arsenic, accounted for about three-quarters of contaminant concentrations greater than human-health benchmarks in untreated source water. Naturally occurring contaminants are mostly derived from the natural geologic materials that make up the aquifers from which well water is withdrawn.

Man-made contaminants were also found in untreated water sampled from the public wells, including herbicides, insecticides, solvents, disinfection by-products, nitrate, and gasoline chemicals. Man-made contaminants accounted for about one-quarter of contaminant concentrations greater than human-health benchmarks, but were detected in 64 percent of the samples, predominantly in samples from unconfined aquifers.

"Detections of contaminants do not necessarily indicate a concern for human health because USGS analytical methods can detect many contaminants at concentrations that are 100-fold to 1,000-fold lower than human-health benchmarks," said lead scientist Patricia Toccalino. "Assessing contaminants in these small amounts helps to track emerging issues in our water resources and to identify contaminants that may warrant inclusion in future monitoring."

Scientists tested water samples for 337 properties and chemical contaminants, including nutrients, radionuclides, trace elements, pesticides, solvents, gasoline hydrocarbons, disinfection by-products and manufacturing additives. This study did not assess pharmaceuticals or hormones.

Most (279) of the contaminants analyzed in this study are not federally regulated in finished drinking water under the Safe Drinking Water Act.

The USGS also sampled paired source and finished (treated) water from a smaller subset of 94 public wells. Findings showed that many man-made organic contaminants detected in source water generally were detected in finished water at similar concentrations. Organic contaminants detected in both treated and source water typically were detected at concentrations well below human-health benchmarks, however.

Additionally, the study shows that contaminants found in public wells usually co-occurred with other contaminants as mixtures. Mixtures can be a concern because the total combined toxicity of contaminants in water may be greater than that of any single contaminant. Mixtures of contaminants with concentrations approaching benchmarks were found in 84 percent of wells, but mixtures of contaminants above health benchmarks were found less frequently, in 4 percent of wells.

This USGS study identifies which contaminant mixtures may be of most concern in groundwater used for public-water supply and can help human-health researchers to target and prioritize toxicity assessments of contaminant mixtures. The USGS report identifies the need for continued research because relatively little is known about the potential health effects of most mixtures of contaminants.

Wells included in this study are located in 41 states and withdraw water from parts of 30 regionally extensive aquifers, which constitute about one-half of the principal aquifers used for water supply in the United States.

Human-health benchmarks used in this study include U.S. Environmental Protection Agency Maximum Contaminant Levels for regulated contaminants and USGS Health-Based Screening Levels for unregulated contaminants, which are non-enforceable guidelines developed by the USGS in collaboration with the EPA and other water partners.

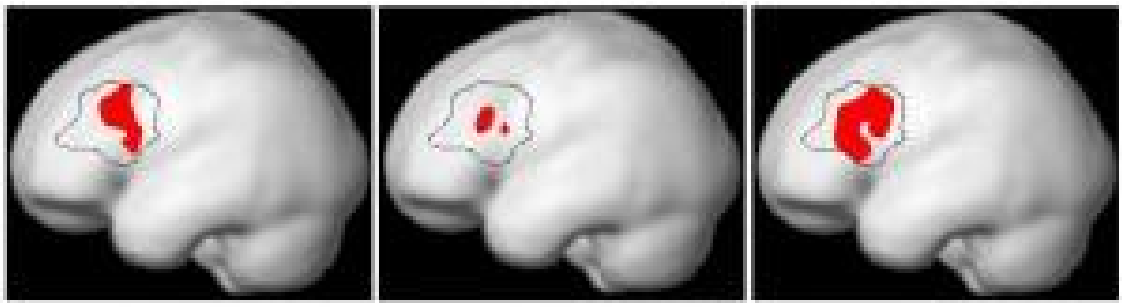
Treated drinking water from public wells is regulated under the Safe Drinking Water Act. Water utilities, however, are not required to treat water for unregulated contaminants. The EPA uses USGS information on the occurrence of unregulated contaminants to identify contaminants that may require drinking-water regulation in the future.

Story Source:

Adapted from materials provided by United States Geological Survey.

http://www.sciencedaily.com/releases/2010/05/100521191446.htm

New Analysis Reveals Clearer Picture of Brain's Language Areas



Sample brain activations of a left frontal language area in three subjects. Activations vary substantially in their precise locations, plausibly due to brain anatomy differences between subjects. Traditional group analyses would only capture a small proportion of each subject's activations and would underestimate the functional selectivity of these regions. (Credit: Evalina Fedorenko / MIT)

ScienceDaily (May 23, 2010) — Language is a defining aspect of what makes us human. Although some brain regions are known to be associated with language, neuroscientists have had a surprisingly difficult time using brain imaging technology to understand exactly what these 'language areas' are doing. In a new study published in the *Journal of Neurophysiology*, MIT neuroscientists report on a new method to analyze brain imaging data -- one that may paint a clearer picture of how our brain produces and understands language.

Research with patients who developed specific language deficits (such as the inability to comprehend passive sentences) following brain injury suggest that different aspects of language may reside in different parts of the brain. But attempts to find these functionally specific regions of the brain with current neuroimaging technologies have been inconsistent and controversial.

One reason for this inconsistency may be due to the fact that most previous studies relied on group analyses in which brain imaging data were averaged across multiple subjects -- a computation that could introduce statistical noise and bias into the analyses.

"Because brains differ in their folding patterns and in how functional areas map onto these folds, activations obtained in functional MRI studies often do not precisely 'line up' across brains," explained Evelina Fedorenko, first author of the study and a postdoctoral associate in Nancy Kanwisher's lab at the McGovern Institute for Brain Research at MIT. " Some regions of the brain thought to be involved in language are also geographically close to regions that support other cognitive processes like music, arithmetic, or general working memory. By spatially averaging brain data across subjects you may see an activation 'blob' that looks like it supports both language and, say, arithmetic, even in cases where in every single subject these two processes are supported by non-overlapping nearby bits of cortex."

The only way to get around this problem, according to Fedorenko, is to first define "regions of interest" in each individual subject and then investigate those regions by examining their responses to various new tasks. To do this, they developed a "localizer" task where subjects read either sentences or sequences of pronounceable nonwords.

Sample sentence: THE DOG CHASED THE CAT ALL DAY LONG

Sample nonword sequence: BOKER DESH HE THE DRILES LER CICE FRISTY'S

By subtracting the nonword-activated regions from the sentence-activated regions, the researchers found a number of language regions that were quickly and reliably identified in individual brains. Their new method revealed higher selectivity for sentences compared to nonwords than a traditional group analysis applied to the same data.

"This new, more sensitive method allows us now to investigate questions of functional specificity between language and other cognitive functions, as well as between different aspects of language," Fedorenko concludes. "We're more likely to discover which patches of cortex are specialized for language and which also support other cognitive functions like music and working memory. Understanding the relationship between language and the rest of condition is one of key questions in cognitive neuroscience."

Next Steps: Fedorenko published the tools used in this study on her website: http://web.mit.edu/evelina9/www/funcloc.html. The goal for the future, she argues, is to adopt a common standard for identifying language-sensitive areas so that knowledge about their functions can be accumulated across studies and across labs. "The eventual goal is of course to understand the precise nature of the computations each brain region performs," Fedorenko says, "but that's a tall order."

Story Source:

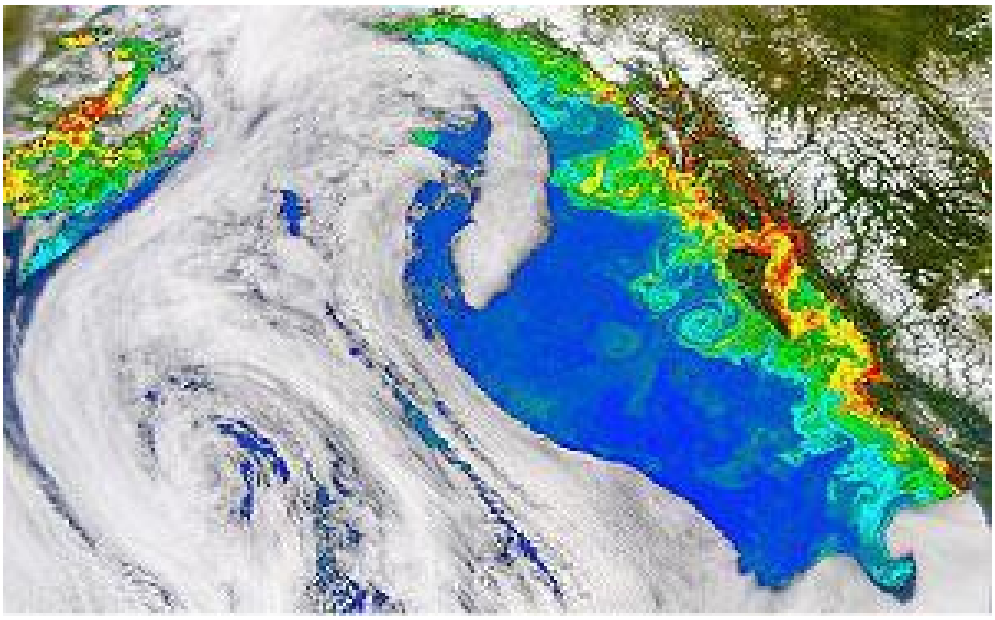
Adapted from materials provided by McGovern Institute for Brain Research, Massachusetts Institute of Technology (MIT).

Journal Reference:

1. E. Fedorenko, P. J. Hsieh, A. Nieto Castanon, S. Whitfield-Gabrieli, N. Kanwisher. **A new method for fMRI investigations of language: Defining ROIs functionally in individual subjects**. *Journal of Neurophysiology*, 2010; DOI: 10.1152/jn.00032.2010

http://www.sciencedaily.com/releases/2010/05/100518144436.htm

Why Do Earth's Storm Tracks Differ from Those of Jupiter?



Atmospheric storm track eddies overlying a dynamic ocean and mountain orography. (Credit: SeaWiFS image courtesy the SeaWiFS Project, NASA/Goddard Space Flight Center, and ORBIMAGE)

ScienceDaily (May 23, 2010) — Computer simulations show that both ocean dynamics, such as the Gulf Stream, and mountain ranges influence the pattern of storm tracks on Earth. This also explains why Earth's storm tracks are so different from those on the gas giant Jupiter.

Storm tracks are regions where swirling eddies are concentrated. On Jupiter, eddies gather into belts at particular latitudes, meaning that the storm tracks circle the planet symmetrically.

But on Earth the storm tracks in the atmosphere, corresponding to regions where weather is highly variable, do not circle the planet uniformly. Although Earth's storm tracks broadly occupy the mid-latitudes, they contain both tilt and along-stream variability in strength. To understand how weather patterns will change in a future climate, we need to understand what mechanisms are responsible for controlling the present-day patterns.

"The main candidates for causing asymmetric storm tracks on Earth are ocean dynamics and mountain orography -- the shape of mountain ranges. Our study, published in the Journal of Climate, examines their relative roles using a special type of computer model, and answers a long-standing debate on the subject," says Dr Chris Wilson of the National Oceanography Centre.

Weather and climate in Europe are affected by small changes to the position of the North Atlantic storm track. Some previous studies suggest that the Gulf Stream has a large warming effect on European climate, since it carries large amounts of warm water from the tropics towards the continent. However, another study suggests that ocean dynamics such as the Gulf Stream are negligible and that the reason for the relative warmth of Europe for its latitude is that mountain orography causes the jet stream to deviate, carrying warm air from the tropics.

Both ocean dynamics and mountain orography provide potential mechanisms to break the symmetry of the storm track, mechanisms which are not present on Jupiter.

"We used an intermediate-complexity coupled ocean-atmosphere climate model to perform a set of highly idealised experiments. First, we made an Earth with a static ocean, which stored and released heat but didn't transport it, and with flat continents without mountains. Then we introduced ocean dynamics and orography in stages, until we got a realistic Earth. This set of four experiments allowed us to study the individual effect of ocean dynamics and orography on the storm track pattern, as well as the effect from their interaction."

Full-complexity climate models require a huge amount of supercomputer resources, so are not suitable to highly idealised experiments. Intermediate-complexity models contain simpler equations describing the physics of the system, but fill a useful niche, allowing testing of ideas before full-complexity simulation. For this study, the intermediate-complexity model FORTE replicates the observed storm tracks to quite a high degree of accuracy in the control simulation, adding confidence to the results from the idealised experiments.

The model experiments show that ocean dynamics and mountain orography play comparable roles in shaping the pattern of Earth's storm tracks. Ocean dynamics act to shift the storm tracks poleward and induce tilt over the western North Atlantic, and mountain orography causes along-stream variability in the storm tracks and tilt over the western Pacific. The interaction between ocean dynamics and orography has a minor local effect on the storm tracks.

"Our study shows that ocean dynamics do influence atmospheric storm tracks and therefore European weather and climate. We do not yet know how sensitive forecasts of European weather and climate will be to the detailed representation of ocean dynamics. However, we have shown that both oceans and mountains influence storm tracks to a similar degree but with different effects," says Wilson.

The researchers are Chris Wilson and Bablu Sinha of the National Oceanography Centre, and Ric Williams of the University of Liverpool.

Story Source:

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

Journal Reference:

1. Chris Wilson, Bablu Sinha, Richard G. Williams. **The Effect of Ocean Dynamics and Orography on Atmospheric Storm Tracks**. *Journal of Climate*, 2009; 22 (13): 3689 DOI: 10.1175/2009JCLI2651.1

http://www.sciencedaily.com/releases/2010/05/100518130636.htm

Increased Cancer Risk of People With Type 2 Diabetes, Large Study Finds

In the largest study worldwide on the combined risk of diabetes and cancer, researchers found that people affected by type 2 diabetes have an elevated risk of 24 of the types of cancer studied. (Credit: Nicole Schuster, Deutsches Krebsforschungszentrum)

ScienceDaily (May 22, 2010) — Cancer and diabetes -- are risk factors the same for these two diseases? Or does diabetes cause processes in the body which promote the onset or growth of cancer? It is still unclear why diabetics have a higher rate of cancer than people who are not affected by this metabolic disorder.

In order to precisely identify the types of cancer in which diabetes plays a role, Kari Hemminki of DKFZ collaborated with colleagues in Sweden and the United States to carry out the largest study ever on cancer risks of people with type 2 diabetes. The study included 125,126 Swedish citizens who had been hospitalized due to problems associated with type 2 diabetes. The epidemiologists compared the cancer incidence in these patients with that of the general population in Sweden.

The scale of the study also made it possible, for the first time, to quantify correlations between diabetes and less common types of cancer. The researchers discovered that people with type 2 diabetes have an increased risk of developing 24 of the types of cancer studied. The most significant risk elevation was established for pancreatic and liver cell cancers. The rate of these cancers in people with type 2 diabetes is elevated by factor six and 4.25 respectively compared to the general population. The epidemiologists also found the risk of cancers of the kidneys, thyroid, esophagus, small intestine and nervous system to be more than twice as high.

In addition, the study confirmed an observation suggesting that people with type 2 diabetes have a significantly lower rate of prostate cancer. This was particularly apparent in diabetes patients with a family history of the disease. The more family members are affected by diabetes, the lower is the personal prostate cancer risk. "Right now, we can only speculate about the causes," said Hemminki. "Possibly, a lower level of male sex hormones in diabetics may be among the factors that are responsible for this."

Could it be that cancer rates in study participants with type 2 diabetes appear to be increased just because their tumors happened to be found earlier as a result of hospital routine diagnostics? To rule this out, the researchers separately analyzed how many cancers had occurred in study participants after one and five years

respectively following their hospital stays. Although this revealed a slightly lower risk elevation, the trend was the same.

In the industrialized countries, between two and twenty percent of the population get type 2 diabetes. Hence, this metabolic disease ranges among the greatest challenges for the public healthcare system. Type 2 diabetes, which used to be incorrectly called "old age diabetes," is characterized by insulin resistance in tissue. It means that the cells of those affected do not take up glucose from the blood upon receipt of an insulin signal.

For their study the scientists evaluated data reported to a registry following every hospital release in Sweden from 1964 to 2007. These data were combined with the Swedish National Family Cancer Database which registers all cancer cases that have occurred in Sweden since 1958. Since the cancer database is linked with a multiple-generation register, it is possible to track cancer cases among parents and siblings of patients.

Story Source:

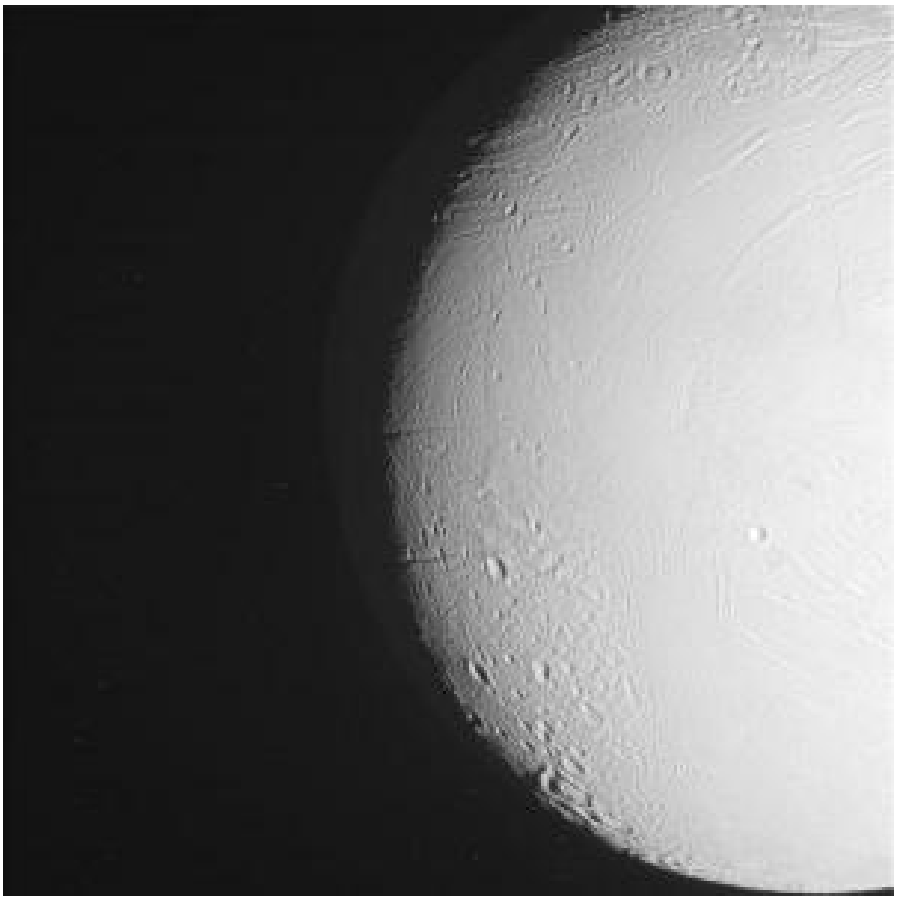
Adapted from materials provided by Helmholtz Association of German Research Centres.

Journal Reference:

1. K. Hemminki, X. Li, J. Sundquist, K. Sundquist. **Risk of Cancer Following Hospitalization for Type 2 Diabetes**. *The Oncologist*, 2010; DOI: 10.1634/theoncologist.2009-0300

http://www.sciencedaily.com/releases/2010/05/100521102629.htm

Cassini Heading to Saturn's Titan After Tagging Enceladus



This raw, unprocessed image of Enceladus was taken on May 18, 2010, by the Cassini spacecraft, which was approximately 75,000 kilometers (46,500 miles) away at the time. (Credit: NASA/JPL/SSI)

ScienceDaily (May 22, 2010) — NASA's Cassini spacecraft is on its way to a flyby of Saturn's largest moon, Titan, after capturing some stunning images of Enceladus. One view shows the hazy outline of Titan behind Saturn's rings, with the dark curve of Enceladus at the bottom.

In other images, Enceladus put its craggy face forward, exhibiting some of the fractures and cratering that have made the Saturnian moon a favorite of both planetary scientists and outer-planet mission groupies. A view of Enceladus' terminator was taken by NASA's Cassini spacecraft on May 18 from approximately 75,000 kilometers (46,500 miles) away.

Cassini sent back numerous images May 18, 2010, as it finished the first leg of its planned double flyby. Cassini passed within about 435 kilometers (270 miles) of the Enceladus surface.

Cassini is heading toward Titan for a flyby that occurs in the late evening May 19 Pacific time, which is in the early hours of May 20 UTC. Because of a fortuitous cosmic alignment, Cassini can catch glimpses of these two contrasting worlds within less than 48 hours, with no maneuver in between.

The main scientific goal at Enceladus was to watch the sun play peek-a-boo behind the water-rich plume emanating from the moon's south polar region. Scientists using the ultraviolet imaging spectrograph will be able to use the flickering light to measure whether there is molecular nitrogen in the plume. Ammonia has already been detected in the plume, and scientists know heat can decompose ammonia into nitrogen molecules. Determining the amount of molecular nitrogen in the plume will give scientists clues about thermal processing in the moon's interior.

The Cassini-Huygens mission is a cooperative project of NASA, the European Space Agency and the Italian Space Agency. The Jet Propulsion Laboratory, a division of the California Institute of Technology in Pasadena, manages the Cassini-Huygens mission for NASA's Science Mission Directorate in Washington. The Cassini orbiter was designed, developed and assembled at JPL.

More raw images from the Enceladus flyby, dubbed "E10," are available at:
http://saturn.jpl.nasa.gov/photos/raw/

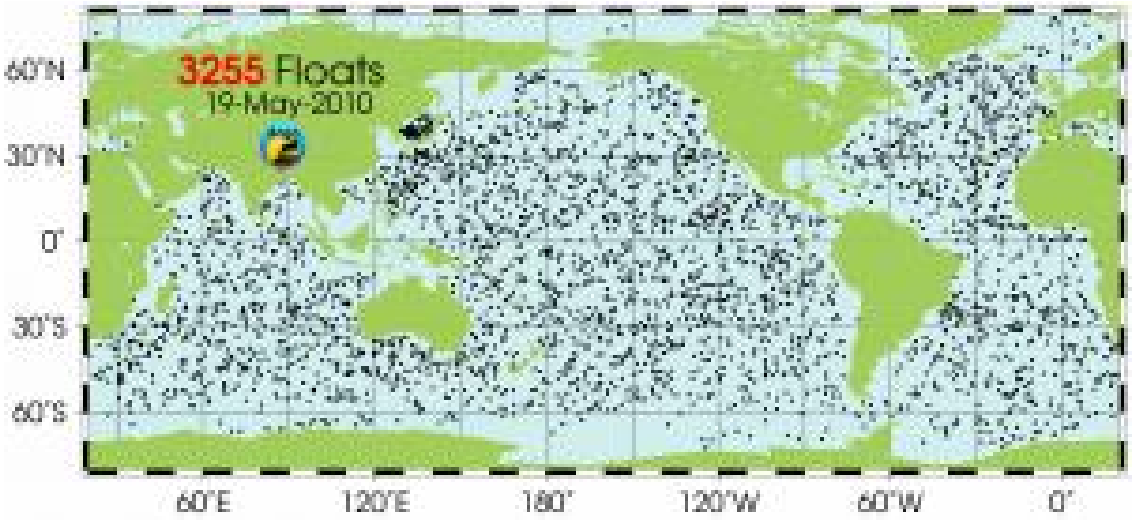
More information on the Titan flyby, dubbed "T68," is online at:
http://saturn.jpl.nasa.gov/mission/flybys/titan20100520/

Story Source:

Adapted from materials provided by NASA/Jet Propulsion Laboratory.

http://www.sciencedaily.com/releases/2010/05/100521210426.htm

Ocean Stored Significant Warming Over Last 16 Years, Study Finds



The international science team analyzed nine different estimates of heat content in the upper ocean, based on ocean temperature data from a global array of more than 3,200 Argo free-floating profiling floats and longer data records from expendable bathythermographs dropped from ships. (Credit: International Argo Project)

ScienceDaily (May 22, 2010) — The upper layer of the world's ocean has warmed since 1993, indicating a strong climate change signal, according to a new study. The energy stored is enough to power nearly 500 100-watt light bulbs per each of the roughly 6.7 billion people on the planet.

"We are seeing the global ocean store more heat than it gives off," said John Lyman, an oceanographer at NOAA's Joint Institute for Marine and Atmospheric Research, who led an international team of scientists that analyzed nine different estimates of heat content in the upper ocean from 1993 to 2008.

The team combined the estimates to assess the size and certainty of growing heat storage in the ocean. Their findings are published in the May 20 edition of the journal *Nature*. The scientists are from NOAA, NASA, the Met Office Hadley Centre in the United Kingdom, the University of Hamburg in Germany and the Meteorological Research Institute in Japan.

"The ocean is the biggest reservoir for heat in the climate system," said Josh Willis, an oceanographer at NASA's Jet Propulsion Laboratory and one of the scientists who contributed to the study. "So as the planet warms, we're finding that 80 to 90 percent of the increased heat ends up in the ocean."

A warming ocean is a direct cause of global sea level rise, since seawater expands and takes up more space as it heats up. The scientists say that this expansion accounts for about one-third to one-half of global sea level rise.

Combining multiple estimates of heat in the upper ocean -- from the surface to about 2,000 feet down -- the team found a strong multi-year warming trend throughout the world's ocean. According to measurements by an array of autonomous free-floating ocean floats called Argo as well as by earlier devices called expendable bathythermographs or XBTs that were dropped from ships to obtain temperature data, ocean heat content has increased over the last 16 years.

The team notes that there are still some uncertainties and some biases.

"The XBT data give us vital information about past changes in the ocean, but they are not as accurate as the more recent Argo data," said Gregory Johnson, an oceanographer at NOAA's Pacific Marine Environmental Laboratory. "However, our analysis of these data gives us confidence that on average, the ocean has warmed over the past decade and a half, signaling a climate imbalance."

Data from the array of Argo floats -- deployed by NOAA and other U.S. and international partners - greatly reduce the uncertainties in estimates of ocean heat content over the past several years, the team said. There are now more than 3,200 Argo floats distributed throughout the world's ocean sending back information via satellite on temperature, salinity, currents and other ocean properties.

Story Source:

Adapted from materials provided by National Oceanic and Atmospheric Administration.

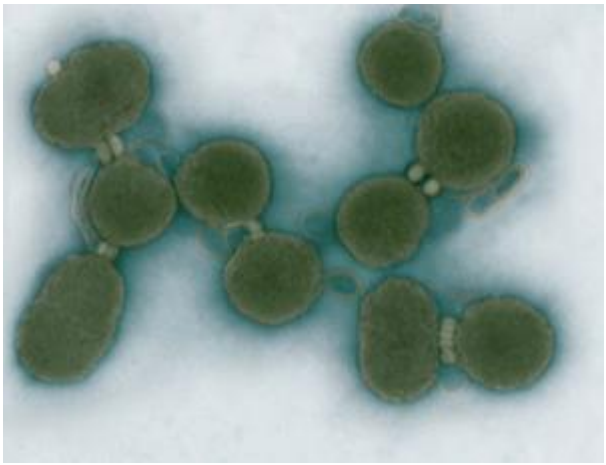
Journal Reference:

1. John M. Lyman, Simon A. Good, Viktor V. Gouretski, Masayoshi Ishii, Gregory C. Johnson, Matthew D. Palmer, Doug M. Smith, Josh K. Willis. **Robust warming of the global upper ocean**. *Nature*, 2010; 465 (7296): 334 DOI: 10.1038/nature09043

http://www.sciencedaily.com/releases/2010/05/100521192533.htm

Where next for synthetic life?

- 26 May 2010 by **Ewen Callaway** and **Andy Coghlan**
- Magazine issue 2762.



JCVI-syn1.0, the first self-replicating species whose parent is a computer (Image: Tom Deerinck and Mark Ellisman/National Center for Microscopy and Imaging Research/University of California)

MAKE a genome - check. Transplant it into an emptied cell to create the world's first synthetic life form - check. Frenzied media coverage accusing the researchers concerned of "playing God" - check.

Craig Venter and his teams at the J. Craig Venter Institute in Rockville, Maryland, and San Diego, California, have shown themselves to be technical wizards by synthesising a genome from code contained on a computer, and using it to start a cell line of the resulting synthetic organism (see "How the synthetic bacterium was made"). If demonstration was needed that there is no such thing as the "mystery of life", they have provided it in stunning style. The new life form they have made is derived from information, pure and simple.

Other synthetic biology researchers, while impressed by Venter's technical achievement, are restrained about its implications, both practical and philosophical. They were already well aware that there is no magical Wizard of Oz behind life's curtain, and they feel the first fruits of synthetic biology - organisms designed to make clean fuels and cheap pharmaceuticals, for example - are more likely to come through less ambitious approaches.

"It's cool and has taken a lot of effort," says Alistair Elfick at the University of Edinburgh, UK. "But it doesn't take us that much further scientifically." He and many other researchers in the field say they are unlikely to synthesise whole bacterial genomes themselves.

It's cool and has taken a lot of effort, but it doesn't take us that much further scientifically

"This is a marvellous advance, but it doesn't immediately open up or enable new studies for the broad community," says James Collins of Boston University, who notes that Venter's team spent about $40 million to create the synthetic cell. "We don't have that kind of money in academic research."

The costs of making long stretches of DNA - currently about $1 per letter - will almost certainly fall. But even if synthetic genomes become dramatically cheaper to make, there is still the question of how to write one. "We have a long way to go to really develop sufficient understanding to build an operational genome from scratch," Collins says.

Genomes are too much of a black box for deliberate and predictable tinkering, says Gos Micklem at the University of Cambridge. "It's like trying to build a car engine when you don't understand what the individual parts do."

Even if biologists learn how to write novel genomes fluently, they face another huge hurdle: getting the enormous molecules to "boot up" in a foreign cell. Venter's genome was modelled on that of a mycobacterium, and was implanted into the cytoplasm of a closely related species. It remains to be seen whether these vessels will accept the genome of drug-making *Escherichia coli* or, more difficult still, a biofuel-producing alga. "It will be very challenging to jump between very different species," Collins says.

These criticisms may be unfair to Venter and his team, as their stated goal was to synthesise a bacterial genome that existed as data and implant it into a cell. As Venter is fond of saying: "This is the first self-replicating species that we've had on the planet whose parent is a computer."

More than anything, the guarded reception from Venter's peers demonstrates how far synthetic biology has come via other routes. In recent years, it has yielded the once costly anti-malarial drug artemisinin, a valuable polymer, and even biofuels. "Those didn't involve millions of genetic changes, those involved a dozen," says George Church at Harvard Medical School in Boston.

The chemical company DuPont has spent the better part of a decade and hundreds of millions of dollars identifying about 20 genetic changes that enable *E. coli* to produce a polymer called 1,3-propanediol. Church and his team have come up with a way of introducing multiple genetic changes into bacteria more quickly and cheaply, called multiplex automated genome engineering or MAGE.

Church is now working on improving the technique. "It's an order of magnitude less expensive to do partial genomes than to do the whole ones, and there are really amazing things that can be done," he says.

For now the preferred approach - and one that is acknowledged by Venter - is to create a "toolbox" of genetic components or "BioBricks" that act in a predictable way, ready for assembly into combinations with whatever properties are desired. These genes or circuits of genes are kept ready and available for assembly into bio-devices that actually have a function.

The Massachusetts Institute of Technology keeps a registry of 2500 BioBricks. Many of these have come from students competing in an annual event called the International Genetically Engineered Machine competition, or iGEM, but according to Richard Kitney at Imperial College London, only about 10 per cent work properly.

So Kitney, in collaboration with the University of California, Berkeley, and Stanford University in California, is creating a professional BioBrick registry. "There are now about 300 parts that are fully understood and characterised," he says. "You can use them to make professionally engineered biological devices."

In contrast to Venter's latest achievement, which demonstrates a proof of principle but has no immediate practical use, everyone involved in BioBrick projects is using biological tools to try and solve practical problems, Kitney says. "All of us are focused on applications... producing devices and systems that spawn new industries."

Kitney and his colleagues have made a biological sensor which detects a protein from bacteria that cause urinary tract infections. The device has three BioBrick components: a detector; an amplifier that increases the signal; and an indicator. The three components form a bio-device which is then placed into *E. coli*.

Going one step further, the team is developing a version that doesn't need an *E. coli* cell. Instead, the three genes are added to a broth and produce a response equivalent to that of a live cell. "We're working on a new version that detects the superbug MRSA, with a red fluorescent protein," Kitney says.

Elfick and his colleagues are tinkering with six enzymes that together can break down cellulose, the normally indigestible polymer in waste plant matter, with the aim of turning plant waste into biofuel.

Venter has the same goals. He just envisions a different way of achieving them, and perhaps it is this ambition that sets him apart from his peers. "There's zero doubt in my mind that being able to control the whole thing from scratch is orders of magnitude more powerful than changing a genome," Venter says. "The unknown is how long it will take us."

How the synthetic Bacterium was made

What has Craig Venter actually produced, and what might he be planning to do with it?

What are the basics?

Craig Venter's team at the J. Craig Venter Institute (JCVI) in Rockville, Maryland, and San Diego, California, made a synthetic cell by stitching together the genome of a goat pathogen called *Mycoplasma mycoides* from smaller stretches of DNA synthesised in the lab. They then inserted the genome into the empty cytoplasm of a related bacterium, *Mycoplasma capricolum*. The transplanted genome booted up in its host cell, and then divided over and over to make billions of *M. mycoides* cells (*Science*, DOI: 10.1126/science.1190719). The new strain has been named JCVI-syn1.0.

Cool. But it sounds familiar.

Venter and his team, which includes geneticists Hamilton Smith and Clyde Hutchison, have previously accomplished both feats - creating a synthetic genome and transplanting a genome from one bacterium into another - but this time they have combined the two.

To trick the *M. capricolum* host into accepting an artificial genome from another species, the team added chemical markers called methyl groups to the synthetic DNA - making it appear to be natural - and knocked out an "anti-invader" enzyme in the host cell. Achieving this trick was the breakthrough - and Venter has not published all the details on how it was achieved.

Why not - do they want to patent the technique?

Yes. JCVI's main funder, a company also headed by Venter called Synthetic Genomics, has exclusive access to all the technology JCVI produces, and has applied for 13 patents on unique synthetic genomes invented by the JCVI team. The JCVI applied in 2006 for a patent on the "minimal bacterial genome" that Venter now hopes to assemble. Entire, customised synthetic genomes with industrially useful capabilities may be easier than natural genes to patent as they do not face the objections raised by attempts at "patenting nature".

Can Venter expect to become mega-rich?

Very likely. The JCVI is a not-for-profit foundation but Venter is hoping that the huge range of potentially useful applications of customised bugs will eventually produce rich dividends for him and for society. Venter

is collaborating with Exxon Mobil to produce biofuels from algae and with Novartis to create vaccines. "As soon as next year, the flu vaccine you get could be made synthetically," he says.

What are the pure science applications?

Synthetic cells have potential as a scientific tool. For example, bacteria could be created that produce new amino acids, the chemical units that make up proteins. Geneticists could then see how these "cyborg" bacteria evolve, compared with bacteria that produce the usual suite of amino acids.

How can they be sure that the new bacteria are what they intended?

The bugs' genomes are "watermarked" with distinctive markers, all of which were found in the synthetic cell when it was sequenced. The watermarks contain the names of 46 scientists on the project, several quotations written out in a secret code, and a website address. As a hint to the code, Venter has revealed the quotations, which include: "To live, to err, to fall, to triumph, to recreate life out of life," from *A Portrait of the Artist as a Young Man* by James Joyce.

Does this mean they created life?

No. The team made the new genome out of DNA sequences that had initially been made by a machine, but bacteria and yeast cells were used to stitch it together and duplicate it. The cell into which the synthetic genome was then transplanted contained its own proteins, lipids and other molecules. Until the host cell is itself built artificially from scratch it cannot be said that life has been created.

Bioterror, kill switches and hara-kiri

Now that synthetic life has been made in the lab, how do we make sure it stays there?

For Venter and his team, bio-containment was simple: the cells they created require a broth of nutrients unlikely to be found outside the lab. Their genome also lacks the harmful genes from the goat pathogen on which it was based. "We don't work with goats, so we think we have pretty good containment systems," Venter says.Future synthetic cells, though, will require extra measures. One approach would be to make cells that incorporate a synthetic amino acid into their proteins, so no proteins could be made without the supplement. James Collins at Boston University envisions a killer genetic circuit that is shut off by a lab chemical, and switched on outside the lab. "If they are not in their happy lab environment they would commit cellular hara-kiri," he says. Bacteria could also be programmed to stop dividing after a certain number of generations.George Church of Harvard Medical School has called for all synthetic biology labs and their suppliers to be registered, an idea the US National Institutes of Health is looking into. "Everybody in the synthetic biology ecosystem should be licensed," Church says.Some companies that make stretches of DNA to order have begun scanning requests to see if they match genes for known toxins, but these measures are only voluntary, and therefore patchy.

Andy Ellington at the University of Texas in Austin says fears of synthetic bioterrorism are in any case overhyped, and probably unrealistic given the $40 million and thousands of person- hours it took Venter's team. "It's not a real threat," he says.

http://www.newscientist.com/article/mg20627622.600-special-report-where-next-for-synthetic-life.html?DCMP=NLC-nletter&nsref=mg20627622.600

The taste of tiny: Putting nanofoods on the menu

- 27 May 2010 by **Emma Davies**

Magazine issue 2761.

It's a small food revolution (Image: Hulton Archive/Getty)

NOTHING says summer holidays quite like ice cream. On a hot afternoon by the sea, there's little to beat the simple pleasure of a cooling scoop of your favourite flavour. Can food get much more satisfying than this?

Vic Morris thinks it can, with the help of nanotechnology. He is part of a team tweaking foods to trick the body into feeling pleasantly full long after the final mouthful - and without overeating.

Ice cream that makes you feel full could be just the beginning. Nanotechnology promises even saltier-tasting salt, less fattening fat, and to boost the nutritional value of everyday products. Nanofood supplements could even tackle global malnutrition.

So what is a nanofood? It isn't just about nanoparticles. Many foods have a natural nanostructure - the proteins in milk form nanoscale clusters, for example - that can be altered on the nanoscale to enhance their properties.

In fact, researchers have been changing the nanostructure of food for years, for example by adding emulsifiers to improve the texture of ice cream. It's the emergence of technologies such as atomic force microscopy that has changed the game by finally opening a window on the nanoworld. Rather than working blind, Morris can now take a close look at the tiny structures he works on, understand their behaviour and then make changes in a more rational and deliberate way.

These imaging techniques are behind the high-satisfaction foods Morris is helping to develop at the Institute of Food Research (IFR) in Norwich, UK, which promise to help fight obesity by making people feel full before they overeat. Many foods, from ice cream to hollandaise sauce, contain emulsions, in which the fat is whipped into tiny droplets coated with a stabilising layer of proteins. Emulsions were always assumed to collapse in the stomach, but Morris has seen otherwise: some don't break down until their protein coat is disrupted by the bile salts they meet in the small intestine.

By cross-linking the proteins, the IFR team can strengthen the protein coat and delay the emulsion's breakdown until the final part of the small intestine, called the ileum. The sudden burst of fats so far down the small intestine triggers the "ileal brake" - the mechanism that makes us feel full. "The body thinks it has a high-fat diet," says Morris. The team is now looking to apply this approach to real foods.

Hitting the ileal brake isn't the only way emulsions could be co-opted into helping cut our fat intake. In "diet" versions of many emulsion-based foods, such as mayonnaise, about half of the fat content is replaced with water, making them less satisfyingly creamy. One alternative is to hide that extra water as nano-droplets within each drop of oil so that the mouth experiences less water and more creamy fat. If the idea works as well on the production line as it does in the lab, low-fat mayonnaise might taste and feel exactly like the regular version.

The encapsulation idea has caught the eye of the food industry. "It's about improving the nutritional value and shelf life of food products without affecting anything else, such as taste or texture," says Charles-François Gaudefroy, an R&D director at Unilever, which owns numerous food brands.

The food industry is notoriously tight-lipped about products in development (see "Ready for nanofoods?"), and Gaudefroy won't say what nanofoods Unilever is looking into. Two other food multinationals, Kraft and Nestlé, declined to talk about their research in the area at all. One area they are likely to be working on, however, is finding ways to add extra nutrients to their products by packaging them inside fat or polymer particles.

"We know that the food industry is looking at encapsulating certain ingredients like omega-3 fatty acids, vitamins or minerals," says Frans Kampers, who researches bionanotechnologies at Wageningen University and Research Centre in the Netherlands. The idea is an attractive one. Oil-soluble nutrients can be poorly absorbed in the watery environment of the gut, with a proportion passing right through the body. Nano-encapsulation converts them to a dispersed form that is more easily taken up (*Current Opinion in Colloid & Interface Science*, vol 14, p 3). Wrapping them in nano packages also extends their shelf life, masks any unpleasant tastes and, in the case of nano-emulsions, makes them invisible to the naked eye so that they don't affect a food's appearance.

The food industry is looking at encapsulating vitamins, minerals and omega-3 fatty acids

However, translating these benefits into practical products is proving difficult. Stabilising nano-emulsions is notoriously hard - as is demonstrating any health benefits. "Three or four years ago there was a lot of hype about nano," says Gaudefroy. Many projects were started on the back of that hype, but quite a few have failed because of the difficulty of delivering something with tangible advantages, he says.

While Unilever, Kraft and Nestlé say they have no nano-enhanced foods on the market, smaller companies are already selling nanofoods over the internet. In the US, RBC Life Sciences, based in Irving, Texas, markets Slim Shake, a "meal-replacement shake". The company does not reveal any technical information about the product, but Kimberly Lloyd of RBC told the BBC in October 2008 that it is taking "4 to 6-nanometre individual silica particles and... coating them with chocolate and cocoa ingredients". The idea is that the increased surface area should deliver more of a flavour hit to the taste buds. The company claims this means less fat and sugar can be used, cutting the calorie count.

It isn't the only such product available. Nanosilver, for example, is available in various health supplements and bottled waters, and its suppliers suggest it can boost the immune system. In November 2008, the European Food Safety Authority rejected a request to approve nanosilver products for sale in the European

Union, because of a lack of safety data. It is "persistent" nanoparticles like silver and silica, which don't break down in the body, that are causing the greatest safety concerns among food researchers, says Morris.

Micrometre-sized persistent particles of silica and titanium dioxide have been used as food additives for decades, for example as whiteners in products like chewing gum, with no apparent ill effects. Make the particles smaller, and things are different: some nanoparticles seem able to penetrate the cells lining the gut, and so have the potential to travel around the body. Last December, a team led by Roel Schins at the Environmental Health Research Institute (IUF) in Düsseldorf, Germany, published research suggesting that some nanoparticles, including silica and titanium dioxide, can induce DNA damage in human intestinal cells (*Nanotoxicology*, vol 3, p 355).

However, other work hints that the body might not be entirely defenceless. In the 1980s, Jonathan Powell, now at the MRC Collaborative Centre for Human Nutrition Research in Cambridge, UK, was part of a team which showed how the gut uses lymphoid structures called Peyer's patches to mop up persistent titanium dioxide and silicate microparticles. They also estimated that everyone in the UK ingests about 40 milligrams of dietary inorganic particles per day. "As far as we can tell, these food additives aren't doing much," he says.

Powell suspects that nanoparticles have always formed naturally in the gut and been scavenged by the Peyer's patches, which are part of the immune system (*Journal of Autoimmunity*, vol 34, p 226). "I think that food additives are riding this route, hijacking the mechanism," says Powell.

While questions over the safety of persistent nanoparticles still linger, other food nanoparticles are essential for our health. Much of the iron in both meat and plant-based foods is in the form of ferritin, a storage protein which forms particles with a diameter of 12 nanometres and an iron oxide core. The human gut has been exposed to these dietary nanoparticles for millennia.

Bottom up

Dora Pereira, one of Powell's colleagues in Cambridge, is working on a project that aims to boost our iron intake by mimicking ferritin. Over 30 per cent of the world's population suffers from anaemia, mostly due to iron deficiency, and today's iron supplements aren't particularly effective. "Current supplements are so different to what we are normally exposed to in our diet that they result in side effects, or are poorly absorbed," says Pereira.

To tackle the problem, the team has made nanoparticulate mimics of ferritin by wrapping iron oxide in a coat made from compounds found naturally in food, such as tartaric acid. Tests on iron-deficient volunteers look promising, says Pereira: the nano-iron was absorbed well and caused fewer side effects than standard supplements.

The benefits of the nanofoods glimpsed so far could be just the beginning. Rather than processing ingredients to create beneficial nanoscale components, a far more flexible approach would be to build foods almost from scratch. A team at the Wageningen University and Research Centre has already created a meat-like structure built up from milk protein to demonstrate how this could one day be done (*Biomacromolecules*, vol 8, p 1271).

While the researchers used a food extract as their starting point, in principle it might one day be possible to synthesise the building blocks of food at the nanoscale and assemble them to make artificial foods. Kampers thinks such an approach could ultimately provide a way to help feed the world's rapidly expanding population. "It is impossible to produce the amount of meat needed and we need to find an alternative high-protein

route."In the shorter term, the benefits of new iron supplements are clear to see, and many will be lured by the promise of a truly satisfying low-fat meal. Feel-full ice cream could soon be on sale at a beach near you.

Editorial: *How to persuade us to swallow nanofood*

Ready for nanofoods?

What might be the first nano-enhanced food to hit supermarket shelves? The food industry remains tight-lipped, and inquisitive consumers might not discover which products are in development until they are actually launched.

In the UK, the food industry recently came under fire from the House of Lords Science and Technology Committee for its lack of transparency. "The food industry did not wish to publicise their work on developing nanotechnology-based products, either here or in the US," says Lord Krebs, chairman of the inquiry into nanotechnologies and food. The committee suggested that food companies are fearful of a consumer rejection of nanotechnology on the same scale as that which affected genetically modified (GM) crops.

Charles-François Gaudefroy of Unilever says they recognise the issues surrounding nanotechnology must be debated in public. "We don't want to be in the position of the GM industry, especially because our products are put on the market for consumers. We are interested in nano but we must make sure that our products are seen with trust and confidence by consumers."

Trust and confidence depend on whether new products can be shown to be safe. "Of course foods have to be safe. For the food industry, safety is a given," says Ian Norton, formerly at Unilever Research, and now at the University of Birmingham, UK. Lord Krebs, a former head of the UK government's Food Standards Agency, is more cautious: "When I was head of the FSA, there were plenty of cases where the food industry's claims about safety were not borne out."

The taste of tiny

Nanoparticles are usually defined as having one or more dimensions of the order of 100 nanometres. But nano isn't always best: in many cases, particles don't have to be that small.

A few years ago, a group of researchers set out to make nano-salt. The smaller the particles, the higher the ratio of the salt's surface area to its mass, and the team reasoned that this would allow them to use less salt to achieve the same taste. The team tested a variety of nano-sized salt particles, but the product that eventually emerged - called Soda-Lo, and sold by Eminate, a spin-out company of the University of Nottingham, UK - has micrometre-sized grains, 50 to 100 times larger than the largest nanoparticles. Particles this size turned out to give the best taste hit, says Kathy Groves of Leatherhead Foods International, who worked on the project. "The saltier salt is the micro salt."

Nanoparticles can have some advantages over their larger cousins, but they also have drawbacks, Groves adds. "A lot of nanoparticles are very sticky and tend to clump together."

Emma Davies is a science writer based in Hertfordshire, UK

http://www.newscientist.com/article/mg20627611.100-the-taste-of-tiny-putting-nanofoods-on-the-menu.html

Cosmic hit-and-runs create failed stars

- 27 May 2010 by **Rachel Courtland**
- Magazine issue 2762.

A snapshot of a circumstellar disc around a Sun-type star being perturbed by a close star-star encounter (Image: Ingo Thies, Pavel Kroupai and Simon P. Goodwin et al)

IT'S hit-and-run on a cosmic scale. Close encounters between swerving young stars might help spawn the brown dwarfs riddling the Milky Way.

Brown dwarfs are balls of gas whose mass is generally dozens of times that of Jupiter. Like stars, brown dwarfs are capable of fusing hydrogen atoms, but they are too lightweight to sustain the process.

The origin of these failed stars is a mystery. Brown dwarfs might form like their larger cousins, collapsing directly from turbulent gas clouds, or they might form in a similar way to planets, condensing out of the discs of gas girdling young stars.

Simulations had shown that instabilities in the disc of gas around an isolated young star can trigger the formation of brown dwarfs. Now Ingo Thies and Pavel Kroupa of the University of Bonn in Germany, and colleagues, have shown that the process can also take place in a more commonplace scenario, involving a crowded cluster of newborn stars.

In new simulations, the team found that young stars that zoom close enough to their siblings can destabilise the surrounding gas discs, allowing denser areas to collapse rapidly and form brown dwarf-sized objects (arxiv.org/abs/1005.3017).

Gas pulled away in such encounters might also form planets with a wide range of orbital inclinations. This could explain the origin of some of the exoplanets that have been detected with orbits significantly tilted with respect to their star's equatorial plane, Thies says.

It is not clear how often brown dwarfs might be created in such stellar hit-and-runs, says Mark Krumholz of the University of California, Santa Cruz. "But this is a nice idea in that it does make some testable predictions." Since there is a higher chance of such close encounters in dense star clusters, we might expect to detect more brown dwarfs there, he says.

http://www.newscientist.com/article/mg20627623.100-cosmic-hitandruns-create-failed-stars.html

Eat bacteria to boost brain power

- 13:00 27 May 2010 by **Debora MacKenzie**

Brain-boosting bug feast (Image: Nicki Pardo/Getty)

Could playing in the dirt make you smarter? Studies in mice suggest that it could.

Mice given peanut butter laced with a common, harmless soil bacterium ran through mazes twice as fast and enjoyed doing so. So says Dorothy Matthews of the Sage Colleges in Troy, New York state, who presented her results at the annual meeting of the American Society for Microbiology in San Diego, California, this week.

In a classic test of learning ability, Matthews gave mice a treat – white bread with peanut butter – as a reward to encourage them to learn to run through a maze. When she laced the treat with a tiny bit of *Mycobacterium vaccae*, she found that the mice ran through the maze twice as fast as mice that were given plain peanut butter. This suggests that they had learned to navigate the maze faster, Matthews says.

Moreover, the mice given the bacteria continued to run the maze faster than those without it for 18 more trials over the next six weeks, showing they weren't just made more alert by a surprise change to their treat. This effect lasted for four weeks after the last piece of doctored peanut butter was given to the mice.

Speedy solvers

Matthews believes this was caused by the effect *M. vaccae* has on the immune system, something that was investigated in 2007 by Chris Lowry, now at the University of Colorado at Boulder.

Lowry was trying to explain why sick people – who have activated immune systems – often become depressed and sluggish, which could be an adaptation that speeds recovery.

His team found that exposing mice to the bacteria, and hence activating their immune system, activated clusters of neurons in their brainstem called the dorsal Raphe nuclei. These neurons connect to the forebrain and other brain structures that regulate mood and behaviour.

This result led Matthews to investigate whether the bacteria's effect on the brain extended to a more general difference in cognitive function – and she found that it did.

Focus on that maze

The bacteria may speed up learning because the Raphe nuclei stimulate a brain region called the hippocampus, which handles spatial memory, she says.

But the bacteria also changed the mice's mood – they showed less behaviour that indicates anxiety, such as grooming and searching, perhaps analogous to the calmer behaviour immune activation triggers in people.

This is likely to have been caused by changes to the higher mental functions in the forebrain, which perhaps allowed them to focus better on the maze.

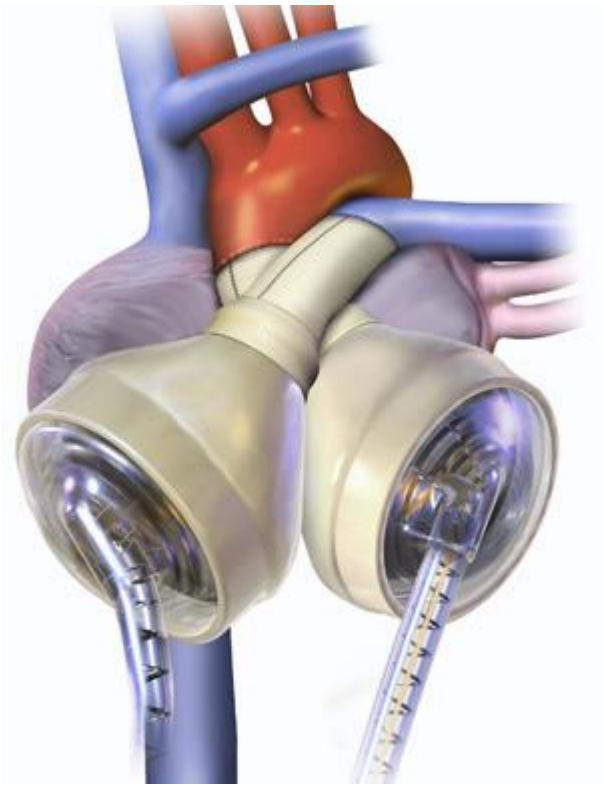
Matthews says that exposure to soil bacteria may affect human brains too. "It just shows that we evolved with dirt as hunter-gatherers," she says. "So turn off your TV and go work in your garden, or walk in the woods."

Journal Reference: *Neuroscience*, DOI: 10.1016/j.neuroscience.2007.01.067

http://www.newscientist.com/article/dn18967-eat-bacteria-to-boost-brain-power.html

Arizona man is first to take artificial heart home

- 17:07 27 May 2010 by **Andy Coghlan**



Artificial heart (Image: SynCardia Systems)

Charles Okeke, a 43-year-old father of three from Phoenix, Arizona, is the first person to leave hospital with a completely artificial heart. Since 3 May he has been home with his family, thanks to a backpack-sized device that is powerful enough to keep his artificial heart pumping while he awaits a donor heart. How does the heart work and what's next for synthetic organs? *New Scientist* provides some answers

What is an artificial heart and who is entitled to receive one?

Since they were first approved for use in people by the US Food and Drug Administration (FDA) in 2004, some 850 people worldwide have been fitted with "total artificial hearts". Made by SynCardia Systems of Tucson, Arizona, they consist of implantable, synthetic pumping chambers, which replace the failing left and right ventricles of a person's real heart.

People qualify to be fitted with one only if both left and right ventricles are failing. The artificial hearts are designed as a temporary arrangement until a real, donated heart becomes available. Until recently, recipients have had to remain in hospital when fitted with one, sometimes for as long as two and half years. As many as 80 per cent of recipients survive long enough to receive a donated heart.

At present, about 3100 Americans need heart transplants each year, but only 2000 donated hearts become available. The typical waiting time is 1 to 2 years.

How do the artificial hearts work?

Surgeons remove both existing ventricles and replace each with a vessel, similar to an upturned funnel, which contains a flexible diaphragm. All four valves of the heart are also removed. The artificial right ventricle is then hooked up to the cardiovascular system so that it can accept "used" blood that arrives, deoxygenated, from the rest of the body, and then pump this out to the lungs for reoxygenation.

The artificial left ventricle is hooked up to receive oxygenated blood from the lungs and pump it out to the rest of the body. The artificial ventricles are able to pump blood because they receive pressurised air from a machine that has to be kept outside the body.

Why does this keep someone hospital-bound?

It's all down to the machine, known as "Big Blue", which pressurises the air. It is simply too large, heavy and bulky for people to carry around with them, meaning they are confined to hospital.

So how did Okeke "escape"?

Hospitalised since his own heart was replaced by an artificial version in September 2008, Okeke is the first to receive a much smaller version of the pumping device called the "Freedom Driver". Also made by SynCardia, it is small enough to fit into a backpack that he must wear continuously.

SynCardia says it has now received permission from the FDA to hook 60 more people up to Freedom Drivers, half of whom will be discharged. The other half will stay in hospital, allowing researchers to compare the health of both groups.

Are patients fitted with this type of artificial heart in any danger?

Peter Weissberg, medical director at the British Heart Foundation, says the biggest risk is of infection since pipes pass from outside the body to the heart. Another worry is that blood clots will form at points in the chambers where blood flow is sluggish, says Don Isaacs, a spokesman for SynCardia. However, he adds that the artificial ventricles are specially shaped to prevent this happening.

Is the SynCardia heart the only option?

It's the only total heart replacement approved by the FDA. But there are plenty of implantable devices that can help the heart function, provided one ventricle is still intact. The best known are left ventricular assist devices (L-VADs), which raise the pressure of blood pumped from the existing but faulty left ventricle. The HeartMate made by Thoratec of Pleasanton, California, is one example. Because they have less work to do than a total artificial heart, people fitted with the devices are able to return home following the implant.

Could someone ever have an artificial heart that would never need to be replaced by a donor heart?

A promising idea is to take a heart from a cadaver and strip it of all flesh, leaving a scaffold of tough collagen tissue that the recipient's immune system would not reject as "foreign". Next, this scaffold could be coated with stem cells from the recipient's bone marrow, which would develop into the tissue and blood vessels of the heart, guided by various growth factors. An even more ambitious project is to follow a similar procedure, but using scaffolds from pig hearts.

Work towards these goals is progressing. For example, a team led by Doris Taylor at the University of Minnesota in Minneapolis has made beating hearts in the lab by coating the stripped-down "scaffolding" of one rat's heart with tissue grown from another rat's stem cells.

What other body parts can be replaced with implants?

Cochlear implants are entirely implanted and have long been used in people with damaged hearing. Meanwhile, an artificial lung called the "BioLung" is under development by MC3, a company based in Ann Arbor, Michigan. Although this siphon-shaped device sits outside the body, it is plumbed into the lungs, helping them exchange gases more efficiently.

http://www.newscientist.com/article/dn18969-arizona-man-is-first-to-take-artificial-heart-home.html?full=true&print=true

What does an amniotic cocktail taste like?

- 16:40 25 May 2010 by **Linda Geddes**

Getting a taste for what mum likes (Image: Julia Fullerton-batten/Stone/Getty)

Bumpology *is our weekly column on the science behind pregnancy, written by our reporter whose own bump is growing larger by the day*

Days to go: 97

Waist size: 89 centimetres (35 inches)

Additional note: Back to craving cakes this week. Perhaps baby is developing a sweet tooth.

Tucking into a particularly spicy curry the other night, I started wondering if my fetus was sharing in any of these wonderful taste sensations. Fetal taste buds are said to develop just 13 to 15 weeks into pregnancy, and we're also told that babies can distinguish between different flavours in breast milk. But do flavours also get into the amniotic fluid?

According to Julie Mennella, a taste researcher at the Monell Chemical Senses Center in Philadelphia, Pennsylvania, they can. "If it gets into the blood supply, it will get into the amniotic fluid and the breast milk," she says.

Volatile compounds, such as the sulphurous compounds that give garlic its taste, are able to get into the blood and thence into the amniotic fluid. Each day in the third trimester of pregnancy, fetuses breathe and swallow around a litre of amniotic fluid, which passes over olfactory receptors in the nose and the taste receptors in the mouth.

Several studies have shown that babies whose mothers consumed garlic or anise during pregnancy are drawn towards those smells in the first few days after birth. "If you take amniotic fluid from mothers who have eaten a really garlicy meal, you can smell it," Mennella says, although she adds that no one to her knowledge has

investigated whether capsaicin – the compound that puts the kick in chillis – can also get into the amniotic fluid.

Safety lesson

The memories of these tastes also seem to persist for some time after birth, and may shape babies' preferences for foods in later life. In 2001, Mennella found that the infants of mothers who drank 300 millilitres of carrot juice four times a week for three weeks during the last trimester of pregnancy, or during the first two months of breastfeeding, showed a greater enjoyment of cereals prepared with carrot juice once they were weaned (*Pediatrics*, vol 107, p e88).

More recently, Mennella says she has found that infants whose mothers ate a lot of fruit during pregnancy are more accepting of fruit when it is introduced to them during weaning. "The baby is learning what foods mom likes," she says. "I think it's the first way they learn what foods are safe and also what foods are available."

Pregnancy and lactation may therefore be ideal times to set babies a good example by eating a healthy and varied diet, she suggests.

It may also be possible to set a bad example, however, as Paula Abate of the Mercedes and Martín Ferreyra Institute of Medical Investigation in Córdoba, Argentina, and her colleagues recently showed. They found that infants whose mothers consumed at least 22.1 grams of alcohol per week during pregnancy – that's just under 3 units (equivalent to two small glasses of wine) – exhibited more smiling, suckling and licking expressions in response to the smell of alcohol than those whose mothers drank infrequently or abstained during pregnancy (*Experimental Biology and Medicine*, DOI: 10.3181/0703-mr-69). None of these infants showed signs of fetal alcohol syndrome, however.

Intoxicated partners

All this raises the question of whether preferences learned in utero extend into the teens or adulthood. Could my mother's wine consumption during pregnancy (she admits that she had the odd glass with dinner) explain my penchant for viognier, for example?

Studies in rats suggest it might. In a slightly bizarre experiment, adolescent rats whose mothers had been given alcohol during pregnancy showed a greater interest in intoxicated partners than those whose mothers hadn't consumed alcohol, and also preferred its smell.

Recent evidence has also suggested that the children of alcoholics are more likely to battle with alcohol problems themselves. Becoming accustomed to the taste during late pregnancy might be one mechanism through which this happens, says Abate. "Prenatal alcohol exposure strongly predicts later drinking patterns and alcohol-related drinking problems," she says.

It is also too early to know just how much a mother needs to drink for the taste to reach her baby, but personally, I'm not going to let this stop me from having the odd glass of wine. I also can't stop wondering what these amniotic cocktails taste like.

http://www.newscientist.com/article/dn18960-bumpology-what-does-an-amniotic-cocktail-taste-like.html?full=true&print=true

Shadows open window into the autistic mind

- 26 May 2010 by **Eugenie Samuel Reich**
- Magazine issue 2761.

Shadows can be distracting (Image: Andy Ryan/Stone/Getty)

WHEN Peter Pan lost his shadow, he was still recognisable, even though most of us find shadows help us to identify objects. Children with autism, however, appear to regard the dark shapes as more of a distraction.

There is evidence that people with autism process images differently, including finding it harder to decode facial expressions. To investigate how autism affects recognition of objects in general, Umberto Castiello of the University of Padua in Italy and colleagues compared the ability of 20 children with autism and 20 children without the condition to recognise objects drawn with and without shadows.

They found that the children with autism named objects without shadows slightly faster than neurotypical children, but were more than 10 per cent slower at naming objects with shadows. "The presence of shadows dramatically affects the ability of autistic individuals to recognise visual objects," says Castiello.

The presence of shadows affects the ability of people with autism to recognise objects

Children without autism link objects and their shadows in a way that improves object recognition, says Castiello. When they were shown pictures with shadows that didn't match the objects, for example a round vase with a triangular shadow, it took them 30 milliseconds longer to name the object.

For children with autism, however, it made little difference whether the shadows matched the objects or not; object recognition was 40 milliseconds slower for any kind of shadow. Castiello concludes that shadows appear to autistic children as nothing more than "noisy" distractions (*PLoS ONE*, DOI: 10.1371/journal.pone.0010582).

Uta Frith, a developmental psychologist specialising in autism at University College London, calls the results "striking". She says that they support a theory that people with autism don't use an object's context - in this case its shadow - to help interpret raw visual data.

More broadly, it's been found that people with autism tend to pay more attention to the component parts of a task than its overall purpose. For example, Frith has observed that children with autism enjoy fitting together the pieces of a jigsaw puzzle but, unlike neurotypical children, are uninterested in the picture being built up.

Castiello suggests teaching children with autism in well-lit classrooms to minimise shadows and distractions.

http://www.newscientist.com/article/mg20627615.100-shadows-open-window-into-the-autistic-mind.html?full=true&print=true

Shape-shifting 'tube robot' could aid heart surgery

- 26 May 2010 by **Paul Marks**

Magazine issue 2761.

The future of heart surgery (Image: Childrens hospital, Boston/Harvard Medical School)

A SURGICAL robot that can change its shape to skirt safely around vital organs and navigate inside arteries could one day spare cardiac patients the risks of open heart surgery.

The instruments currently used in keyhole surgery are either stiff and needle-like, so they can only be manoeuvred in straight lines, or flexible and unable to transmit any force to the tissue. "Catheters are great, but they are like floppy noodles," says Pierre Dupont, a biomedical engineer at Boston University. "They follow curvature and contours, but you have limited control at the tip - you can't pull and push on tissue."

Now Dupont and his team have come up with a way to combine the steerability of a flexible catheter with the stiffness of a needle. Called a concentric tube robot, the technology relies on a series of telescoping curved tubes. As each tube extends and twists from the preceding one, the robot is able to form a multitude of serpentine shapes, allowing it to easily navigate inside an artery while also being stiff enough to transmit force from the surgeon's hand to the area of interest.

The robot could greatly extend the range of procedures that can be carried out via minimally invasive surgery, Dupont told the International Conference on Robotics and Automation in Anchorage, Alaska, this month. For example, it could be used to perform some cardiac operations that currently require open heart surgery, with the robot reaching the heart via the veins in the neck.

The concentric tube robot comprises three gently curved nickel alloy tubes, each a couple of millimetres wide. Surgeons identify the path they wish to navigate in advance, then choose the combination of pre-curved tubes that would enable the robot to adopt the shapes needed to follow that route.

Using electric motors, each tube can rotate independently, and is able to telescope into and out of the other tubes. The surgeon uses a joystick to control the device, aided by software that helps plan the route and steer the robot.

At its tip the robot has a high degree of three-dimensional dexterity, and can be fitted with a number of cutting, gripping and cauterising tools to be used during surgery.

The robot has been tested in heart surgery on pigs. "We successfully used the robot to plug holes in the heart," says Dupont, who is now developing the robot at Boston Children's Hospital.

The team came up with the idea when trying to develop a surgical tool that could gently grasp a fetus's limb to turn it in the right direction for in-utero surgery.

"There's a great need for higher surgical dexterity and these nested tubes seem quite an advance," says Brian Davies, of the medical mechatronics lab at Imperial College London. But he warns that verifying the robot's software is safe - and not prone to lethal, jerky hiccups - will be a major challenge.

http://www.newscientist.com/article/mg20627616.500-shapeshifting-tube-robot-could-aid-heart-surgery.html

Dementia: Sing me the news, and I'll remember it

- 25 May 2010 by **Nora Schultz**

Magazine issue 2761.

I'll remember that (Image: Alan Hicks/Getty)

SINGING to elderly people with dementia helps them form new memories, one of the first skills they tend to lose.

Music is known to aid memory, especially recalling autobiographical information. For example, people with Alzheimer's disease are better at remembering events from their own past when music is playing in the background. It was less clear whether tunes could also help them learn.

Brandon Ally at Boston University and his team were inspired by the report of a man with Alzheimer's who could recall current events if his daughter sang the news to him to the tune of familiar pop songs. They decided to try it out for themselves.

They gave 13 people with Alzheimer's and 14 healthy seniors the lyrics from 40 unfamiliar children's songs to read, half accompanied by the actual song and half by the spoken words. All the participants saw the lyrics again without audio and mixed in with lyrics from a further 40 unknown songs. Those with Alzheimer's were able to recognise 40 per cent of the original lyrics that had been accompanied by song but only 28 per cent of those read to them. The healthy seniors recognised 80 per cent of lyrics, regardless of whether they had been sung or spoken (*Neuropsychologia*, DOI: 10.1016/j.neuropsychologia.2010.04.033).

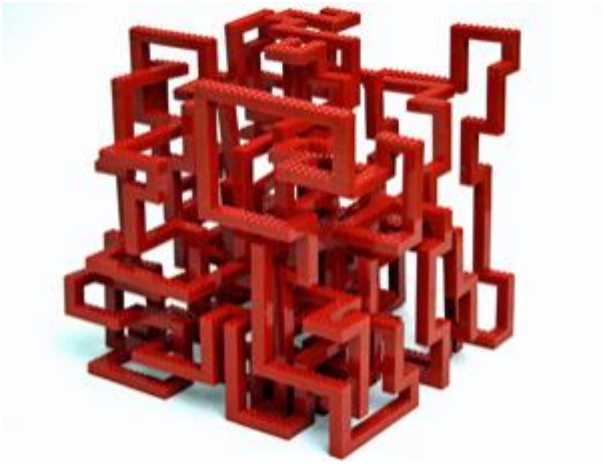
Very few things enhance new learning in people with dementia, says Ally. "It's really cool that hearing the lyrics sung did." He suggests that teaching patients new medication regimes via a song in the early stages of dementia might enable them to live independently for a bit longer.

We don't yet know why singing should help, but Ally says that music engages areas of the brain, including subcortical regions, that are typically spared until later on in dementia. Music may also improve attention, he adds.

http://www.newscientist.com/article/mg20627614.700-dementia-sing-me-the-news-and-ill-remember-it.html

'Human Lego' may one day build artificial organs

- 23 May 2010
- Magazine issue 2761.



Child's play (Image: Balkanpix.com/Rex Features)

BUILDING artificial tissue could become child's play, if Lego-like blocks made of human cells can be assembled into working organs. So far the blocks have been used to build a variety of living 3D shapes that have never before been created on a cell-by-cell basis, such as tubes and solid spheres. The hope is that the bricks will be used to construct artificial tissues for human implantation.

Javier Fernandez and Ali Khademhosseini at the Massachusetts Institute of Technology built the "human Lego" by dipping cells cultured from liver tumours into a polymer called polyethylene glycol (PEG). The parcel was then hardened, or baked, with UV light to form bricks. Another coating of PEG made the bricks sticky, and they were placed in a mold. To fill any gaps, the whole structure was dunked in PEG a final time and irradiated once more (*Advanced Materials*, DOI: 10.1002/adma.200903893).

Despite being trapped and baked within a polymer, cell staining shows that the cultured cells remained alive, says Fernandez, an obvious necessity if they are to be used for artificial tissues. Other attempts to produce 3D cellular structures have failed because cells don't stick to each other, says Fernandez. PEG overcomes this problem.

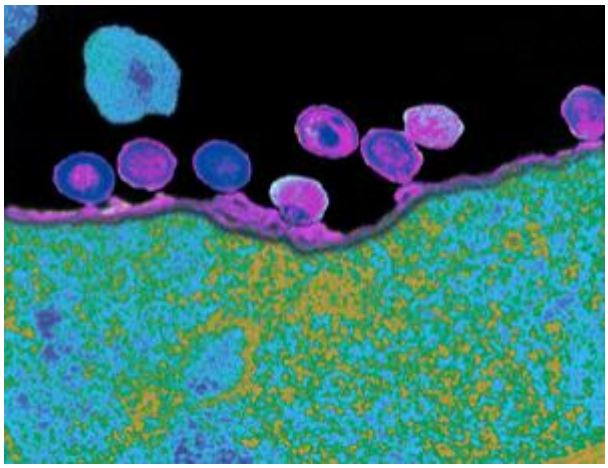
It's a nice idea, says Emmanuel Reynaud of University College Dublin in Ireland, but a polymer is not a tissue. The individual live cells are not communicating, and "cells in a tissue have to communicate with each other".

http://www.newscientist.com/article/mg20627615.200-human-lego-may-one-day-build-artificial-organs.html

Remove HIV's invisibility cloak to defeat it

- 21 May 2010 by **Linda Geddes**, Baltimore

Magazine issue 2761.



Outing the intruder (Image: Voisin/Phanie/Rex Features)

REMOVING a chemical "invisibility cloak" that makes HIV-infected cells look healthy might be the key to ridding people of the virus.

Human cells protect themselves against immune attack by displaying proteins on their surface that mark them as "self". When the immune system detects these proteins, it holds back. One way HIV evades immune attack is by hijacking one of these proteins - CD59 - and using it to disguise itself and the cells it infects as healthy, human cells.

This cloak doesn't kick in directly following HIV infection. First, antigens on HIV's surface prompt the immune system to pump out vast quantities of anti-HIV antibodies, which bind to the antigen and even trigger the destruction of some HIV. But once the infection is established, the CD59 cloak prevents further immune attack on the viral particles and infected cells, which also display the antigen (see diagram, right). "HIV patients have a very strong antibody response, but unfortunately it doesn't work," says Qigui Yu of the Indiana University School of Medicine in Indianapolis.

HIV patients have a very strong antibody response but unfortunately it doesn't work

To kick-start this immune attack, Yu and Xuebin Qin of Harvard Medical School wanted to find a way to remove this cloak. They knew that a bacterium found in the human throat secretes a toxin called intermedilysin that binds to CD59. By isolating the toxin's binding site they made a small molecule called rILYd4.

When they added this molecule to blood from people with HIV, it enabled the antibodies already in the blood to destroy viral particles. Red blood cells and uninfected immune cells were unscathed, probably because there were no antibodies specific to these cells present (*The Journal of Immunology*, DOI: 10.4049/jimmunol.0902278).

Yu has preliminary results suggesting rILYd4 fights infected cells too. At the American Association of Immunologists' meeting in Baltimore, Maryland, last week, he reported that his team infected human immune cells with HIV and exposed them to rILYd4 plus antibodies taken from people with HIV. This destroyed some infected cells, he says, as did transferring another set of HIV-infected human cells to mice subsequently injected with rILYd4 and anti-HIV antibodies.

Robert Siliciano, who researches HIV at Johns Hopkins University in Baltimore, says the approach is interesting. However, he cautions that it may not work against infected cells that have entered a resting state, in which they no longer express HIV antigens.

Yu's answer is to use a "shock and kill" strategy. This involves reactivating infected cells so they express HIV antigens, before adding rILYd4. Meanwhile, Qin's team is trying to reduce the chances of rILYd4 blocking CD59 in normal cells as well as HIV-infected ones, preventing an immune attack on healthy cells.

The drug could prove useful as antiretroviral drugs don't clear the body of HIV. "If you stop using the drug, the virus can bounce back very quickly," Yu says.

http://www.newscientist.com/article/mg20627614.600-remove-hivs-invisibility-cloak-to-defeat-it.html?full=true&print=true

Omega-3: Fishy claims for fish oil

- 20 May 2010 by **Sanjida O'Connell**

Magazine issue 2760.

One pill may not be fit for all (Image: Justin Hutchinson/Getty)

IF I told you that one cheap pill could boost your brain power, protect you from heart disease and cancer, and even alleviate depression, all with no known side effects, would you want it? Who wouldn't?

You've probably heard of the pill's main ingredient: omega-3, a substance found in fish oil and other natural products (see diagram). If the flood of headlines and adverts from food and supplement manufacturers are to be believed, you need only boost your intake of omega-3 and all these benefits will be yours.

Omega-3 supplements first appeared in the early 1980s. Given they are still going strong 30 years later, you would be forgiven for thinking that claims of their beneficence have all been substantiated. Yet several new studies, as well as recent reviews of existing evidence, call this received wisdom into question. So before you splash out on supplements and food fortified with extra omega-3 it might be worth taking a closer look at the evidence. Do any of the claims stand up under scrutiny?

Omega-3 is the name of a family of fatty acids made of chains of carbon atoms of varying length. They cannot be synthesised in the human body, and so must be obtained from our diet. Three members of the family are particularly important to human health. Short-chain alpha-linolenic acid (ALA) is a key molecule found abundantly in green leafy vegetables, walnuts and flax (linseed), rape (canola) and soybean oil, broccoli and algae. It is the vital precursor molecule that gets converted by all mammals into two important long-chain relatives in the omega-3 family, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA).

DHA is vital for human health and is present in membranes of many different types of cells, in particular in the brain and retina. EPA has anti-inflammatory effects. Humans convert between 5 and 10 per cent of ALA to EPA and less than 4 per cent of ALA to DHA. DHA and EPA can also be obtained directly by eating animal products, particularly seafood. Algae make large amounts of EPA and DHA and these fatty acids accumulate up the marine food chain, with the highest levels found in predator fish like mackerel and tuna.

Eye problems

Research into the role of essential fatty acids began in the 1920s. Early studies found that primates deprived of ALA showed depleted levels of DHA, which caused abnormalities in retinal function and visual acuity. Other symptoms included extreme thirst and exceptionally dry hair and skin.

The area was reinvigorated in the late 1970s when Nobel laureate John Vane showed that prostacyclin - a molecule involved in preventing blood from clotting - could be derived from EPA. A flurry of interest followed, including a key paper by Daan Kromhout, published in *The New England Journal of Medicine* in 1985, showing that even a modest intake of fish was associated with low rates of heart disease (vol 312, p 1205). Several subsequent large studies have supported the finding that omega-3 can reduce the chance of a repeat heart attack.

Omega-3's role in protecting people against heart disease seemed clear-cut - at least it did until Lee Hooper, a nutrition researcher at the University of East Anglia, UK, reviewed the results of many of these studies. In 2006 she published her controversial conclusion: "Long-chain and shorter chain omega-3 fats do not have a clear effect on total mortality combined cardiovascular events, or cancer."

"It might work in some groups of people, but not necessarily for all," she says, and points out that one study, carried out by the UK's Medical Research Council Epidemiology Unit in Cardiff, found men who had angina were more likely to die if they were taking fish oil supplements than when on a placebo or eating oily fish. "It wasn't a perfect study but these results worried us," she says.

However, in 2008 a joint report by the World Health Organization and the UN Food and Agriculture Organization (FAO) on fats and fatty acids concluded that omega-3 may contribute to the prevention of coronary heart disease. Tom Sanders, a nutrition researcher at King's College London, who contributed to the WHO report, says that since Hooper's review was published two large studies have shown that purified EPA and DHA can ward off cardiovascular disease. He says an analysis of studies focusing on those who have already had one heart attack generally indicate that if you take oily fish or fish-oil supplements for around two years, the risk of having a second heart attack is reduced by around 18 per cent - even taking into account other confounding variables, such as obesity and smoking.

Sanders, who acted as a consultant for the FAO/WHO report, says the latest analysis of randomised controlled trials shows that taking fish or fish-oil supplements also reduces the risk of having any form of cardiovascular disease by 11 per cent: "We concluded that the evidence is somewhere between probable and convincing that omega-3s can protect you from cardiovascular disease." Hooper though still stands by her 2006 conclusion. "We just don't have good enough evidence," she says.

Sanders admits that we still don't know how omega-3s may confer this protective effect. Because the trial used fish oil, it is still unclear whether any protective role was down to EPA, DHA, ALA or some combination of these.

There is certainly no shortage of claims when it comes to other benefits of omega-3s, yet they are even harder to back up with solid evidence, let alone explain. For example, Joseph Hibbeln, a psychiatrist from the National Institutes of Health in Bethesda, Maryland, has found a correlation between the amount of fish a country eats and the rate of depression there. "There is a large difference in the risk of depression predicted by how much fish people consume," he says. "I was ecstatic when I got these results."

Germans, he found, eat less than 10 kilograms of fish per person per year, and 5 per cent are depressed. By contrast, the Japanese eat around 65 kilograms, and less than 1 per cent of them are depressed. This has led

some researchers to suggest that omega-3 supplements could be used to cure depression. Hibbeln has even linked rates of fish consumption with murder rates in a paper published in the journal *Lipids* in 2004 and believes eating oily fish can reduce aggression, citing a paper published in *The British Journal of Psychiatry*, which made the claim that adding omega-3 from fish oil plus minerals to prisoners' diets reduced levels of violence.

Sanders and Hooper say these correlations have been vastly over-hyped. "These claims take the results much further than the science actually warrants," says Sanders. The old mantra, that correlation doesn't imply causation, should be heeded in other cases too (see "Omega-3 myths").

The claims take the results much further than the science warrants

One of the most common claims for omega-3s is that they can boost brain power. In the UK, Madeleine Portwood from Durham County Council and Alex Richardson from the physiology, anatomy and genetics department at the University of Oxford carried out a trial on nearly 300 children, half of whom took a placebo while the other half took omega-3 fish oil supplements. Portwood and Richardson assessed the children's reading, writing and ability to concentrate and found that there was a significant improvement in those taking omega-3 - but this was seen in only 40 per cent of the children on supplements.

A further study run by Portwood and Durham County Council concluded that pupils who took omega-3 supplements in the year before their GCSE exams got better results than those who did not. Sanders thinks this second study is virtually worthless because there was no placebo control group. "No conclusions can be made about the cognitive benefits of fish oil," he says. As things stand, the claim that taking fish oil can improve mental performance is little better than speculation. None of these results has been replicated and systematic reviews of the evidence fail to find consistent proof of the claims made. A paper published last month reported the results of a two-year double-blind placebo-controlled study, the longest and largest of its kind, that tested the effects of omega-3 supplements on cognitive ability in a group of 867 people aged between 70 and 80. People on omega-3 supplements showed no improvement over the placebo group.

So, apart from possibly protecting you from cardiovascular disease, do omega-3s have any other positive effects? Hooper says omega-3s probably help reduce joint pain caused by rheumatoid arthritis. She points to a review paper published in 2007 in the journal *Pain*, covering 17 randomised, controlled trials of omega-3s on joint pain. "There is evidence that omega-3s' anti-inflammatory properties remove morning stiffness and reduce the amount of anti-inflammatory drugs needed," she says. "But it doesn't stop the progression of arthritis and it does not protect the joint or prevent further deterioration. It only dampens down the pain."

Crucial role

The crucial role of omega-3 during fetal development is well established. Numerous studies have shown that omega-3s, particularly DHA and EPA, are key in the development of the brain and eyes in the fetus and early childhood. As a result, the WHO/FAO report recommends pregnant women slightly increase their EPA and DHA intake from a standard 0.25 grams per day for the average adult, to 0.3 grams per day with at least 0.2 grams being DHA.

Should pregnant women therefore take supplements? Women are better than men at converting ALA to DHA and the fetus is also capable of higher rates of conversion than adults are. Sanders says this means DHA supplements aren't necessary as long as the expectant mother is eating a balanced diet that includes some omega-3 from fish or vegetarian sources.

In adults, omega-3s do slowly get oxidised, and need to be replaced. The WHO recommendation of 0.25 grams per day should more than adequately cover this. Is it worth boosting your intake beyond that? At present there is slim evidence this would have any other effect than moderate the risk of repeat heart attack, and that can be better achieved by other means. Sanders has studied rates of cardiovascular disease in vegetarians - who generally have very low levels of DHA or EPA in their diet - and says they have far lower rates simply because of their healthier lifestyle and the fact that they are less likely to be smokers.

Even if evidence does eventually emerge to suggest that boosting your baseline level of omega-3s can provide clear-cut health and lifestyle benefits, it's highly unlikely that there would be enough fish to provide omega-3s for the planet's burgeoning population. And Sanders thinks it's probably fine to rely on our natural capacity for converting omega-3s from plants into the long-chain omega-3s that fish oil is so rich in. Just 1 gram of ALA - for example, from 10 grams of rapeseed oil, which is less than a tablespoonful - should meet the WHO's recommended levels to prevent deficiency. The WHO also says there is "convincing" evidence that taking between 0.25 and 2 grams of DHA per day could help reduce risk of a fatal heart attack, but, as Sanders says, there are other equally effective ways of protecting yourself from that risk.

The bottom line, as with many nutrition-related questions, is to simply maintain a balanced diet.

Editorial: *Omega-3: Best taken with a big pinch of salt*

Omega-3 myths

ADHD

*Claim***:** omega-3 levels are low in children with attention-deficit hyperactivity disorder and supplements can improve core symptoms

*Current thinking***:** systematic reviews found there were too many inconsistencies between studies to draw any reliable conclusions

Aggression

*Claim***:** countries with a high level of omega-3 in their diet have the lowest murder rates

*Current thinking***:** correlation is not disputed, but critics of the study say this is insufficient evidence to claim causation

Alzheimer's disease

*Claim***:** DHA may delay onset of Alzheimer's, based on evidence from rat studies

*Current thinking***:** two recent large studies found omega-3 supplements had no effect on cognitive function in normal ageing or on the incidence and treatment of dementia

Brain boosting

*Claim***:** fish oil supplements significantly improve reading, spelling and behaviour

*Current thinking***:** a systematic review of all studies found insufficient evidence to identify any effect. The largest study to date reported no effect on cognitive function in later life

Cancer

*Claim***:** DHA can reduce tumour size in rats

*Current thinking***:** a systematic review by the World Cancer Research Fund found little evidence of any effect of omega-3s on cancer. The only reliable study suggested eating fish could reduce the risk of thyroid cancer, but the reviewers believe this was almost certainly due to the iodine content of fish, not omega-3

Depression & other mental health problems

*Claim***:** countries with high levels of omega-3 in their diet have low levels of depression and suicide

*Current thinking***:** when results from randomised controlled trials were systematically reviewed, no evidence of effects on mental health, including schizophrenia and bipolar disorder, were found

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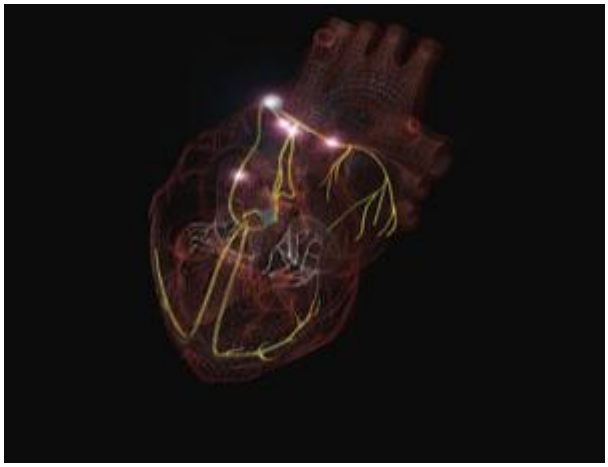
https://mail.google.com/mail/?ui=2&shva=1#inbox/128d7b6dff8bca29

Heartbeats tapped for power generator implant

- 17:12 20 May 2010 by **MacGregor Campbell**



Mobile generator (Image: 3DClinic/Getty)

A minuscule electricity generator implanted in the body could power an early-warning system for hypoglycaemia – or other medical conditions – from a heartbeat. A "nanogenerator" has been implanted in a live rat and has generated electricity from the animal's beating heart. In future it could run in-vivo sensors.

Zhong Lin Wang at the Georgia Institute of Technology in Atlanta knew that at the nanoscale carefully constructed wires of zinc oxide could act as piezoelectric materials – materials that convert mechanical energy into electricity. So with colleagues he set about creating a flexible generator that could harvest energy from natural actions such as breathing or heartbeats.

The team deposited zinc-oxide nanowires on a flexible polymer substrate that allows the nanowires to bend in a variety of ways. They sealed the device in a polymer to shield it from body fluids and to ensure that any electricity they measured was generated by the device, not background interference.

This 2 millimetre by 5 millimetre rectangular device was then attached to a rat's diaphragm muscle using tissue adhesive. "The device is so tiny, you can barely see it by eye," says Wang.

With each breath, the rat's implant stretched and twisted, deforming the nanowires and generating up to 4 picoamps of current at a potential of 2 millivolts. Wang then implanted a similar device on a different rat's heart, generating around 30 picoamps at 3 millivolts.

Power up

While the amount of energy generated is small, Wang thinks he can scale up its output enough to power simple implantable nanosensors – blood pressure or glucose sensors, for instance – that have modest power requirements and don't need a continuous supply.

Wang says that the device can capture motion in any direction, so it does not have to be fixed in a particular alignment. "Any deformation can drive the device," says Wang.

Other devices have already been used to generate power from body movements. For example, last year researchers at NASA's Glenn Research Center in Cleveland, Ohio, implanted a ceramic piezoelectric generator into a rabbit's quadriceps muscle. The device generated enough electricity to continuously power a stimulator attached to the same muscle – but required large movements to generate power.

The Georgia Tech work "is very creative" because it uses involuntary natural actions whose movements are small, says Xudong Wang a nanoengineer at the University of Wisconsin-Madison who was not involved with the research. "It's the first time a nanogenerator has been tied to muscle movements in vivo."

Journal reference: *Advanced Materials*, DOI: 10.1002/adma.200904355

http://www.newscientist.com/article/dn18941-heartbeats-tapped-for-power-generator-implant.html?full=true&print=true

The wisdom of herds: How social mood moves the world

- 24 May 2010 by **John Casti**
- Magazine issue 2761.

Affecting my mood (Image: Katja Lenz/AFP/Getty Images)

DURING an international conference in Switzerland in 2006 I told an audience that if I were to take a 20-year nap, one thing I would certainly not expect to see when I awoke would be a European Union, or at least not one that bore more than a passing resemblance to today's model. This followed an earlier claim of mine that the phenomenon popularly known as globalisation was in the process of rolling over, and that it will be replaced in the coming years by its opposite, localisation. This was probably the least popular talk at the meeting, and a leading candidate for the talk that provoked the most hostile audience reaction of any I have ever given. (I should mention that this was a conference of futurists.)

What a difference a year or two makes. The driving force behind both these temerarious claims is what I call the "social mood" of a population. No collective human activities or actions, such as globalisation or, for that matter, trends in popular culture such as fashions in films, books or haute couture, can be understood without recognising that it is how a group or population sees the future that shapes events. Feelings, not rational calculations, are what matter. To see what our world might be like tomorrow, next year or next decade, we need to spend time and money investigating "social mood".

Put simply, the mood of a group - an institution, state, continent or even the world - is how that group, as a group, feels about the future. Is the group optimistic or pessimistic? Clearly, this question must be addressed on the timescale appropriate for the type of event we care about. For instance, in a short-timescale prediction such as the sort of films people will like next year, it would be useless to look at the shifting mood of the population over decades. But decades would be exactly right for a phenomenon like globalisation.

The mood of a group is how that group, as a group, feels about the future

So how do we measure the social mood? Public opinion surveys and questionnaires are of very limited use since they don't reflect what people actually do. Nor do they take into account that people are influenced by others and don't make decisions independently. The very essence of social cohesion is grouping together, or "herding", which is the opposite of individuals making independent choices.

It turns out that one very useful measure of the social mood, reflecting both actions and herding, is a financial market average. A market index such as the Dow Jones Industrial Average (DJIA) in New York serves remarkably well to characterise the "bets" people make about the future on all timescales. It is not a perfect "mood meter", but it works, is easy to obtain from newspapers, has very little measurement error, and provides historical data on all timescales.

All of these are highly desirable qualities for any practical "sociometer" - a term coined by the American financial guru and social theorist Robert Prechter in his studies of social mood, brought together in 1999 in *The Wave Principle of Human Social Behavior and the New Science of Socionomics*. This wave principle, formally named the Elliott wave principle after accountant Ralph Nelson Elliott, who developed the concept in the 1930s, describes how financial markets follow swings in mood from pessimism to optimism and back, in a natural sequence, creating wave patterns in price movements.

For nearly a decade now, I have been reflecting on the empirical evidence that strongly suggests that events taking place in periods of positive social mood are of a dramatically different character from events you can expect when the mood is negative. So when people are optimistic about the future, words like "unifying", "liberating", "joining" and "tolerant" tend to describe the events we are likely to see. The opposites - "fragmentation", "separation" "restricting", and "bigoted/xenophobic" - describe events that tend to occur in periods of negative mood.

Returning to globalisation, the modern form - the free flow of money, people, ideas and materials across national boundaries - was born at the 1975 World Economic Forum meeting in Davos, Switzerland. That was a time when the social mood was buoyant and rising dramatically. The Group of Six (the global government forum which by 1997 had grown into the Group of Eight, or G8) was set up that year. In 1994, the North American Free Trade Agreement was created, followed by the World Trade Organization in 1995. All three events took place when the DJIA was shooting off into the stratosphere.

The associated skyrocketing globalising process started to run out of steam in early 2000, just when the social mood went into decline for nearly three years. Then, in late 2002, the mood (according to the DJIA) turned upward, leading to the spate of articles, books and media reports extolling the virtues of globalisation that we were bombarded with until the bottom fell out of both the social mood and globalisation - and a lot of other things - in late 2007.

Consider these two headlines: "Unexpected results: globalization has widened income disparity" (*The Wall Street Journal*, 24 May 2007) and "Trade talks fail to get doha plan" (BBC Online, 18 May 2007). Does either sound like it describes a story you would label as being "joining", "unifying" or "tolerant"? They are not about minor technicalities or marginal aspects of globalisation either, but about the very foundations of the process: income balance, free movement of labour, reduction or removal of trade tariffs, and the like. These headlines come from a time when the global social mood, as measured by the DJIA, was rising to its peak in October 2007.

Suppose we want to establish a longer-term picture of Europe's social mood. Using the Dow Jones Stoxx Euro 50 index of blue-chip companies in Europe over the last 25 years, we would add milestone events in the history of the EU to this chart. So, for example, the Single European Act of 1987, the 2001 Treaty of Nice that cleared the way for expanding the union, and the 2009 Lisbon Treaty would be our "positive mood" events, taking place during periods when share prices were topping out. "Negative mood" events, such as setbacks in ratifying the constitution of the EU (2003), the risk to the countries within the euro area from the banking debacle (2008), and the current Greek debt crisis (2010) all took place at periods when shares were tumbling.

To close on a small word of caution: there was never any certainty that the events I have described here would actually happen. Social mood theory provides a probabilistic forecast, not a certainty. But at the end of my book *Mood Matters*, I argue that it is probably a mistake to think that the long-term negative social mood is over. The DJIA topped out in real-money terms - relative to the value of gold - in 1999 and it has been downhill ever since.

I quote John Petersen, founder of the Arlington Institute, a non-profit think tank which specialises in predictive modelling. He believes we are at the start of "megachanges", including the collapse of the global financial system, the end of oil, serious climate change, dramatic rises in food prices, and more. I would add the loss of everyday jobs such as car worker, and supermarket or airline employee. What makes the situation uniquely complex is that the multiple trends are converging.

So, to keep up with the rapidly changing circumstances of the coming years, and cushion ourselves against the "social tsunami" we are facing, the best strategy is to follow Petersen's advice: stay flexible, remain open to new ideas and, most importantly, stay cool.

Profile

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http://www.newscientist.com/article/mg20627616.900-the-wisdom-of-herds-how-social-mood-moves-the-world.html

Could domestication save the bluefin from extinction?

- 21 May 2010
- Magazine issue 2761.

Bringing in bonito (Image: Phil Crean/Alamy)

COULD the tiger of the sea be domesticated - and thereby saved? Plans to farm endangered Mediterranean bluefin tuna moved a step closer this week, following the successful rearing in captivity of the smaller but closely related species, the Atlantic bonito.

Fernando de la Gándara and colleagues at the Spanish Oceanographic Institute in Murcia announced that for the first time they had reared bonito from egg to sexually mature adult - a cycle that takes a year. Now they hope to apply many of the methods to raising bluefin. "We're developing lots of techniques in the bonito that we can use in bluefin larval breeding and handling," says de la Gándara, who is part of the European Union's "Selfdott" project to farm bluefin.

So far, the project has succeeded in keeping bluefin larvae alive for more than two months. But with a breeding cycle of four years, from the larval stage through to spawning, domesticating the bluefin will take a while. "We need at least another four years to close the life cycle of the bluefin," de la Gándara says.

The aim of the Selfdott project is to relieve pressure on the wild stocks of Mediterranean bluefin, which have declined by 50 per cent since the 1970s. Domestication could be the fish's only hope. At the March meeting on trade in endangered species in Doha, Qatar, proposals to ban bluefin trade were defeated.

http://www.newscientist.com/article/mg20627614.000-could-domestication-save-the-bluefin-from-extinction.html

Living in denial: Unleashing a lie

- 21 May 2010 by **Jim Giles**

Magazine issue 2760.

Think diseases spread fast? Lies are faster (Image: Saturn Stills / SPL)

IN November 2006, the conservative columnist Piers Akerman published a scathing attack on climate science in Australia's *Daily Telegraph.* Akerman contended that warnings about warming were deliberately exaggerated. To back his claim, he quoted John Houghton, a former chair of the Intergovernmental Panel on Climate Change, saying: "Unless we announce disasters no one will listen."

Early the next year, Lee Morrison, a conservative Canadian journalist, reused the quote in an opinion piece in the *Calgary Herald*. That summer, a scholar at the Acton Institute for the Study of Religion and Liberty in Grand Rapids, Michigan, repeated it again in a journal article.

So the quote's gradual rise to prominence began. It has now appeared in at least three books, well over 100 blog posts and on around 24,000 web pages. It has become a rallying cry for climate deniers. Yet Houghton never said or wrote those words. His 1994 book usually cited as the source contains no such phrase. The first person to publish them appears to have been Akerman.

How did a fabrication spread so widely? It's something that happens disturbingly often, even with preposterous or discredited claims. According to Cass Sunstein, a legal scholar at Harvard University, the answer lies with the frailties of human psychology. Once released into the wild, erroneous statements follow predictable routes into acceptance or obscurity, driven by well-known psychological processes.

First of all, a falsehood has to have at least a shred of believability. In 2008 bloggers claimed that Obama was the secret love child of Malcolm X. They did not get much traction.

Falsehoods that sound plausible, on the other hand, can seep unquestioned into consciousness. This happens in part because we use mental short cuts to help us make sense of the world, and also because we seldom bother to check the veracity of what we are told. Here, for instance, is a rumour I just made up: England footballer Ashley Cole owns a fur-lined Ferrari. This is both silly and, as far as I know, untrue. But Cole does have a well-known fondness for bling, which people may take into account when evaluating statements about

him. It has been shown that untruths that fit with such mental short cuts are more likely to be remembered as correct, even when there is no evidence they are true.

This may be what drove the spread of the Houghton quote. The writers who recycled it were already hostile to climate science, so the idea that a prominent scientist had been deliberately alarmist probably seemed reasonable to them.

Any falsehood can acquire currency in this way, as long as there are enough people inclined to believe it. Science is especially vulnerable as most people cannot evaluate its claims for themselves - and that can mean anything goes.

Any falsehood can acquire currency if there are enough people inclined to believe it

Once receptive individuals start circulating a falsehood, it is a candidate for widespread dissemination. To understand how some untruths go on to gain general acceptance, we need to consider how social groups shape our judgements.

Mass delusion

Imagine a group of parents who are individually weighing up the evidence for and against vaccination. Let's say that one couple, perhaps already suspicious of mainstream medicine, encounter a rumour that vaccines cause autism, and decide not to vaccinate. The next couple now have new information to consider. As well as the scientific evidence, there is the knowledge that two friends are worried enough not to vaccinate. This might swing them against vaccination too... and so on for each subsequent parent. At some point, expert advice and reports of scientific studies arguing for vaccination come to be outweighed by the mass of parents who say vaccination is unsafe.

This is an informational cascade, a phenomenon first described in 1993 by the economist David Hirshleifer, now at the University of California, Irvine. Cascades can drive the popularity of everything from YouTube videos to medical procedures. They also mean that falsehoods can come to be believed simply because others believe them.

The process is amplified by the "echo chamber" of the internet, which has made it easier than ever to encounter and spread falsehoods. It also makes it easier to start them. Propagators are often aware of what they are doing, according to Sunstein. Some act out of self-interest, such the desire for money or fame. Others are defending an ideology or faith. Some are simply malicious.

The mainstream media often participates in the cascade. John Kerry's 2004 US presidential bid was derailed by a group of Vietnam veterans called the Swift Boat Veterans for Truth, who disputed his war record. Though their allegations were largely unfounded, dozens of media outlets repeated them.

To the casual listener or reader it seemed that pundits everywhere were questioning Kerry's war record. In situations like that, a phenomenon that psychologists refer to as the "illusion of truth" can kick in. "Hearing something 10 times does not mean there are 10 different pieces of information," says Hirshleifer. "But the more you hear something the more likely you are to believe it is true." And so it is with denial: if everybody appears to be saying that climate science is corrupt, or that the MMR vaccine causes autism, it takes on the appearance of fact.

Is there any way to combat the corrosive spread of untruth? The obvious strategy is simply to set the record straight - yet that often fails, and can even be self-defeating.

Political scientists Brendan Nyhan of the University of Michigan, Ann Arbor, and Jason Reifler of Georgia State University, Atlanta, have studied this phenomenon. In one experiment they had students read news stories that included a quote stating, incorrectly, that George W. Bush had banned all stem-cell research. Some stories also included a correction. As expected, students who read the second version were less likely to come away with the belief that Bush had banned stem cell research - but only if they were already sympathetic to Bush. Liberal students were impervious to the correction.

This is an example of confirmation bias, the natural tendency to seek out and believe evidence that fits with our preconceived ideas while ignoring or dismissing the rest.

Self-defeating correction

Another experiment involved a story implying that weapons of mass destruction had been found in Iraq. Some versions of the story included material stating, correctly, that this was not true. Once again, the correction did not get through to those inclined to believe the misconception. In fact, the correction actually hardened some peoples' belief that WMDs were present. The cause of this "backfire effect" is not clear, but could explain why attempts to tackle denial can end up entrenching it.

This does not mean that corrections are never worthwhile. Since Akerman was exposed in February by UK newspaper The Independent, at least one vocal critic of climate science has said he will stop using the quote. Aside from that, however, it is business as usual. Several websites have repeated the quote since.

And Akerman? After the exposé, he published a genuine quote from Houghton, edited to appear alarmist, in an attempt to show he had been right all along. And so the rumour-mongering goes on.

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http://www.newscientist.com/article/mg20627606.300-living-in-denial-unleashing-a-lie.html?full=true&print=true

When a sceptic isn't a sceptic

- 18 May 2010 by **Michael Shermer**
- Magazine issue 2760.

Would you object to this sight even if there was no evidence it was causing harm? (Image: Joseph Eid/AFP/Getty Images)

WHAT is the difference between a sceptic and a denier? When I call myself a sceptic, I mean that I take a scientific approach to the evaluation of claims. A climate sceptic, for example, examines specific claims one by one, carefully considers the evidence for each, and is willing to follow the facts wherever they lead.

A climate denier has a position staked out in advance, and sorts through the data employing "confirmation bias" - the tendency to look for and find confirmatory evidence for pre-existing beliefs and ignore or dismiss the rest.

Scepticism is integral to the scientific process, because most claims turn out to be false. Weeding out the few kernels of wheat from the large pile of chaff requires extensive observation, careful experimentation and cautious inference. Science is scepticism and good scientists are sceptical.

Denial is different. It is the automatic gainsaying of a claim regardless of the evidence for it - sometimes even in the teeth of evidence. Denialism is typically driven by ideology or religious belief, where the commitment to the belief takes precedence over the evidence. Belief comes first, reasons for belief follow, and those reasons are winnowed to ensure that the belief survives intact.

Denial is typically driven by ideology or religious belief, where the belief takes precedence over evidence

Denial is today most often associated with climate science, but it is also encountered elsewhere. For example, there are those who do not believe that HIV causes AIDS. Others say that the Holocaust did not happen, or reject the overwhelming evidence for evolution. All merit the moniker "denier", because no matter how much evidence is laid out before them they continue to deny the claim.

Though the distinction between scepticism and denial is clear enough in principle, keeping them apart in the real world can be tricky. It has, for example, become fashionable in some circles for anyone who dares to

challenge the climate science "consensus" to be tarred as a denier and heaved into a vat of feathers. Do you believe in global warming? Answer with anything but an unequivocal yes and you risk being written off as a climate denier, in the same bag as Holocaust and evolution naysayers.

Yet casting questions like these as a matter of belief is nonsensical. Either the Earth is getting warmer or it is not, regardless of how many believe it is or is not. When I say "I believe in evolution" or "I believe in the big bang", this is something different from when I say, "I believe in a flat tax" or "I believe in liberal democracy".

Either evolution and the big bang happened or they did not; both matters can, in principle, be solved with more data and better theory. But the right form of taxation or government cannot be answered with more data and better theory. They are ideological positions that are established by subjective debate. Liberals committed to one vision of society will marshal evidence to support their political beliefs, while conservatives buttress their own world view. Both sides are sceptical of each other's position, both deny information that contradicts their own views, and in most cases disputes are resolved not through experiment and hypothesis testing but through democratic election.

What sometimes happens is that people confuse these two types of questions - scientific and ideological. Sometimes the confusion is deliberate. Denial is one outcome. Thus, one practical way to distinguish between a sceptic and a denier is the extent to which they are willing to update their positions in response to new information. Sceptics change their minds. Deniers just keep on denying.

Read more: *Special report: Living in denial*

True disbelievers

Climate denial

- **In a nutshell**: Global warming either (1) isn't real (2) isn't caused by humans or (3) doesn't matter
- **Origin**: Corporate astroturfing in the early 1990s
- **Call themselves**: Climate sceptics
- **Influence**: *****

Evolution denial

- **In a nutshell**: The theory of evolution is an atheist conspiracy to undermine religion
- **Origins**: 19th century, though continually renewed
- **Call themselves**: Creationists or intelligent design advocates
- **Influence**: ****

Holocaust denial

- **In a nutshell**: The systematic mass killing of European Jews by Nazi Germany is a fabrication, or at least a wild exaggeration
- **Origins**: Late 1940s
- **Call themselves**: Holocaust revisionists
- **Influence**: *

AIDS denial

- **In a nutshell**: HIV either (1) does not exist or (2) does not cause AIDS
- **Origins**: 1987, when molecular biologist Peter Duesberg of the University of California questioned the link between HIV and AIDS in an academic paper
- **Call themselves**: AIDS truthers
- **Influence**: **

9/11 denial

- **In a nutshell**: The US government either orchestrated or was complicit in the 9/11 attacks
- **Origins**: Doubts about the official version of events were circulating within days of the attacks
- **Call themselves**: 9/11 truth movement
- **Influence**: *

Vaccine denial

- **In a nutshell**: Umbrella term for a disparate movement claiming that certain vaccines either (1) do not work or (2) are harmful
- **Origins**: Has been around for as long as vaccines
- **Influence**: ***

Tobacco denial

- **In a nutshell**: There is considerable uncertainty about the science linking tobacco smoke to lung cancer
- **Origin**: 1970s, tobacco industry
- **Influence**: *

Michael Shermer is the publisher of Skeptic magazine, a columnist for Scientific American, an adjunct professor at Claremont Graduate University in California and the author of Why People Believe Weird Things, Why Darwin Matters and The Mind of the Market. His next book is The Believing Brain

http://www.newscientist.com/article/mg20627606.000-living-in-denial-when-a-sceptic-isnt-a-sceptic.html

Why sensible people reject the truth

- 19 May 2010 by **Debora MacKenzie**

Magazine issue 2760.

Good story, shame about the evidence (Image: Chris Casciano)

HEARD the latest? The swine flu pandemic was a hoax: scientists, governments and the World Health Organization cooked it up in a vast conspiracy so that vaccine companies could make money.

Never mind that the flu fulfilled every scientific condition for a pandemic, that thousands died, or that declaring a pandemic didn't provide huge scope for profiteering. A group of obscure European politicians concocted this conspiracy theory, and it is now doing the rounds even in educated circles.

This depressing tale is the latest incarnation of denialism, the systematic rejection of a body of science in favour of make-believe. There's a lot of it about, attacking evolution, global warming, tobacco research, HIV, vaccines - and now, it seems, flu. But why does it happen? What motivates people to retreat from the real world into denial?

Here's a hypothesis: denial is largely a product of the way normal people think. Most denialists are simply ordinary people doing what they believe is right. If this seems discouraging, take heart. There are good reasons for thinking that denialism can be tackled by condemning it a little less and understanding it a little more.

Whatever they are denying, denial movements have much in common with one another, not least the use of similar tactics (see "How to be a denialist"). All set themselves up as courageous underdogs fighting a corrupt elite engaged in a conspiracy to suppress the truth or foist a malicious lie on ordinary people. This conspiracy is usually claimed to be promoting a sinister agenda: the nanny state, takeover of the world economy, government power over individuals, financial gain, atheism.

All denialists see themselves as underdogs fighting a corrupt elite

This common ground tells us a great deal about the underlying causes of denialism. The first thing to note is that denial finds its most fertile ground in areas where the science must be taken on trust. There is no denial of

antibiotics, which visibly work. But there is denial of vaccines, which we are merely told will prevent diseases - diseases, moreover, which most of us have never seen, ironically because the vaccines work.

Similarly, global warming, evolution and the link between tobacco and cancer must be taken on trust, usually on the word of scientists, doctors and other technical experts who many non-scientists see as arrogant and alien.

Many people see this as a threat to important aspects of their lives. In Texas last year, a member of a state committee who was trying to get creationism added to school science standards almost said as much when he proclaimed "somebody's got to stand up to experts".

It is this sense of loss of control that really matters. In such situations, many people prefer to reject expert evidence in favour of alternative explanations that promise to hand control back to them, even if those explanations are not supported by evidence (see "Giving life to a lie").

All denialisms appear to be attempts like this to regain a sense of agency over uncaring nature: blaming autism on vaccines rather than an unknown natural cause, insisting that humans were made by divine plan, rejecting the idea that actions we thought were okay, such as smoking and burning coal, have turned out to be dangerous.

This is not necessarily malicious, or even explicitly anti-science. Indeed, the alternative explanations are usually portrayed as scientific. Nor is it willfully dishonest. It only requires people to think the way most people do: in terms of anecdote, emotion and cognitive short cuts. Denialist explanations may be couched in sciency language, but they rest on anecdotal evidence and the emotional appeal of regaining control.

Anecdote and emotion

Greg Poland, head of vaccines at the Mayo Clinic in Minnesota and editor in chief of the journal *Vaccine*, often speaks out against vaccine denial. He calls his opponents "the innumerate" because they are unable to grasp concepts like probability. Instead, they reason based on anecdote and emotion. "People use mental short cuts - 'My kid got autism after he got his shots, so the vaccine must have caused it,'" he says. One emotive story about a vaccine's alleged harm trumps endless safety statistics.

Seth Kalichman, a social psychologist at the University of Connecticut at Storrs, understands this better than most: he spent a year infiltrating HIV denialist groups. Many of the people he met were ordinary and sincere. "Denialism fills some need," he says. "For people with HIV, it is a coping strategy," albeit a maladaptive one.

Kalichman, however, feels that everyday reasoning alone is not enough to make someone a denialist. "There is some fragility in their thinking that draws them to believe people who are easily exposed as frauds," he says. "Most of us don't believe what they say, even if we want to. Understanding why some do may help us find solutions."

He believes the instigators of denialist movements have more serious psychological problems than most of their followers. "They display all the features of paranoid personality disorder", he says, including anger, intolerance of criticism, and what psychiatrists call a grandiose sense of their own importance. "Ultimately, their denialism is a mental health problem. That is why these movements all have the same features, especially the underlying conspiracy theory."

Neither the ringleaders nor rank-and-file denialists are lying in the conventional sense, Kalichman says: they are trapped in what classic studies of neurosis call "suspicious thinking". "The cognitive style of the denialist represents a warped sense of reality, which is why arguing with them gets you nowhere," he says. "All people fit the world into their own sense of reality, but the suspicious person distorts reality with uncommon rigidity."

It is not only similar tactics and psychology that unite denial in its many guises: there are also formal connections between the various movements.

Many denialist movements originate as cynical efforts by corporations to cast doubt on findings that threaten their bottom line. Big Tobacco started it in the 1970s, recruiting scientists willing to produce favourable data and bankrolling ostensibly independent think tanks and bogus grass-roots movements (see "Manufacturing doubt"). One such think tank was The Advancement of Sound Science Coalition (TASSC), set up in 1993 by tobacco company Philip Morris (*American Journal of Public Health*, vol 91, p 1749). TASSC didn't confine itself to tobacco for long. After getting funds from Exxon, it started casting doubt on climate science.

Such links between denial movements are not unusual. A number of think tanks in the US and elsewhere have been funded by both the oil and tobacco industries and have taken denialist positions on smoking and warming.

TASSC folded when its true identity became widely known, but its successor, JunkScience, still rubbishes tobacco and climate research and warns people not to believe any scientist who says something "might be" true or uses statistics - which pretty much covers all scientists.

Perhaps it is no surprise that some industries are prepared to distort reality to protect their markets. But the tentacles of organised denial reach beyond narrow financial interests. For example, some prominent backers of climate denial also deny evolution. Prominent creationists return the favour both in the US and elsewhere. Recent legislative efforts to get creationism taught in US schools have been joined by calls to "teach the controversy" on warming as well.

These positions align neatly with the concerns of the US political and religious right, and denial is often driven by an overtly political agenda. Some creationists have explicitly argued that the science of both climate and evolution involve "a left-wing ideology that promotes statism, nanny-state moralism and... materialism".

People who buy into one denialism may support others for this reason. Dan Kahan at Yale Law School has found that people's views on social issues such as abortion and same-sex marriage predict their position on climate science too. This, he argues, is because social conservatives tend to be pro-business and resist the idea that it is damaging the planet (*Nature*, vol 436, p 296).

But other denialisms suggest psychology, not just ideology, is crucial. There is no obvious connection between conservatism and vaccine or AIDS denial, and flu denial was promulgated by a left-leaning group suspicious of the vaccine industry.

Common ground

Nevertheless, some connections exist that hint at a wider agenda. For example, there is considerable overlap in membership between the vaccine and HIV deniers, says John Moore, an AIDS researcher at Weill Cornell Medical College in New York. Both movements have massive but mysterious funding.

Consider, too, the journal of the Association of American Physicians and Surgeons, a lobbying group for private medicine. It showcases nearly all denialist causes. In the past two years it has published articles claiming that HIV tests do not detect HIV, second-hand smoke does little harm, smoking bans do not reduce heart attacks, global warming presents little health threat and proposals for a US vaccination registry are "not really about vaccines but about establishing a computer infrastructure... that can be used for other purposes later". It repeatedly published discredited assertions that vaccines cause autism.

It is tempting to wonder if activists sympathetic to climate and evolution denial might be grasping opportunities to discredit science in general by spreading vaccine and HIV denialism.

The conservative character of much denial may also explain its success at winning hearts and minds.

George Lakoff, a cognitive psychologist at the University of California, Berkeley, argues that conservatives have been better than progressives at exploiting anecdote and emotion to win arguments. Progressives tend to think that giving people the facts and figures will inevitably lead them to the right conclusions. They see anecdotes as inadmissible evidence, and appeals to emotion as wrong.

The same is true of scientists. But against emotion and anecdote, dry statements of evidence have little power. To make matters worse, scientists usually react to denial with anger and disdain, which makes them seem even more arrogant.

Poland has reached a similar conclusion. He has experimented a few times with using anecdote and appeals to emotion when speaking to lay audiences. "I get very positive responses - except from numerates, who see it as emotionally manipulative," he says.

There are lessons here for other scientists who engage with denial. They can only win by learning to speak to the "innumerates", who are otherwise likely prey for denialists.

The stakes are high - and sometimes even personal. Like many vaccine developers, Poland has received death threats. "I get phone messages saying 'I hope your kids are safe'," he says. So has Faye Flam, a *Philadelphia Inquirer* reporter who has written in support of climate science.

I get phone messages saying 'I hope your kids are safe'

Denialism has already killed. AIDS denial has killed an estimated 330,000 South Africans. Tobacco denial delayed action to prevent smoking-related deaths. Vaccine denial has given a new lease of life to killer diseases like measles and polio. Meanwhile, climate change denial delays action to prevent warming. The backlash against efforts to fight the flu pandemic could discourage preparations for the next, potentially a more deadly one.

If science is the best way to understand the world and its dangers, and acting on that understanding requires popular support, then denial movements threaten us all.

Read more: *Special report: Living in denial*

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How to be a denialist

Martin McKee, an epidemiologist at the London School of Hygiene and Tropical Medicine who also studies denial, has identified six tactics that all denialist movements use. "I'm not suggesting there is a manual somewhere, but one can see these elements, to varying degrees, in many settings," he says (*The European Journal of Public Health*, vol 19, p 2).

- **1.** Allege that there's a conspiracy. Claim that scientific consensus has arisen through collusion rather than the accumulation of evidence.
- **2.** Use fake experts to support your story. "Denial always starts with a cadre of pseudo-experts with some credentials that create a facade of credibility," says Seth Kalichman of the University of Connecticut.
- **3.** Cherry-pick the evidence: trumpet whatever appears to support your case and ignore or rubbish the rest. Carry on trotting out supportive evidence even after it has been discredited.
- **4.** Create impossible standards for your opponents. Claim that the existing evidence is not good enough and demand more. If your opponent comes up with evidence you have demanded, move the goalposts.
- **5.** Use logical fallacies. Hitler opposed smoking, so anti-smoking measures are Nazi. Deliberately misrepresent the scientific consensus and then knock down your straw man.
- **6.** Manufacture doubt. Falsely portray scientists as so divided that basing policy on their advice would be premature. Insist "both sides" must be heard and cry censorship when "dissenting" arguments or experts are rejected.

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http://www.newscientist.com/article/mg20627606.100-living-in-denial-why-sensible-people-reject-the-truth.html?full=true&print=true

How corporations manufacture doubt

- 20 May 2010 by **Richard Littlemore**
- Magazine issue 2760.

Producing a smokescreen (Image: Andrei Pungovschi/AP/PA)

YOU can't beat doubt as a corporate strategy - especially if your product is life-threatening when used as directed. These days we don't have to speculate as to whether industries have manufactured doubt. They have admitted it too many times.

In 1972, Tobacco Institute vice-president Fred Panzer outlined his industry's "brilliantly executed" defence strategy. A key tactic was "creating doubt about the health charge without actually denying it" while "encouraging objective scientific research."

"Objective scientific research": those words would almost make you believe that Panzer was talking about objective science. But when doubt is your goal, the misuse of language is just another way to confuse the public.

Where tobacco led the way, coal and chemicals followed. And, of course, the fossil fuel industry has been working overtime - and with shocking success - creating doubt about climate change.

Techniques appear to be limited only by the imagination and integrity of the campaigners - which is to say, there don't appear to be any limits. One of the best is to just flat-out lie.

A coalition of US coal and electricity companies set the tone in the 1990s with the creation of the Information Council on the Environment (ICE). It's purpose: to "reposition climate change as a theory not a fact".

ICE hired a PR firm to create advertising messages. These ranged from the ridiculous - "Who told you the Earth was getting warmer... Chicken Little?" - to the blatantly false - "If the Earth is getting warmer, why is Minneapolis getting colder?" But the focus groups found them effective, and that is all that mattered.

ICE also hired scientists to sign querulous opinion-page articles and PR agencies to harass journalists. Today, journalists - embattled, overwhelmed and committed to "balance", no matter how spurious - are useful conduits for spreading doubt.

Other corporate tactics include the creation of phoney grass-roots organisations. The pioneer was The Advancement of Sound Science Coalition (TASSC), set up in 1993 by a group of tobacco, nuclear energy, agribusiness, chemicals and oil companies. TASSC's stated goal was to "encourage the public to question - from the grass roots up - the validity of scientific studies."

ICE and TASSC are no more, but their tactics live on. The doubt industry has ballooned in the past two decades. There are now scores of think tanks pushing dubious and confusing policy positions, and dozens of phoney grass-roots organisations created to make those positions appear to have legitimate following.

It's a hardball world. Never doubt it.

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http://www.newscientist.com/article/mg20627606.200-living-in-denial-how-corporations-manufacture-doubt.html

Questioning science isn't blasphemy

- 22 May 2010 by **Michael Fitzpatrick**
- Magazine issue 2760.

Is "denier" just another insult? (Image: Rodger Bosch / AFP / Getty)

THE epithet "denier" is increasingly used to bash anyone who dares to question orthodoxy. Among other things, deniers are accused of subordinating science to ideology. In his book *Denialism: How irrational thinking hinders scientific progress, harms the planet, and threatens our lives*, for example, Michael Specter argues that denialists "replace the rigorous and open-minded scepticism of science with the inflexible certainty of ideological commitment".

How ironic. The concept of denialism is itself inflexible, ideological and intrinsically anti-scientific. It is used to close down legitimate debate by insinuating moral deficiency in those expressing dissident views, or by drawing a parallel between popular pseudoscience movements and the racist extremists who dispute the Nazi genocide of Jews.

As philosopher Edward Skidelsky of the University of Exeter, UK, has argued, crying denialism is a form of ad hominem argument: "the aim is not so much to refute your opponent as to discredit his motives". The expanding deployment of the concept, he argues, threatens to reverse one of the great achievements of the Enlightenment - "the liberation of historical and scientific inquiry from dogma".

Don't get me wrong: the popular appeal of pseudoscience is undoubtedly a problem. But name-calling is neither a legitimate nor an effective response.

Take, for example, two areas in which I have had some involvement: the controversies arising from Peter Duesberg's claim that HIV does not cause AIDS, and the links between vaccines and autism alleged by the former academic gastroenterologist Andrew Wakefield.

Both Duesberg and Wakefield were reputable scientists whose persistence with hypotheses they were unable to substantiate took them beyond the limits of serious science. Though they failed to persuade their scientific peers, both readily attracted supporters, including disaffected scientists, credulous journalists, charlatans, quacks and assorted conspiracy theorists and opportunist politicians.

In both cases, scientists were dilatory in responding, dismissing the movements as cranks and often appearing to believe that if they were ignored they would quietly disappear. It took five years before mainstream AIDS scientists produced a comprehensive rebuttal of Duesberg. Though child health authorities were alert to the threat of the anti-vaccine campaign, researchers were slow to respond, allowing it to gather momentum.

Social psychologist Seth Kalichman of the University of Connecticut in Storrs mounts a typical defence of this stance in his book *Denying Aids: Conspiracy theories, pseudoscience, and human tragedy*. According to Kalichman, denialists often "cross the line between what could arguably be protected free speech". He justifies suppression of debate on the feeble grounds that this would only legitimise the deniers and that scientists' time would be better spent on research.

Such attempts to combat pseudoscience by branding it a secular form of blasphemy are illiberal and intolerant. They are also ineffective, tending not only to reinforce cynicism about science but also to promote a distrust for scientific and medical authority that provides a rallying point for pseudoscience.

As Skidelsky says, "the extension of the 'denier' tag to group after group is a development that should alarm all liberal-minded people". What we need is more debate, not less.

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Michael Fitzpatrick is a London doctor and author of Defeating Autism: A damaging delusion (Routledge, 2009)

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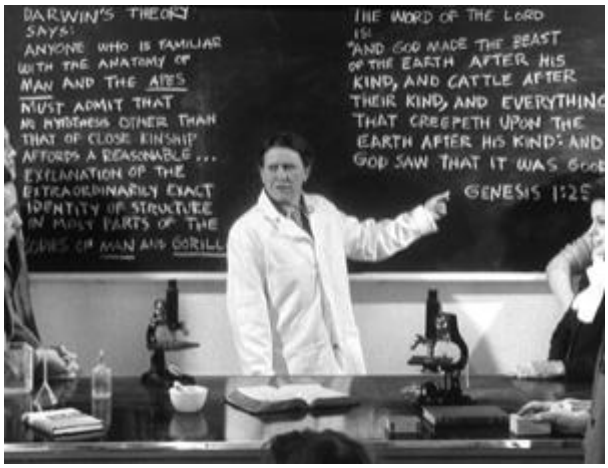
The truth is our only weapon

- 23 May 2010 by **Michael Shermer**
- Magazine issue 2760.



How should we deal with denialists? (Image: Francis Miller / Contributor)

ENGAGING with people who doubt well-established theories is a perennial challenge. How should we respond?

My answer is this: let them be heard. Examine their evidence. Consider their interpretation. If they have anything of substance to say, then the truth will out.

What do you do, however, with people who, after their claim has been fully discussed and thoroughly debunked, continue to make the claim anyway? This, of course, is where scepticism morphs into denialism. Does there come a point when it is time to move on to other challenges? Sometimes there does.

Case in point: Holocaust denial. In the 1990s, a number of us engaged Holocaust deniers in debate and outlined in exhaustive detail the evidence for the Nazi genocide. It had no effect. They sailed on through into the 2000s making the same discredited arguments. At that point I threw up my hands and moved on to other challenges. By the late 2000s the Holocaust deniers had largely disappeared.

Throwing up your hands is not always an option, though. Holocaust denial has always been on the fringe, but other forms - notably creationism and climate denial - wield considerable influence and show no signs of going away. In such cases, eternal vigilance is the price we must pay for both freedom and truth. Those who are in possession of the facts have a duty to stand up to the deniers with a full-throated debunking repeated often and everywhere until they too go the way of the dinosaurs.

Those in possession of the facts have a duty to stand up to deniers with a full-throated debunking

We should not, however, cover up, hide, suppress or, worst of all, use the state to quash someone else's belief system. There are several good arguments for this:

- **1.** They might be right and we would have just squashed a bit of truth.
- **2.** They might be completely wrong, but in the process of examining their claims we discover the truth; we also discover how thinking can go wrong, and in the process improve our thinking skills.
- **3.** In science, it is never possible to know the absolute truth about anything, and so we must always be on the alert for where our ideas need to change.
- **4.** Being tolerant when you are in the believing majority means you have a greater chance of being tolerated when you are in the sceptical minority. Once censorship of ideas is established, it can work against you if and when you find yourself in the minority.

No matter what ideas the human mind generates, they must never be quashed. When evolutionists were in the minority in Tennessee in 1925, powerful fundamentalists were passing laws making it a crime to teach evolution, and the teacher John Scopes was put on trial. I cannot think of a better argument for tolerance and debate than his lawyer Clarence Darrow's plea in the closing remarks of the trial.

"If today you can take a thing like evolution and make it a crime to teach it in the public schools, tomorrow you can make it a crime to teach it in the private schools, and next year you can make it a crime to teach it in the church. At the next session you can ban books and the newspapers. Ignorance and fanaticism are ever busy... After a while, your honour, it is the setting of man against man, creed against creed, until the flying banners and beating drums are marching backwards to the glorious ages of the 16th century when bigots lighted fagots to burn the man who dared to bring any intelligence and enlightenment and culture to the human mind."

http://www.newscientist.com/article/mg20627606.500-living-in-denial-the-truth-is-our-only-weapon.html

I, microbe: Sequencing the bugs in our bodies

- 20:32 20 May 2010 by **Caitlin Stier**

Microbes - in our guts, on our skin and elsewhere - outnumber our own cells by about 10 to 1 (Image: Henrik Sorensen/Getty)

People are more microbe than human, with microbes outnumbering our cells by 10 to 1. But strangely, scientists know more about the microbes that inhabit the soil and sea than those that call us home. Now, the genetic sequencing of 178 of these microbes will help close that gap.

Scientists have long known that our microbial inhabitants, collectively known as the microbiome, can contribute to disease. But culturing the cells outside of the human body can be difficult, complicating efforts to identify many of them, particularly rare species.

The Human Microbiome Project, funded by the US National Institutes of Health, has now used next-generation DNA sequencing technology to study these microbes straight from the source.

A sequel to the human genome project, the project is one of several around the world aiming to characterise the microbiome. It seeks to take a census of microbes from five key sites – the gut, skin, mouth, airways, and urogenital tract – to understand the way the microbes contribute to human health and disease.

So far, the project has sequenced the genomes of 178 microbes towards its ultimate goal of 900, identifying more than 500,000 new genes in the process.

Bacteria as balm

"By being able to characterise more of these species, I think we're gaining more ground in terms of beneficial organisms on the human body and how we can use them to benefit our health," says Karen Nelson, team leader at one of the project's four main sequencing centres, the J. Craig Venter Institute in Rockville, Maryland.

The sequencing project could help pinpoint microbes that contribute to disease, which could lead to new treatment strategies. For example, previous research revealed that the bacterium *Faecalibacterium prausnitzii* helps counteract the misdirected immune response that ravages the gut in people with Crohn's disease. Genetic sequencing may uncover other beneficial bacteria that could be used to treat – or prevent – disease, much as probiotic yogurt helps to regulate digestion.

So far, the project has focused on relatively simple microbes that do not have nuclei in their cells – bacteria and archaea. But project members are now turning their attention to larger organisms with nuclei, called eukaryotes, as well as viruses.

"To me, this is one of the most exciting projects I have worked on," says team member Jane Peterson of the NIH National Human Genome Research Institute in Rockville. "It really is the unknown."

Journal reference: *Science* (vol 328, p 994)

http://www.newscientist.com/article/dn18943-i-microbe-sequencing-the-bugs-in-our-bodies.html

Magic numbers: A meeting of mathemagical tricksters

- 13:44 24 May 2010 by **Alex Bellos**
- Magazine issue 2762.

Getting together for some mathematical fun (Image: Kendrick Brinson)

Martin Gardner, who inspired the gathering we report on in this article, died on Saturday. New Scientist consultant Jeff Hecht has written an assessment of his career on our CultureLab blog.

Gary Foshee, a collector and designer of puzzles from Issaquah near Seattle walked to the lectern to present his talk. It consisted of the following three sentences: "I have two children. One is a boy born on a Tuesday. What is the probability I have two boys?"

The event was the Gathering for Gardner earlier this year, a convention held every two years in Atlanta, Georgia, uniting mathematicians, magicians and puzzle enthusiasts. The audience was silent as they pondered the question.

"The first thing you think is 'What has Tuesday got to do with it?'" said Foshee, deadpan. "Well, it has everything to do with it." And then he stepped down from the stage.

The gathering is the world's premier celebration of recreational mathematics. Foshee's "boy born on a Tuesday" problem is a gem of the genre: easy to state, understandable to the layperson, yet with a completely counter-intuitive answer that can leave you with a smile on your face for days. If you have two children, and one is a boy, then the probability of having two boys is significantly different if you supply the extra information that the boy was born on a Tuesday. Don't believe me? We'll get to the answer later.

As a melting pot of outside-the-box abstract thinking, this gathering is one of a kind. Attendees were invited to make the world's first snub dodecahedron out of balloons, shown how to solve the Rubik's cube while blindfolded and given tips on how to place a lemon under a handkerchief without anyone knowing. The 300 guests included magicians, origamists, artists, maze designers, puzzle writers, toy inventors and cognitive psychologists, as well as some of the world's most gifted mathematicians.

Origami letters

Erik Demaine, for example, is a former winner of the MacArthur fellowship, aka the "genius award", and the youngest person in recent years to be made a professor at the Massachusetts Institute of Technology. Now aged 29, he presented to the gathering some typefaces that he had invented as a result of his academic work in computational geometry. The "hinged dissection font" is a font in which each letter can be made from the same linked chain of 128 identical isosceles triangles. (A hinged dissection is a technique in which a large shape is divided up into smaller shapes, linked together with "hinges", and then refolded into another large shape.)

The letters looked distinctive, if a little clunky. Demaine reckoned the typeface had another more serious problem: "It's way too easy to read!" So he revealed a brilliantly incomprehensible font based on his work in origami: the "origami maze font", for which each letter of the alphabet is the origami fold-pattern that, once folded, would make that letter protrude from the page.

When he started to write in this font, and the screen at the front of the hall filled with an impenetrable grid of red and blue lines – red lines are the "mountain" folds and the blue ones the "valley" folds – the audience clapped and guffawed.

Recreational mathematics may be the "mathematics of fun" but it often inspires serious science. Hinged dissections were invented by the British puzzle creator Henry Dudeney a century ago. Though Demaine became interested in them and in origami for purely playful purposes, they have resulted in some of his most important academic research. Hinged dissections form the basis of his designs for reconfigurable robots, in which blocks hinged together in a chain can be made to fold into any three-dimensional shape.

The pop-up lettering technique behind his origami font could, he says, be used with paper that can pucker up to form tactile shapes: to make, for example, a map you can read in the dark. "There is no way to predict from the recreational side to the product side," Demaine says.

Games master

The four-day Gathering for Gardner, or G4G, owes its name to the journalist Martin Gardner, who died as this article was going to press, aged 95. Between 1957 and 1981 Gardner wrote the monthly "Mathematical games" column in *Scientific American*, which inspired a cult following. A decade after he put down his pen, Atlanta businessman and puzzle collector Tom Rodgers decided to pay tribute to Gardner by organising a gathering in his honour.

This year the gathering mostly took place in the windowless conference room of an Atlanta hotel, apart from one afternoon when everyone relocated to Rodgers's residence on the outskirts of Atlanta. It's a modern house surrounded by a Japanese garden, containing geometrical sculptures and a pathway based on the Fibonacci sequence. Here the guests are free to indulge in all manner of mathematical recreations: University of Arkansas mathematician Chaim Goodman-Strauss led a group in building a Hilbert-space-filling curve out of 320 kilograms of steel; performance artist Caspar Schwabe constructed a "kinetic bamboo hyperboloid"; and composer Vi Hart demonstrated how to make polyhedra out of balloons.

As a melting pot of outside-the-box abstract thinking, this gathering is one of a kind

Of the three main professions represented – mathematicians, magicians and "puzzle people" – the magicians were the easiest to spot: they tended to wear black jackets. Mark Setteducati was a prime example, and he also

wore a dandyish black shirt. He was displaying a copy of a puzzle he had invented called Jigazo, currently the top-selling puzzle in Japan.

Setteducati is a performing magician who curates the magic side of the G4G. Magic was chosen as a theme because Gardner himself was an amateur magician and his first foray into mathematics writing in the 1950s was a book on the mathematics of magic. The two disciplines are happy bedfellows: both exhibit a wonder at the structure of the world, and seek playful ways to subvert it.

Mathemagics

The G4G facilitates the free exchange of ideas between the magical and mathematical communities. The Jigazo – which will be released in Europe and the US later this year – was a product of this traffic. At a previous G4G, Setteducati met the computer graphics pioneer Ken Knowlton, and the puzzle is a collaboration between them.

The Jigazo is a jigsaw puzzle that can be customised to display any picture you want. It contains 300 identically shaped pieces that are all a different shade of blue, and all have a unique symbol on the back. If you take a portrait of yourself and email the image to the Jigazo website, you will receive an email back with a map of the arrangement of the symbols such that when the pieces are assembled in this way the jigsaw shows your portrait.

"What I love about this is the magic behind it," says Setteducati. "With 300 pieces you can make any face in the world." In this context, "magic" means a good deal of fiendishly clever number-crunching.

Setteducati gave me his business card, which is written in backwards-script and incorporates a mirror to read it the right way round. Judged on the originality of its guests' business cards, the G4G is a pretty special event: several were origami models or unusual shapes. The card of Pablos Holman, futurist and security expert, was completely black, his details only visible in UV light.

Another charming aspect of the gathering is the age range of those present. Many of Gardner's contemporaries still come, including 93-year-old mathematician Richard Guy and Solomon Golomb, aged 88, whose work on polyominoes – dominoes with more than two squares – gained prominence thanks to a Gardner column in the late 1950s. (And, many years later, inspired the computer game Tetris, in which falling tetrominoes must be stacked together.) At the opposite end of the age spectrum was Neil Bickford, aged 12, a mathematics blogger from San Jose, California.

Reptilian designs

In 1964, Golomb coined the term "reptile" – short for repetitive tiling – to mean any tile that can reproduce a larger copy of itself. An example of this is the L-shaped tile. Carolyn Yackel, who is best known for her book *Making Mathematics with Needlework*, demonstrated that the number of L-tiles you need to make into a bigger L is always a square: 4, 9, 16 and so on. And she showed a table made of ceramic reptiles that she made with her father.

Tiling is a major theme in recreational mathematics – possibly because as well as being conceptually rich it is also aesthetically gratifying. For example, computer scientist Craig Kaplan from the University of Waterloo in Ontario, Canada, spoke of different ways to design parquet tiles that morph from one shape to another as they cross the floor. The evolution of tiles, he said, suggested "an inexhaustible source of inspiration for art".

Mathematicians are especially fascinated by sets of tiles that can only produce a pattern that never repeats. Such sets are called "aperiodic" and were discovered in the 1960s and later popularised by Roger Penrose in the 1970s. Aperiodicity is interesting because it is so counter-intuitive, and because if patterns never repeat it means that every tile in an arrangement somehow influences the position of every other tile.

Until now, at least two different shapes of tiles were needed, such as Penrose's famous "kite" and "dart" tiles. Which is why a new design known as the "einstein" tile presented at the conference was such a significant mathematical breakthrough. It is the first aperiodic tile that works on its own, with no need for any other shape. Designed by Joshua Socolar, a physicist from Duke University in Durham, North Carolina, and Joan Taylor from Burnie, Tasmania, Australia, it looks like a cross between a snowflake and a small craft from an early *Star Wars* movie. Identical einsteins can only fit together without any gaps or overlaps in a non-periodic way.

Everyone finds probability questions mind-bending, even the world's best mathematicians

Perhaps the mathematician whose career most embodies the spirit of recreational mathematics is G4G stalwart John Horton Conway of Princeton University in New Jersey. "I absolutely love this. It's just so interesting being here with such different people." Yet Conway's presence in Atlanta was not merely physical. In 1970 Gardner wrote one of his most widely read columns, on a Conway invention called the Game of Life. Conway's "Life" is an example of what is known as a cellular automaton, a grid in which the cells can be either alive (white) or dead (black) and where four simple rules determine what happens to the cells in successive generations. The "game" is to choose a pattern of live cells and see how they evolve. As well as providing something fun for early computer programmers, the wonder of seeing how complexity emerges from such simple beginnings captured many people's imaginations in the early 1970s.

Life and Stephen Wolfram

The Game of Life seemed to be everywhere at the G4G. California-based mathematician Tom Rokicki showed some new patterns of mind-boggling ingenuity, including one which produced the image of the numeral 3, then the numeral 1, then 4 and continued writing out the digits of pi. William Gosper, who once held the record for discovering pi to the greatest number of decimal places and is considered one of the first computer hackers, was showing new Life forms on his laptop: "The ingenuity is staggering," he says.

Life appeared again in a talk by Stephen Wolfram, the mathematician and software entrepreneur behind the Wolfram Alpha computational engine and the blockbuster software Mathematica. He believes that cellular automata can recreate the universe and is trying to find the ones that do. Wolfram attended the G4G with his wife and two of his four children. Which brings us back to the opening question: "I have two children. One is a boy born on a Tuesday. What is the probability I have two boys?"

Trouble with boys

The first thing to remember about probability questions is that everyone finds them mind-bending, even mathematicians. The next step is to try to answer a similar but simpler question so that we can isolate what the question is really asking.

So, consider this preliminary question: "I have two children. One of them is a boy. What is the probability I have two boys?"

This is a much easier question, though a controversial one as I later discovered. After the gathering ended, Foshee's Tuesday boy problem became a hotly discussed topic on blogs around the world. The main bone of

contention was how to properly interpret the question. The way Foshee meant it is, of all the families with one boy and exactly one other child, what proportion of those families have two boys?

To answer the question you need to first look at all the equally likely combinations of two children it is possible to have: BG, GB, BB or GG. The question states that one child is a boy. So we can eliminate the GG, leaving us with just three options: BG, GB and BB. One out of these three scenarios is BB, so the probability of the two boys is 1/3.

Judged on the originality of attendees' business cards, this is a pretty special event

Now we can repeat this technique for the original question. Let's list the equally likely possibilities of children, together with the days of the week they are born in. Let's call a boy born on a Tuesday a BTu. Our possible situations are:

- When the first child is a BTu and the second is a girl born on any day of the week: there are seven different possibilities.
- When the first child is a girl born on any day of the week and the second is a BTu: again, there are seven different possibilities.
- When the first child is a BTu and the second is a boy born on any day of the week: again there are seven different possibilities.
- Finally, there is the situation in which the first child is a boy born on any day of the week and the second child is a BTu – and this is where it gets interesting. There are seven different possibilities here too, but one of them – when both boys are born on a Tuesday – has already been counted when we considered the first to be a BTu and the second on any day of the week. So, since we are counting equally likely possibilities, we can only find an extra six possibilities here.

Summing up the totals, there are 7 + 7 + 7 + 6 = 27 different equally likely combinations of children with specified gender and birth day, and 13 of these combinations are two boys. So the answer is 13/27, which is very different from 1/3.

It seems remarkable that the probability of having two boys changes from 1/3 to 13/27 when the birth day of one boy is stated – yet it does, and it's quite a generous difference at that. In fact, if you repeat the question but specify a trait rarer than 1/7 (the chance of being born on a Tuesday), the closer the probability will approach 1/2.

Which is surprising, weird… and, to recreational mathematicians at least, delightfully entertaining.

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http://www.newscientist.com/article/dn18950-magic-numbers-a-meeting-of-mathemagical-tricksters.html

'Light from sound' could spot cancers and terrorists

- 15:46 26 May 2010 by **Anil Ananthaswamy**

Semiconductor devices could one day convert sound into light at terahertz frequencies, a radiation range that can detect skin cancers before they are visible on the surface. Such light could also provide a privacy-protecting alternative to naked body scanners in airports.

Terahertz radiation occupies the region between infrared and microwave frequencies on the electromagnetic spectrum. Its submillimetre-long waves can penetrate fabrics and plastics, but they reflect off explosives and metallic weapons in a characteristic way that can be used to detect such objects hidden beneath clothing – without generating a privacy-compromising image.

It can also identify density differences in tissue caused by nascent skin or epithelial cancers.

Now Mark Fromhold at the University of Nottingham, UK, and his colleagues have developed a theoretical model which shows how blasting a tiny piece of semiconductor material with high-frequency sound waves could generate such radiation.

Bloch party

The researchers modelled what happens when a crystal composed of alternating layers of two semiconductors, such as gallium arsenide and aluminium gallium arsenide, is hit by sound waves with a frequency of about 60 gigahertz.

When an intense high-frequency sound wave hits the crystal, it sets in motion a compression wave that propagates through the crystal, trapping the semiconductor's free electrons in the wave-troughs and sweeping them along.

But when the amplitude of the sound wave rises above a certain threshold, the model showed that the electrons are freed from the troughs and instead start oscillating around the lattice structure.

These are called Bloch oscillations, and are usually induced by applying a voltage across the crystal. But in this case they are caused purely by the incident sound in a process that the researchers say has the potential to be much more efficient.

Super cool

The oscillating electrons act as dipoles and emit photons at terahertz frequencies, which Fromhold says could find uses in medical imaging and security.

Such a device would require a suitably intense source of sound waves, such as a saser – the acoustic equivalent of a laser – the technology for which has already been developed by Tony Kent, Fromhold's colleague at Nottingham.

Also, the semiconductor crystal – which would be a disc about 100 micrometres across and hundreds of nanometres thick – would have to be cooled to 4.2 kelvin, the temperature of liquid helium, to ensure that the lattice is devoid of any thermal vibrations, which can destroy Bloch oscillations.

The work is theoretical but commercial applications, while a long way off, are possible in principle, says Arkadii Krokhin, who studies the structure and electronic properties of solids at the University of North Texas in Denton. "The mathematics is beautiful," he says. "The idea is completely new. I had never heard about making terahertz frequency [light] from sound."

Journal reference: *Physical Review B*, in press

http://www.newscientist.com/article/dn18963-light-from-sound-could-spot-cancers-and-terrorists.html

The history of ice on Earth

- 16:39 24 May 2010 by **Michael Marshall**

Don't forget your woolly mittens (Image: Astromujoff / Getty)

Primitive humans, clad in animal skins, trekking across vast expanses of ice in a desperate search to find food. That's the image that comes to mind when most of us think about an ice age.

But in fact there have been many ice ages, most of them long before humans made their first appearance. And the familiar picture of an ice age is of a comparatively mild one: others were so severe that the entire Earth froze over, for tens or even hundreds of millions of years.

In fact, the planet seems to have three main settings: "greenhouse", when tropical temperatures extend to the poles and there are no ice sheets at all; "icehouse", when there is some permanent ice, although its extent varies greatly; and "snowball", in which the planet's entire surface is frozen over.

Why the ice periodically advances – and why it retreats again – is a mystery that glaciologists have only just started to unravel. Here's our recap of all the back and forth they're trying to explain.

Snowball Earth

2.4 to 2.1 billion years ago

The Huronian glaciation is the oldest ice age we know about. The Earth was just over 2 billion years old, and home only to unicellular life-forms.

The early stages of the Huronian, from 2.4 to 2.3 billion years ago, seem to have been particularly severe, with the entire planet frozen over in the first "snowball Earth". This may have been triggered by a 250-million-year lull in volcanic activity, which would have meant less carbon dioxide being pumped into the atmosphere, and a reduced greenhouse effect.

Deep freeze

850 to 630 million years ago

During the 200 million years of the Cryogenian period, the Earth was plunged into some of the deepest cold it has ever experienced – and the emergence of complex life may have caused it.

One theory is that the glaciation was triggered by the evolution of large cells, and possibly also multicellular organisms, that sank to the seabed after dying. This would have sucked CO_2 out of the atmosphere, weakening the greenhouse effect and thus lowering global temperatures.

There seem to have been two distinct Cryogenian ice ages: the so-called Sturtian glaciation between 750 and 700 million years ago, followed by the Varanger (or Marinoan) glaciation, 660 to 635 million years ago. There's some evidence that Earth became a snowball at times during the big freezes, but researchers are still trying to work out exactly what happened.

Mass extinction

460 to 430 million years ago

Straddling the late Ordovician period and the early Silurian period, the Andean-Saharan ice age was marked by a mass extinction, the second most severe in Earth's history.

The die-off was surpassed only by the gargantuan Permian extinction 250 million years ago. But as the ecosystem recovered after the freeze, it expanded, with land plants becoming common over the course of the Silurian period. And those plants may have caused the next great ice age.

Plants invade the land

360 to 260 million years ago

Like the Cryogenian glaciation, the Karoo ice age featured two peaks in ice cover that may well have been distinct ice ages. They took place in the Mississipian period, 359 to 318 million years ago, and again in the Pennsylvanian 318 to 299 million years ago.

These ice ages may have been the result of the expansion of land plants that followed the Cryogenian. As plants spread over the planet, they absorbed CO_2 from the atmosphere and released oxygen (PDF). As a result CO_2 levels fell and the greenhouse effect weakened, triggering an ice age.

There is some evidence that the ice came and went in regular cycles, driven by changes in Earth's orbit. If true, this would mean that the Karoo ice age operated in much the same way as the current one.

Antarctica freezes over

14 million years ago

Antarctica wasn't always a frozen wasteland. It wasn't until around 34 million years ago that the first small glaciers formed on the tops of Antarctica's mountains. And it was 20 million years later, when world-wide temperatures dropped by 8 °C, that the glaciers' ice froze onto the rock, and the southern ice sheet was born.

This temperature drop was triggered by the rise of the Himalayas. As they grew higher they were exposed to increased weathering, which sucked CO_2 out of the atmosphere and reduced the greenhouse effect.

The northern hemisphere remained relatively ice-free for longer, with Greenland and the Arctic becoming heavily glaciated only around 3.2 million years ago.

Latest advance of the ice

2.58 million years ago

The Quaternary glaciation started just a few million years ago – and is still going on. So its history is relatively recent, in geological terms, and can be studied in far more detail than the others'. It's evident that the ice sheets have gone through multiple stages of growth and retreat over the course of the Quaternary.

During "glacial" stages, the temperature was low and ice extended far away from the poles. During "interglacials", the temperature was somewhat warmer and the ice retreated. Brief, inconclusive periods of advancing ice – typically lasting less than 10,000 years – are called "stadials"; conversely, periods when the ice retreated, but only briefly, are called "interstadials".

The main trigger for the Quaternary glaciation was the continuing fall in the level of CO_2 in the atmosphere due to the weathering of the Himalayas. However, the timing of the glacials and interglacials was driven by periodic changes in Earth's orbit that change the amount of sunshine reaching various parts of the planet. The effect of these small orbital changes was amplified by positive feedbacks, such as changes in greenhouse gas levels.

During the first two-thirds of the Quaternary, the ice advanced and retreated roughly every 41,000 years – the same tempo as the changes in the tilt of Earth's axis. About a million years ago, the ice switched to a 100,000-year cycle for reasons that were until recently a mystery. Now more detailed information about the timing of the ice's movements may have helped glaciologists find an answer.

To make matters more complicated still, the ice didn't advance and retreat simultaneously all around the world. Often it would begin advancing on one continent, with the others only being covered thousands of years later, and then linger on a few continents several millennia after it had disappeared from the others.

So there were actually many overlapping glaciations within the Quaternary, each separately named: the Bavelian and Cromerian complexes of glacials and interglacials; the Elsterian glacial; the Holsteinian interglacial and the Saalian glaciation, among others.

Between 130,000 and 114,000 years ago, the ice retreated during the Eemian interglacial – and then advanced again to create the glacial that most people know as "the ice age".

Our ice age

110,000 to 12,000 years ago

The cool temperatures of the Quaternary may have allowed our brains to become much larger than those of our of hominid ancestors. While that's still open to debate, it's plausible that the most recent glacial period left its mark on our species.

Neanderthals, with whom we shared the planet until just before the last glacial maximum, 20,000 years ago, may have struggled to survive as the rising and falling ice ate away at their habitat – although many other explanations for their extinction have been suggested. What is beyond doubt is that *Homo sapiens* survived and turned to farming soon after the ice retreated, setting the stage for the rise of modern civilisation.

As the glacial period drew to a close and temperatures began to rise, there were two final cold snaps. First, the chilly "Older Dryas" of 14,700 to 13,400 years ago transformed most of Europe from forest to tundra, like modern-day Siberia. After a brief respite, the Younger Dryas, between 12,800 to 11,500 years ago, froze Europe solid within a matter of months – probably as a result of meltwater from retreating glaciers shutting down the Atlantic Ocean's "conveyor-belt" current, although a cometary impact has also been blamed.

Twelve thousand years ago, the great ice sheets retreated at the beginning of the latest interglacial – the Flandrian – allowing humans to return to northern latitudes. This period has been relatively warm, and the climate relatively stable, although it has been slightly colder than the last interglacial, the Eemian, and sea levels are currently at least 3 metres lower – differences that are being closely scrutinised by researchers keen to understand how our climate will develop.

But this respite from the ice is likely to prove short-lived, at least in geological terms. Human effects on the climate notwithstanding, the cycle will continue to turn, the hothouse period will some day come to an end – and the ice sheets will descend again.

http://www.newscientist.com/article/dn18949-the-history-of-ice-on-earth.html

Diamonds travel at freeway speeds inside Earth

- 22 May 2010
- Magazine issue 2761.

EARTH'S insides may move at a creep, but diamonds ride the fast track. Diamond-infused magma may zoom upwards from deep within the planet at a blistering 60 kilometres per hour.

Rising magma in Earth's mantle is thought to ascend at just a few centimetres per year. It was known that kimberlite, which often contains diamonds, can rise more quickly near the surface, but its speed at great depths was unclear.

Now Masayuki Nishi and colleagues at Kyushu University in Fukuoka, Japan, have used the mineral garnet as a speedometer. Garnet inclusions that form inside diamond are stable at depths of between 400 and 700 kilometres, but partially degrade at lower pressures and temperatures. Nishi's team synthesised garnet in heated, pressurised containers and measured how fast it degraded as the temperature and pressure were lowered, simulating ascent through Earth's mantle.

The rate of decay suggested that for a garnet-infused diamond to reach the surface it must take between hours and days to travel from a depth of 400 km. "A rapid ascent mechanism may exist at greater depths than ever thought," says Nishi (*Geophysical Research Letters*, DOI: 10.1029/2010GL042706).

http://www.newscientist.com/article/mg20627615.300-diamonds-travel-at-freeway-speeds-inside-earth.html

Biofuels learn to eat less

- 26 May 2010 by **Helen Knight**

Magazine issue 2762.

Filling up on a less glamorous source (Image: Hannah Johnston/Getty)

THE feast is coming to an end for biofuel producers. Their supposedly clean, green fuel has been gobbling up some of the choicest food crops, including corn, rape and soya, leading to controversy and protests around the world.

Now the industry increasingly finds itself forced to dine on more meagre fare: the inedible scraps left by other industries. But it is now finding ways to turn these scraps into a hearty dinner - and it could even provide for others, too.

First-generation biofuels are a victim of their own success. Talk of climate change and energy security led to a surge in crops grown to fill fuel tanks rather than stomachs, bringing food price hikes and changes in land use.

So the goal now is to efficiently convert so-called "second-generation" sources - grasses, wood, paper and the inedible waste from food crops - into biofuels. One of the main biofuels is bioethanol, which could supplement or even replace gasoline as a transportation fuel.

Squeezing meaningful quantities of bioethanol from this waste is challenging but not impossible. In a report last year, the Biotechnology Industry Organization, a lobby group based in Washington DC, estimated that second-generation biofuels could reduce annual US petroleum imports by nearly $70 billion by 2022. The US imported $24.7 billion in energy-related petroleum in January 2010 alone.

One report estimates that biofuel from plant waste could reduce US petroleum imports by $70 billion

Bruce Dale of the Office of Biobased Technologies at Michigan State University in East Lansing is even more optimistic. He thinks second-generation biomass could, in theory, generate 350 billion litres of biofuel per year - essentially equivalent to all of the US's oil imports.

In order to do so, ways must be found to break down the cellulose that forms the inedible cell walls of green plants into an easily digested form that can be converted into sugars using enzymes. Those sugars can then be fermented into bioethanol.

Dale and his colleagues have developed a technique called ammonia fibre expansion (AFEX) that he says can convert over 90 per cent of the cellulose into biofuel. AFEX involves adding biomass to an ammonia-filled chamber at 100 °C and up to 20 times atmospheric pressure. After 5 minutes the pressure is explosively released, and the combined effects of the hot ammonia and rapid depressurisation breaks up the cell wall,

pulling apart its cellulose microfibres. This makes it easier for enzymes to reach the cellulose molecules, meaning more of it can be turned into sugar.

Finally, these sugars are fermented with yeast or bacteria to produce bioethanol or other biofuels. The technique produces 300 litres of biofuel from a tonne of plant material, Dale says, compared with around 160 litres per tonne using existing commercial techniques.

The university has licensed the technology to a company called MBI in Lansing, Michigan, which plans to build a pilot plant that by the end of this year will be able to process a tonne of plant material per day. It hopes to have a commercial plant running by early 2012, processing 250 tonnes of biomass per day and generating around 27 million litres of biofuel each year, says David Jones of MBI.

It is not the only company with big claims for efficient bioethanol yields. ZeaChem, based in Lakewood, Colorado, says its process can convert a tonne of feedstock into over 500 litres of bioethanol. That's because the firm uses acetogenic bacteria found in the guts of insects - rather than standard yeast - to convert the sugar into ethanol.

Fermentation produces carbon dioxide, and so reduces the amount of carbon available to be converted to ethanol. The acetogenic bacteria directly convert all of the carbon in sugar into acetic acid, which is then combined with hydrogen to produce ethanol without the carbon losses, the firm claims.

Microbiogen, a firm based in Lane Cove, New South Wales, Australia, says fermentation can be profitable even with carbon losses. Its fermentation process yields a surprising by-product - plentiful supplies of brewer's yeast.

Microbiogen uses dilute sulphuric acid to break down another component of the plant cell wall: a complex polymer called hemicellulose, which binds cellulose microfibres together. The hemicellulose separates into its chief building block, a sugar called xylose, which can then be washed away with hot water. The process was developed by the National Renewable Energy Laboratory in Golden, Colorado.

The xylose does not go unused, however. Microbiogen has spent a decade developing a strain of brewer's yeast, *Saccharomyces cerevisiae*, for the fermentation stage that is unique in being the only non-genetically modified strain able to thrive on xylose as well as glucose. As such, the yeast is suitable for use in GM-free foods.

Around one-third of the yeast grown on the xylose is used in fermentation, while the remaining two-thirds can be harvested and used for animal or human food production. "This means we potentially get about 200 litres of ethanol plus 80 to 90 kilograms of excess high-protein yeast per tonne of waste plant material," says Philip Bell of Microbiogen.

The firm plans to cultivate further yeast strains that, as well as producing biofuel, might find uses in wine-making, brewing, baking and health food manufacture. Selling the excess yeast should help to make second-generation biofuels more economical, Bell says. "The conversion of xylose into yeast biomass appears to be at least as valuable, if not more so, than converting it into ethanol," he says.

If he's right, the biofuel industry could soon become known as a food provider rather than an unwelcome consumer.

http://www.newscientist.com/article/mg20627624.300-biofuels-learn-to-eat-less.html

Just what we need: sarcasm software

- 13:22 25 May 2010 by **MacGregor Campbell**

Computers are getting better at understanding human languages, thanks partly to algorithms that can analyse sentences for positive or negative sentiments, says Ari Rappoport of the Hebrew University of Jerusalem, Israel. But picking up on sarcasm is still a problem. "In many cases, sarcasm is difficult even for people to recognise", never mind computers, he says.

Rappoport and colleagues wrote a sentiment-analysing program. They then trained this software to recognise sarcasm by feeding it sentences that had been flagged up by human reviewers as likely to contain sarcasm.

The team used the trained program to analyse a selection of product reviews on Amazon.com and a random selection of posts on Twitter. Three human volunteers were asked to rate the same material for sarcastic content.

The algorithm agreed with the volunteers 77 per cent of the time for Amazon.com product reviews and 83 per cent of the time for the tweets.

Nice work, really

"It is a very exciting paper, because it attacks a problem that I didn't really think we were ready to make headway on," says Lillian Lee, a natural language processing expert at Cornell University in Ithaca, New York, who was not involved with the study.

David Traum, a language researcher at the University of Southern California in Marina del Rey, says that getting people to agree about what constitutes sarcasm from single utterances with little context is difficult. "Really all we can say is that for these cases computers are about as good as people at agreeing with other people about what is sarcastic."

The research was presented at the International AAAI Conference on Weblogs and Social Media in Washington DC this week. The tool could be used by marketers to track online public sentiment surrounding brands.

http://www.newscientist.com/article/dn18956-just-what-we-need-sarcasm-software.html?full=true&print=true

Rheumatoid arthritis 'on the rise in women'

Page last updated at 23:19 GMT, Wednesday, 26 May 2010 0:19 UK

Chronic pain can be debilitating

One of the most common forms of arthritis is on the rise among women in the US, according to a study.

Researchers from the Mayo Clinic in Minnesota say rheumatoid arthritis cases rose 2.5% between 1995 and 2007, after 40 years of decline, but fell among men in the same 12-year period,

Rheumatoid arthritis affects around 350,000 people in the UK.

The condition is a form of arthritis which happens when the body's immune system attacks joints.

This causes pain and swelling, which can lead to problems with mobility.

Continue reading the main story

More and more people with this long term condition are managing to stay working and live very full productive lives

National Rheumatoid Arthritis Society Ailsa Bosworth, Chief Executive

It often starts between 40 and 50 years of age and women are three times more likely to be affected by the condition than men.

The study looked at cases of rheumatoid arthritis in Minnesota between 1995 and 2007.

They examined the medical records of 1,761 residents in Olmsted County.

They found cases of rheumatoid arthritis increased by 2.5% per year from 1995 to 2007, while it fell in men by 0.5%.

Study leader Dr Sherine Gabriel said: "We observed a modest increase of rheumatoid arthritis incidence in women during the study period, which followed a sharp decline in incidence during the previous four decades."

Previous studies have found a link between cigarette smoking and rheumatoid arthritis.

Vitamin D deficiency has also been associated with the development of the condition.

Commenting on the work, published in the journal Arthritis and Rheumatism, Ailsa Bosworth, Chief Executive of UK charity the National Rheumatoid Arthritis Society, said the findings were a concern.

She said: "I would like to assure people living with rheumatoid arthritis that in the last 10 years due in part to the use of biological therapies and tighter control of the disease at an earlier stage that more and more people with this long-term condition are managing to stay working and live very full productive lives.

"However more definitely needs to be done to raise public awareness of rheumatoid arthritis and that people raise their risk of developing the disease if they smoke."

http://news.bbc.co.uk/2/hi/health/10166727.stm

Births to older mothers 'treble' in 20 years

The typical age for a first-time mother is about 29
The number of births to older mothers has almost trebled in 20 years and is continuing to rise, figures have shown.

Some 26,976 babies were born to women aged 40 and over in 2009, compared with 9,336 in 1989 and 14,252 in 1999, figures for England and Wales show.

Among those aged 35 to 39 there were 114,288 births in 2009, a rise of 41% on the 81,281 in 1999.

The data, published by the Office for National Statistics, showed a 0.3% drop in the overall number of births.

The data means the typical age for a first-time mother has risen to 29.4 in 2009, compared with 29.3 in 2008 and 28.4 in 1999.

Compared with 2008, the birth rate for women under 35 has fallen. There was a 2.3% drop among women under 20, from 26 births per 1,000 women in 2008 to 25.4 in 2009.

'Good news'

Rates for women aged 20 to 24 and 25 to 29 fell by 1.6% and 1.4% respectively, while for women aged 30 to 34 there was a 0.4% decline.

But rates for women aged 35 to 39 and 40 to 44 continued to rise in 2009, by 1.2% and 2.4% respectively.

Women had an average of 1.95 children each in 2009, down from 1.97 children the previous year.

The figures also showed that the proportion of births to mothers born outside the UK continued to rise, from 24.1% in 2008 to 24.7% in 2009.

The proportion of births to overseas mothers has increased every year since 1990, when it was just under 12%. In 1999, the figure was 14.3%.

Louise Silverton, deputy general secretary of the Royal College of Midwives, said the small decline in the birth rate was "a tiny morsel of good news".

"The birth rate has gone up by 19% since 2001 yet the number of midwives has risen by only 11% over the same period.

"The figures also mask the fact that an increasing number of births are becoming more complicated, requiring more of midwives' time.

"This very small decrease in the birth rate should not be used as an excuse to stop or reduce the promised rise in the number of midwives."

http://news.bbc.co.uk/2/hi/uk_news/8705374.stm

Hospitals warned on vagina swabs

Page last updated at 23:19 GMT, Wednesday, 26 May 2010 0:19 UK

Maternity staff are being warned about standards

Midwives and other staff involved in delivering babies are being warned about leaving swabs inside the vaginas of women who have just given birth.

The National Patient Safety Agency has issued an alert across England and Wales urging staff to take more care.

The watchdog has received reports of 99 cases over the past two years where the swabs have been left inside women.

While this is a small fraction of the 500,000 births a year, the NPSA said it still wanted to improve standards.

Swabs are commonly used after vaginal birth where there is bleeding.

But if left inside the vagina they can cause infection.

The NPSA said NHS trusts should improve the way they record and count swab use so errors are picked up.

Sara Johnson, head of maternity care at the NPSA, said: "This guidance is necessary as the effects of infection and the psychological harm associated with these incidents can be significant and last beyond the immediate postnatal period."

Commenting on the recommendations, Mervi Jokinen of the Royal College of Midwives, said: "These guidelines reaffirm the need for awareness and vigilance from midwives and other health professionals."

http://news.bbc.co.uk/2/hi/health/10167843.stm

San Quintín and Brackish-Water Farming

Water issues inland present a challenge and a threat to agriculture and the economy.

By Kristian Beadle

An example of a typical smaller farm operation further from the coast in San Quintin, which has access to better (fresher) water. (Kristian Beadle)

While traveling in Baja California, Kristian Beadle finds that water issues inland present a challenge and a threat to agriculture and the economy.

Location: Just inland of Cabo San Quintín, around the corner from a huge bay/wetland, lays an agricultural complex that serves the U.S. market.

Conditions: A generator whines and whirrs in the evening air — there is no grid electricity in this beach community. High-altitude clouds cover the night sky.

Discussion: The trans-peninsular highway cuts through innumerable small towns south of Ensenada; dusty farmlands blur in the glare of afternoon sunlight. I tried to put my sinus-induced headache aside and focus on the goal: to reach the mother load of Baja's agricultural valleys, San Quintín, a place built for the noble purpose of selling America cheap food. How else could such a vast operation exist where water is brackish and the native soil resembles parchment?

We spent the night parked in a gringo ex-pat community slurping oysters that we bought from a roadside seafood peddler. Those wondrous mollusks, cultivated in aquaculture farms in the wetlands of Cabo San Quintín, were tempered with fresh lime and tapatio hot sauce, which did, in fact, improve my headache. Oyster farming and sportfishing are also important industries here.

During our morning walk, we discovered the beach was actually an express highway for fishermen towing their *pangas*. Sand dollars littered the dunes, like free money from another eon. Extinct volcanoes lay lumbering in the distance past the wetlands. People milled about and hopped on buses to work in the fields.

I visited a tomato farm that was being reconstructed after this winter's storm damage, which washed away bridges and fields alike. The valley's labor force of up to 25,000 people is 80 percent Mixteco, indigenous people from Oaxaca who left their eroded lands to find employment in San Quintín.

Sure enough, the guys I spoke to, Raul and Miguel, fit the description. "*Hay trabajo aqui*," there is work here, they said, justifying the journey of many thousand miles from Oaxaca, except in the low season, Raul added, when people migrate to Sinaloa on the northern Mexico mainland to tend fields where "*la agua es major*," the water is better.

I asked Raul what he meant by better water, remembering that my shower last night tasted a tad salty. He pointed out the two-story building next to us: a small desalination plant that converts the salty well water into irrigation water. This is a common and serious problem in flat coastal areas: saltwater intrusion in the freshwater aquifer.

Normally, the freshwater aquifer "floats" on top of a saltwater lens, as it is constantly re-supplied by rain and river runoff. However, saltwater is more buoyant (as you may have noticed — it is easier to float in an ocean than a lake) so for every foot of freshwater that is removed, the salt-water lens tends to rise several feet — and the well water starts coming up brackish with salt.

[*Note: Salt-water intrusion is covered in more detail for curious readers in the accompanying box*]

Running a desalination plant isn't cheap — it is complex and uses a lot of electricity. If it weren't for the hungry U.S. market across the border paying these extra costs, it wouldn't be financially viable. Which begs the question: What would happen if the water became saltier due to over-drawing and/or sea-level rise? Would costs increase? What if energy became more expensive? I wondered if there could be a breaking point for farms to operate profitably — and if people's jobs could one day be in jeopardy.

Unemployment around here was low, according to Raul. But if the industry took a tumble, and if he lost his job, I asked, where would he go?

"Maybe America — I have family there," said Raul.

In the disturbing but highly informative book, *Endangered Mexico: An Environment on the Edge*, Joel Simon discusses how traditional farmlands in Mexico are no longer producing enough crops to support the peasant families living on them. Eroded and nutrient-depleted, it is ecological degradation, Simon claims, that has led to a massive migration to overcrowded cities in Mexico and illegal immigration to the United States.

For the time being, the equation appears favorable for San Quintín. The local paper had a big ad encouraging people to "protect the wetland, it supports our economy." As we headed out of town, a sign for an RV park read, "fresh water showers, guaranteed!"

I wondered, guaranteed for how long?

http://www.miller-mccune.com/environment/san-quintin-and-brackish-water-farming-16608/?utm_source=Newsletter111&utm_medium=email&utm_content=0601&utm_campaign=newsletters

The Next Apollo Project in 140 Characters

Innovators are being asked to friend Uncle Sam as the next good ideas for the government are being sought through social networks.

By Emily Badger

The next big idea could be a tweet away as innovations for the government are being sought through social networks.

Anil Dash sums up the power of crowdsourcing with a simple question he put to his Twitter feed a few months back. It was time for a new cell phone, he announced. What should he get?

"Somebody I don't even really know said, 'Here's a list of the most popular handsets in America ranked by how much radiation they put out,'" Dash recalled.

Now he had an info stream he hadn't even thought to consider. And if social media could better inform his relatively small cell phone conundrum, imagine what it could do for the big-picture questions we really want to get right — the questions government answers on behalf of us all.

"We have this disconnect where, as a private citizen, I can ask for my friends' opinions on something on Twitter or Facebook," Dash said. "But yet, someone can be making decisions that affect all of us" — a government official, that is — "but not have that ability."

At least where those questions intersect with science and technology, Dash has been trying to outfit the government with that same power. He directs the American Association for the Advancement of Science's Expert Labs project, which aims to connect policymakers with the wisdom outside their institutions.

The bureaucrats, Dash has found, have been eager for the exchange, to get new ideas from beyond the usual suspects and vested interests. Surprisingly, the skepticism has come from the other side: Citizens weary of traditional government feedback loops often question if anyone will honestly weigh their input.

Generic feedback@government.gov e-mail addresses tend to turn people off. And while the Obama administration has embraced "open government" on the Web, much of it has taken the form, Dash jokes, of "come to, say, the State Department website and tell us about how the State Department could run better."

THE IDEA LOBBYMiller-McCune's Washington correspondent Emily Badger follows the ideas informing, explaining and influencing government, from the local think tank circuit to academic research that shapes D.C. policy from afar.

"One of the things we found early on is that there's not a lot of random passerby traffic on most dot-gov sites, even whitehouse.gov," he said. "People go there for very specific reasons. They're not looking to answer a question."

Instead, Expert Labs has proposed government take its queries to where the people are already talking — on Facebook and Twitter, for starters. Expert Labs is working with an open-source application called ThinkTank that allows people to submit a question across multiple platforms and organize the responses in a single location.

On its first project, just completed last week, Expert Labs worked with the White House Office of Science and Technology Policy, which has been trying to get the public to offer up ideas for the "grand challenges" American science should tackle in the coming century.

"The next Apollo program or human genome project?" the White House asked on Twitter.

Many people took that to be a choice between two options, not an open-ended call for new ideas. Question wording, it turns out, becomes a fine art in 140 characters.

Expert Labs is trying not just to promote government crowdsourcing, but to study the best ways to make it useful. How do you craft a clear-eyed two-line prompt that will have the broadest impact? What time should you post Facebook status updates to yield the most responses? And once people have interacted, how do you filter out the noise and repeat submissions?

The abbreviated format of social media that makes it easy to mass-communicate also puts constraints on how much you can ask and how in-depth others can respond. Next time, Dash said, Expert Labs will encourage people to include links.

On a first attempt, though, the "grand challenges" exercise was pretty successful. The White House held a 48-hour social-media blitz on April 12-14, and 2,000 people responded via Facebook and Twitter with suggestions that ranged from improving early earthquake detection to designing a handheld device that could diagnose traumatic brain injury on the football or battlefield.

Expert Labs last week released all of the responses in one spreadsheet, data it's hoping open-source developers will now tinker with. Within the next month, Dash will also be releasing a second analysis detailing what Expert Labs learned from the process of collecting that data.Later this summer, the labs will take up a second project with a government agency, and by the end of the summer, it hopes to have a refined ThinkTank application in the federal application store for any agency to use.

"People still think social networks are purely for personal use, that it's a lot of kind of relatively meaningless dialogue and conversation," Dash said. "Just educating people about the potential of these networks has been a big part of our focus."

http://www.miller-mccune.com/politics/the-next-apollo-project-in-140-characters-16358/

Peak Wood: Nature Does Impose Limits

What lessons from the multiple experiences of Peak Wood can today's society learn for addressing global peak oil?

By John Perlin

The lessons learned from the annals of history on peak wood should heighten our awareness of the consequences of the limits of natural resources, but has it? (Cacahouette / flickr.com)

Ed. Note — While the specifics of Peak Oil can be debated, the existence of an inflection point in which petroleum becomes increasingly difficult and expensive to extract is not. A few days ago our Melinda Burns looked at possible scenarios on how the world might cope with Peak Oil. Here, John Perlin, author of A Forest Journey: The Story of Wood and Civilization*, recaps and expands on the cautionary tales he's recounted on how the world has already experienced in the age of Peak Wood.*

Constant fuel wood crises taught pre-Colombian Americans in New England the precariousness of accessible wood supplies. Their minimal tool set circumscribed the distance they could gather firewood essential for survival before the task became unbearable. Reliance on stone tools made felling trees and cutting them up laborious. Lacking domesticated animals as well as wheels for carts and sails for ships for hauling added to their burden. Village sites constantly moved to access forests close enough for humans to carry such bulky cargo as it was only a matter of time they cleared the woods nearby

When they encountered the newly arrived Europeans, such as Roger Williams, the founder of Rhode Island, their obsession with "peak wood" would often enter the conversation.

Williams recalled the often-asked question, "Why come the English hither?" And then projecting onto the English their own obsession the indigenous Americans would reply rhetorically, "It is because you want firing. Having burnt up the wood in one place, [Englishmen] are [forced] to follow the wood, and so, to remove to a fresh, new place for the wood's sake."

The Native Americans' unending search for plentiful wood supplies also led to questioning the reality of Christianity's notion of hell and as a consequence, rejecting Christianity.

As one Jesuit complained, "When [the Iroquois] first heard of the eternal fire and of the burning decreed for the punishment of sin, they withheld their belief, because, as they said, there could be no fire where there was no wood then what forest could sustain so many fires through such a long space of time" as eternity?

The idea of no limits to resources like wood and oil derived from technological advances such as metallurgy, domestication of animals, the wheel and sails for ships. Thanks to such technological advances, humanity began to believe it had moved beyond nature.

In the West, such arrogance began, at least in literature, with Gilgamesh in the Fertile Crescent almost 5,000 years ago.

Gilgamesh was the ruler of a city-kingdom in southern Mesopotamia (now southern Iraq), and a mythologized version of his reign appears what's likely the world's oldest written story, *The Epic of Gilgamesh*. In this story, the ruler wished to construct great palaces and temples to make his city a wonder for all to view. To realize his dream, he had to have at his disposal large amounts of timber. Fortunately for Gilgamesh a great primeval forest grew in the mountains just north of the lowlands we now call the Fertile Crescent. These timberlands occupied such a huge swath of land that no one, not Gilgamesh or anyone else, knew how far they stretched.

When these forests went, the successors of Gilgamesh sailed the Mediterranean for huge trees, found them in Crete, cut the forests down with their metal axes, put the timber in their boats powered by sails and hauled them overland when they arrived on shores of the Middle East.

Civilization continued its march westward in search of wood. In the poet Hesiod's time timber grew throughout Greece. Some 300 years later Plato reminisced how in an earlier period "there was an abundance of wood in the mountains" but "now they only afford sustenance to bees."

So the Greeks, with their ships and bronze axes, eyed the woods of Sicily and Italy. Theophrastus, a botanist and a younger contemporary of Plato, reported that the land of the Latins contained bay, myrtle, wonderful beech, fir and silver fir. The Greeks named one forest just south of Rome "birdless," because the trees there grew so close together that not even birds could enter.

A few miles north of Rome lay a forest, described by the historian Livy as more impenetrable than those in Germany, at that time regarded as wilderness. Two centuries later the Roman philosopher Lucretius watched "day by day the woods retreat farther and farther" from Rome, as farmers cleared the land for cultivation. Three centuries later the deforestation of much of Italy forced the Roman government to establish a fleet of fuel ships, much like oil tankers of today, to scour the Mediterranean lands west and south, especially North Africa and France, for fire wood.

Southern England's woods also attracted the Romans because the ground there yielded iron ore and hardwoods, an excellent fuel for smelting. More than a thousand years later these same woodlands provided

building material for England's fleets and fuel for its first industrial revolution that once more produced iron for the nation.

As the English lost its woods to agriculture and industry, the country, once coveted by Rome for its trees, now searched abroad, as had the Romans years before, for necessary commodities.

Sixteenth- and 17th-century entrepreneurs only had to look to Ireland for great woods and thickets to continue producing iron and building casks and ships. By 1641, the English had felled so many trees on the former densely forested island that according to a 1651 survey of its natural resources past and present, a person could now "travel whole days without seeing any woods or trees."

England also sought out the Baltic countries for timber large enough to mast its Royal Navy, which served as the "wooden walls" protecting the kingdom. Centuries of providing England, as well as France and Holland, with its biggest trees took its toll. By the beginning of the 18th century few trees large enough grew in the Baltic.

White pines growing in Britain's New England colony, then judged as the largest trees in the world, took up the slack. The colonists, though, regarded these large trees as ideal for lumber to sell abroad for capital to start up new homestead. By the time of the American Revolution, woods close to population centers on the Eastern Seaboard no longer existed.

(As environmental ecologist Kent Mountford has written in an elegy for the woods of southern Maryland, "Many of the colonists and our founding fathers were perfectly able to read the Greek and Latin accounts, but the lessons went unheeded, and the litany of errors continues.")

As impressive as the Eastern forest had first appeared to Europeans, those venturing west of the Appalachian Mountains and descending into the Ohio Valley "were agreeably surprised on finding nature in a novel and more splendid garb," than ever seen before. The trees made up "a grand assemblage of gigantic beings which carry the imagination back to other times before the foot of the white man had touched the American shore." Indiana, at the beginning of the 19th century, was "one vast forest." Ohio, though, presented "the grandest unbroken forest of 41,000 square miles that was ever beheld."

Cheap lumber and cheap fuel extracted from these forests made possible America's development from the Revolution to the Civil War into a powerful and prosperous nation. Such growth, though, took a terrible toll on the woodlands. By 1877, one observer reported in *The Popular Science Monthly* that "the states of Ohio and Indiana … so recently a part of the great East-American forest, have even now a greater percentage of treeless area" than portions of Europe settled and cultivated for thousands of years.

The author continued, "In the economy of Nature forests perform innumerable functions which no artificial contrivance can imitate," and closed writing, "'Timely prevention,' wrote Dr. Radcliffe, 'not only saves us from diseases, but from those greater evils — the remedies.'"

It became clear that the decimation of the forests from the Atlantic to the Mississippi were going to become just another chapter in humanity's piecemeal destruction of the planet.

Today's assault on the Amazon and other rainforests continues the same sad story. The lure of present profit has driven this relentless war against the world's trees throughout time and all continents. As liberal economists in the 17th century showed, a landowner could expect a profit of a little more than 3 shillings per acre by preserving his woods, whereas by converting it to pasture brought three times that much. It therefore made perfect pecuniary sense to clear the land.

Despite such accounting, Frederick Engels, the social scientist and communist theorist, saw residual issues beyond immediate gain when it came to deforestation.

"What did the Spanish planters in Cuba, who burned down the forests on the slopes of the mountains and obtained sufficient fertilizer from the ashes for one generation of highly profitable coffee trees, care that the heavy tropical rains later washed away the now unprotected upper stratum of the soil and left only bare rock behind?" he asked in his *Dialectics of Nature*.

Engels then added his critique: "In relation to nature, the present mode of production is predominantly concerned only about the first, the most tangible result. Why should one be surprised, then, that the more remote effects of actions directed to this end turn out to be of quite a different character?"

Current events have proven Engels a seer. No one considered that by removing the trees and turning to fossil fuels would now threaten the planet by accelerating climate change. Nor did many stop to think that oil would peak, just as wood has done so many times before.

We should therefore take Engels quite seriously when he admonished his generation and those who came before and those to come, "Let us not flatter ourselves on account of our human victories over nature. For each such victory nature takes its revenge on us. Each victory, it is true, in the first place brings about the results we expected, but in the second and third places it has quite different, unforeseen effects which only too often cancel the first."

http://www.miller-mccune.com/environment/peak-wood-nature-does-impose-limits-16596/

Peak Oil and Apocalypse Then

Based on the past experience of Japan, North Korea and Cuba, an Oxford researcher identifies three possible responses to peak oil: Predatory militarism, totalitarian retrenchment and socioeconomic adaptation.

By Melinda Burns

An Oxford researcher warns that historic commodity shortages foreshadow a painful future. (inok / istockphoto)

Oil is the backbone resource of industrial society, but the Oil Age will come to an end, someday. The pessimists say the world reached maximum oil production in 2008. Middle-of-the-road optimists say peak oil won't occur until 2030. Either way, production is already past its peak and on a terminal decline in 54 of the 65 largest oil-producing countries in the world, including Mexico, Norway, Indonesia and Australia. It's been declining in the lower 48 states of the United States since 1970.

What will happen when cheap oil is no longer available and supplies start running short? In an interview with Miller-McCune.com, Jörg Friedrichs, a lecturer in politics at the University of Oxford, examines how different parts of the world would likely react to a peak oil scenario.

Despite its timeliness, Friedrichs' examination of the global energy crunch was rejected a dozen times before it found a home in the August issue of *Energy Policy*. A pre-print version, a shortened version and a public discussion can be viewed online.

Miller-McCune.com: In your study, you ask the question, "What is likely to happen if peak oil occurs?" When do you think that will be?

Jörg Friedrichs: As a social scientist, I don't ask when peak oil will occur. This is a question for geologists, engineers and possibly economists. Some of them believe that the world has reached the peak of the Oil Age, or is about to reach it in this decade. Instead of joining their debate, my question is, "What if?" This I see as a social scientific research challenge.

M-M: Why do you think the U.S. would cynically choose "predatory militarism" in the face of future resource shortages, as fuel-starved Japan did before World War II?

JF: Predatory militarism is the result of desperation and temptation. In the Japanese case, the element of desperation prevailed. As a consequence of their own ill-conceived policies, they saw no other choice in 1941 than to loot oil from the East Indies, even at the cost of starting a suicidal war with the United States. In the case of the U.S., the element of temptation may be stronger. Why compete for a scarce but vital resource in markets when you have a military option? Why negotiate with people like Hugo Chávez if you have a military stick? We have sometimes seen this pattern in the past, and we are likely to see it more often after peak oil. However, there is also likely to be a great deal of desperation. One should not underestimate the likely consternation of many American citizens when their fossil-fuelled and consumerist lifestyle is in serious jeopardy.

M-M: What about China, another country that is heavily dependent on oil imports?

JF: On the one hand, the situation of China would be more desperate than the U.S. because their access to foreign oil is militarily less secure. But on the other hand, they would be less tempted because their navy and air force is no match for the U.S. The Chinese military could hardly control the shipping lanes from Angola to China, or even in the Straits of Malacca. But they may perhaps be tempted to launch predatory military operations in Central Asia.

M-M: In your view, what would other entrenched dictatorships likely do if their imports of oil were severely reduced?

JF: It's awful to imagine, but they may follow the example of North Korea. On its own cynical terms, the North Korean regime has successfully dealt with a severe oil supply disruption that began in the early 1990s. When the Soviets stopped delivering subsidized oil to foreign "comrades," the North Korean elite basically screwed its own population. Elite privileges were preserved, while hundreds of thousands of ordinary people starved.

M-M: Wouldn't there likely be popular movements to overthrow those dictatorships?

JF: This is indeed likely to happen in many places. Where authoritarian regimes try a North Korean strategy but fail, a failed state is the most likely outcome.

M-M: You offer a third, less shocking scenario, one in which "local solidarity" and urban "self-help" agriculture gets people through a period of severe fuel shortages, as in Cuba after the collapse of the Soviet Union. What countries do you think might take this route?

JF: The Cuban experience offers an interesting contrast to what happened in North Korea. Despite a similar crisis, there was a period of considerable hardship, but no mass starvation. This was possible because, unlike North Korea, Cuban society preserves a lot of social glue and traditional knowledge. Developing countries are more likely to be in this category than developed countries. Unfortunately, many developing countries are hopelessly overpopulated. But where there is social glue and where sustainable lifestyles can be recovered, people may find a way to muddle through at the local level.

M-M: Why don't you think the West would be a good candidate for "local solidarity"?

JF: Strictly speaking, it's not so much a problem of the West but of a particular lifestyle. When social glue and traditional lifestyles have eroded, they are not easily recovered. After several generations of individualism and affluence, Westerners will have a hard time accepting that they need to rely on communities and must revert to a sustainable lifestyle. After 65 years of mass consumerism, Japanese society is likely to face similar problems.

M-M: What about Europe?

JF: Western Europe falls under the category of places where social glue and sustainable lifestyles are almost passé. Unlike the U.S., Europe is not a particularly promising contender in case of a military scramble for resources. And unlike North Koreans, Europeans are not likely to accept a totalitarian "solution" to the problem of how to slice up a shrinking pie. After peak oil, probably the best hope for Europe is populist regimes that might mobilize residual national solidarity to weather the crisis. I'm not a fan of populist regimes, but they typically emerge when democratic societies enter a deep crisis.

Fortunately, there are a few rays of hope. Western Europe has invested more in energy conservation and sustainable energy than any other part of the world; and railways offer a fallback position for transportation that is not available in most other places. There is a chance that Europe may possess large reserves of shale gas. In any case, Russia and the Near East can supply Europe with oil and gas. Unfortunately, however, such deals are highly unstable and subject to constant renegotiation. In the long run, Europeans could hardly avoid a return to a more subsistence-based lifestyle, but given their long exposure to mass consumerism, they will have a very hard time in the process.

M-M: Explain how Dixieland fits into your views of peak oil and its aftermath.

JF: Dixieland is a cautionary tale for those who believe that social and technological innovation will take care of all problems. After Southern elites lost slavery as the backbone of their way of life [during the U.S. Civil War], it took them at least a century to adjust to the new reality. Why did they not simply embrace industrial capitalism and liberal democracy? Well, I guess it is not so easy to give up one's lifestyle. Now, imagine that people were to face an energetic downgrade, rather than the upgrade available to Dixieland after the Civil War. While the "challenge" for Dixieland was lifting its socioeconomic fabric to industrial capitalism and liberal democracy, after peak oil the opposite would be the case. Do you really think people would have an easier time adjusting to peak oil? The world would sorely miss cheap and abundant energy, and liberal democracy would become more and more difficult to sustain. The example of Dixieland shows that it takes a lot of time for the "new consciousness" to emerge that is necessary for radical social change.

M-M: But isn't that comparing apples and oranges? The Civil War was about much more than technology.

JF: I am really not interested in the Civil War and its root causes. What I am interested in is rather the reaction of Southern society to the defeat. How do people react when they are deprived of their socioeconomic backbone resource — slaves for Dixie, oil for us? What happens when people are forced to radically adjust their way of life? This hasn't happened very often in history, but we can look at the South of the United States from the end of the Civil War in 1865 to the Civil Rights Act of 1964 to get some clues.

M-M: Why do you dismiss the possibility of a smooth transition from oil to other sources, such as solar and wind power or a new, improved generation of nuclear reactors?

JF: I do not dismiss this possibility. The ideal solution would be to electrify everything from road traffic to heating systems, and then produce electricity with whatever energy source is available. But let us not forget that such a technological fix would take a lot of time and investment. Unless the energy descent after peak oil is very smooth indeed, there may simply not be enough time. Alas, technological crash programs are much more difficult under crisis conditions. This is not to deny that solar and wind, as well as nuclear energy, can be helpful in the transition. But the transition is unlikely to be smooth.

M-M: You say that coal would become a more important energy source for at least a couple of decades, with dire consequences for the climate. What about clean coal and other technological innovation?

JF: Most clean coal technologies, as well as many other innovations, are currently at the experimental stage. As mentioned, their implementation requires a lot of time and investment that may not be available under crisis conditions. Another serious problem is the fact that clean coal technologies, such as carbon capture and storage, require energy and thereby reduce efficiency. You basically siphon off energy from productive purposes to reduce carbon emissions. If we assume that sufficient energy supply will become a serious challenge after peak oil, this may hardly be acceptable to some people.

M-M: After peak oil, how does the world realign itself, in your view? Which countries come out on top?

JF: This depends on your criteria. If the criterion is the ability to gain military access to energy resources, then I'd say the U.S. If it is the capacity for peaceful adaptation, then I'd look at developing countries that are not too much overpopulated. If the criterion is political stability, then countries with a recoverable authoritarian tradition are likely to work better than liberal democracies. This sounds like a dismal criterion, but stability will be highly valued in times of crisis when entire countries fall apart. It doesn't have to be as bad as North Korea: just think of "authoritarian democracies" such as Putin's Russia.

Oil exporting countries such as Brazil or Iran are also possible winners. However, they may just as well fall victim to military predation and/or the notorious "resource curse."

M-M: What happens to global oil corporations such as Exxon and Shell?

JF: In the transition, they are likely to lose further ground to the state-controlled companies of oil exporting countries such as Saudi Aramco or the Nigerian National Petroleum Corporation. As a consequence, even oil importing countries would increasingly rely on state-controlled companies. This is already happening, for example, in the case of the China National Petroleum Corporation.

M-M: Instead of collapse, you forecast a "slow and painful" adjustment to peak oil, lasting a century or more. Is there anything people can do right now to prevent that from happening? Or is it inevitable, as you suggest it is, that "industrial society will start crumbling and free trade will begin to disintegrate?"

JF: I believe it's inevitable. But this doesn't mean that action cannot make a difference. There is a difference between slamming into a brick wall and crashing into a haystack. Peak oil is not likely to be a haystack, but it doesn't have to be a brick wall — if, that is, people take appropriate measures to prepare themselves and smoothen the descent.

M-M: You say your research was "trashed 12 times" before it was accepted for *Energy Policy*. Why?

JF: My colleagues in the social sciences are just not (yet) ready to face this topic. Most of them prefer to stage disciplinary sham fights rather than looking at pressing issues. Perhaps it's going to be like the end of the Cold War or the current financial crisis, where clever analyses by social scientists have appeared only after the fact.

But, of course, I cannot entirely exclude the possibility that peak oil is still 20 years down the line. Nor can I exclude the chance that some technological breakthrough such as fusion technology is around the corner. If that happens, I will be glad if my research turns out to be inapplicable. As mentioned in my introductory statement, I am only exploring a (highly plausible) hypothesis.

But be that as it may, I am very grateful that, after all these futile attempts, Energy Policy has now published my research. The journal is run by energy experts rather than social scientists, and it is significant that they have accepted the article without further ado.

http://www.miller-mccune.com/environment/peak-oil-and-apocalypse-then-16535/

Punta Cabras and a Shipwreck

An overturned fishing boat symbolizes the plight of the world's fisheries.

By Kristian Beadle

An abandoned fishing boat in Punta Cabras. While fishing in this part of Mexico is still plentiful, the rest of the world cannot say the same thing. Overfishing and ocean acidification are very real global threats. (Kristian Beadle)

El Hippo continues it's journey south, finding an overturned fishing boat that comes to symbolize the plight of the world's suffering fisheries.

Location: On a sandy bluff next to a fisherman's house in Punta Cabras, a few hours south of Ensenada.

Conditions: Hot and dry. The swell is smaller than yesterday, when the panga capsized.

Discussion: The open fields were golden in the afternoon light, when we arrived in Punta Cabras. Further from the coast, the earth seemed to warp into hills and mountains, like a wrinkled carpet that a little boy pushed together as a landscape for his toys. That first night, under a starry sky and waning new moon, we found a beachside bluff to camp, next to the baritone rumble of the ocean. With help from our two-burner propane stove we ate *pollo asado* (the ubiquitous roasted chicken that is sold on most street corners), homemade coleslaw and drank a glass of wine. There was much rejoicing: We were in the open country.

The next morning was warm, but I discovered the water was freezing, while surfing small beach breaks in front of our camp. After a mighty breakfast and coffee, we rode our bikes along the ranch lands, kept mostly undeveloped by the rugged terrain and increasing distance from the border. Past a hillcrest, the markings of a fish camp: a deserted trailer, some junk cars and a few *pangas* — the 14-foot cabin-less boats that are commonly used for fishing in Baja.

When we returned, a sight startled us. A white *panga* — that we had seen in the morning bobbing offshore — was now upside down and dangerously close to the breakers. Three men clambered on top of the overturned hull as it drifted slowly toward the waves. On the beach, a few men were scurrying about frantically, trying to figure out what to do. One of them was the fishermen's cousin; after I talked to him for a minute, we decided to paddle out with my surfboards and try to assist. Just as we were about to enter the water, fortunately (for the fishermen, and us too!) a rescue boat arrived, which had been summoned earlier by the cousin, and it whisked the men away to safety.

According to the cousin, the men had been diving for clams when a rogue wave hit them sideways and caused the capsize. I was surprised when I saw the *panga* on shore later that afternoon, fully intact, after being dragged onto the beach by the men; and I was ashamed that I had missed the whole endeavor, having fallen asleep during a particularly deep siesta, only waking up to the grumbling of their trucks as they left to repair the now un-submerged outboard engine.

They left smiling and relaxed — it was all in a day's work. Despite the tribulations, the fishermen like the sea and their life by the coast. They sell the clams and urchins to the Japanese market, which brings enough money to pay for their 4×4 pickup trucks and sturdy boats that can handle an occasional capsize.

"It's better here," said Jorge, the fisherman who lived at the house next to our campsite. Jorge used to live in Tijuana and work across the border but had relocated to Punta Cabras. His house was simple, built like a large shed of materials that happened to be available. Jorge told me, gesturing with his hands, "The air is clean here, no violence, you know? The ocean is good to us — most days! Flip sometimes and not much money sometimes, but it's OK. I like the wind."I hoped that these men could continue their livelihood by the sea for a long time. Fisheries are already a tough business — and fish stocks can and have collapsed due to overfishing or ecosystem stress. Prime examples include the North Atlantic cod fishery and many salmon fisheries. Now climate change may also accelerate the decline of worldwide fisheries, due to the twin problems of ocean acidification and ocean warming.

These physical processes are well studied, according to a 2009 report by International Union for Conservation of Nature. Since the Industrial Revolution, ocean acidity has increased 30 percent. Excess carbon dioxide in the atmosphere descends and mixes with water to produce carbonic acid, which in turn weakens the carbonates that shellfish need to calcify and create their shells. Coral reefs may also fail to calcify — intensifying what is already a global catastrophe. Coral reefs, which are habitat for a huge array of marine organisms, and support the coastal livelihood of millions of people, have been dying in huge numbers due to bleaching associated with warm water. During the 1998 El Niño phenomenon alone, it was reported that 16 percent of the earth's tropical corals perished. The eastern Pacific, where Baja California is located, is in a better position than most. The strong westerly winds common to this area drive upwelling from deep ocean trenches and brings up cold water — the storehouses of nutrients. For this reason, the fishermen in Baja may have enough clams, lobster and fish for their lifetime — and people everywhere can continue to enjoy seafood. If the ocean is as bountiful and resilient as we hope, perhaps a few more generations of fish camps and capsized *pangas* will bless this coast.

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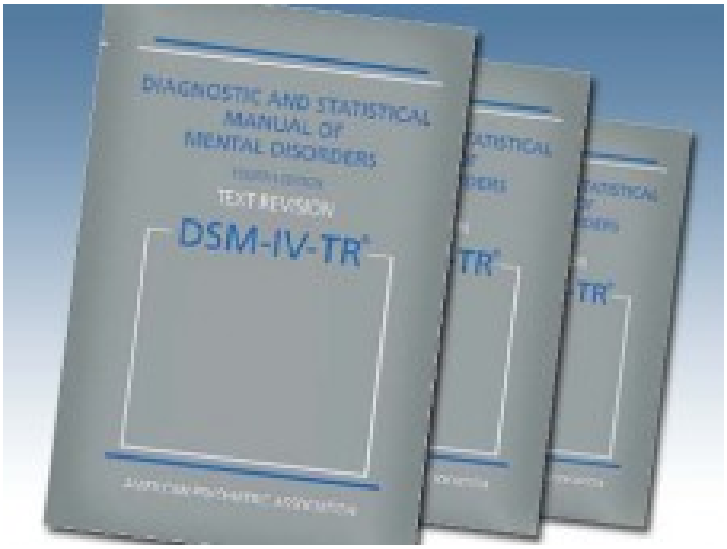
Infallibility and Psychiatry's Bible

The latest "Diagnostic and Statistical Manual of Mental Disorders" is being revised and, by some, reviled.

By Arnie Cooper



The latest Diagnostic and Statistical Manual of Mental Disorders is being revised and, for some, the revision isn't worth the paper it's printed on. Seen here is the fourth edition.

"For every ailment under the sun/There is a remedy, or there is none/If there be one, try to find it/If there be none, never mind it."

Imagine how easy the practice of psychology would be if we lived in the black-and-white world of Mother Goose. Alas, resolving the many pathologies amid the vast spectrum of human behavior remains in many cases elusive, despite myriad treatments and interventions available today.

Still, the path to wellness would be near impossible were it not for the *Diagnostic and Statistical Manual of Mental Disorders*. This encyclopedia of mental illness, published by the American Psychiatric Association, offers the final word on everything from kleptomania to schizophrenia. No wonder it's regularly consulted by clinicians, health insurance companies, the pharmaceutical industry and policymakers throughout the United States and, in varying degrees, the rest of the world.

Commonly referred to as the "psychiatrist's bible," like its namesake, the 886-page *DSM* has inspired more than its share of controversy over the years.

The latest battle became public last summer when the authors of the current *DSM-IV,* Allen Frances and Robert Spitzer, sent a letter to the APA's Board of Trustees warning of serious problems with both the process and content of the *DSM-V,* currently being revised for publication in 2013. Their missive followed a back-and-forth between Frances and the APA in the pages of the *Psychiatric Times.*

In their July 6, 2009 letter, Frances and Spitzer assailed the *DSM-V* task force for its lack of transparency: "The *DSM-V* leadership has lost contact with the field by restricting the necessary free communication of its workgroups and by sealing itself off from advice and criticism." Unless the internal review process improved, the authors warned that questions would be raised about the "legitimacy" of the APA's role in producing this and future manuals.

Perhaps more disturbing, especially to the general public, was Frances and Spitzer's assertion that thanks to new thresholds for defining mental illness, tens of millions of "false positives" — otherwise known as people — will become newly diagnosed patients "subjected to the needless side effects and expense of treatment."

All of this is complicated by medicines that may not do what they promise to. (A recent article in the *Journal of the American Medical Association*, for example, found that antidepressants were no more effective than sugar pills for individuals suffering mild to moderate depression.)

Frances knows the problem all too well. As the former chair of the *DSM-IV* task force, the 57-year-old Duke University professor of psychiatry contributed unintentionally to some of the most popular over-diagnoses involving children.

"I'd been party to three false epidemics, ADD, autism and childhood bipolar, thinking that I'd been very careful," Frances says. "I had realized that no one else would be in a position to know how damaging it could be as someone who's already contributed to the problems. If *we* could be conservative and careful and do this, a group that wants to be ambitious and that is less careful could do much more damage."

This did not sit well with the APA, which responded with a counterattack. In the *Psychiatric News* response, APA President Alan Schatzberg said that Frances "misrepresented" the information presented through *DSM-V* updates as final products rather than works in progress.

Moreover, Schatzberg hinted that Frances and Spitzer were questioning the *DSM* for their own financial gain. As Schatzberg wrote: "Both [Frances and Spitzer] continue to receive royalties on *DSM-IV*-associated products. The fact that Dr. Frances was informed at the APA Annual Meeting last month that subsequent editions of his *DSM-IV*-associated products would cease when the new edition is finalized, should be considered when evaluating his critique and its timing."

Both doctors reject Schatzberg's charge and continue to speak out against the direction the new *DSM* is headed. Three days after the much anticipated (and delayed) publication of the *DSM-V* draft proposal on Feb. 8, Frances wrote another commentary for *Psychiatric Times*, "Opening Pandora's Box: The 19 Worst Suggestions for DSM-V." Just how much an impact all this internal feuding will have on the final product remains to be seen, but one thing is certain: As technology, politics, society, medicine and the legal system continue evolving, so too will the *DSM*.

History of the *DSM*

The *Diagnostic Statistical Manual* originated in the 1840s when the U.S. Census made its first attempt to determine how many patients were confined to mental hospitals. At first, only a single category — idiocy/insanity — was used, but by 1880 the census listing had expanded to seven disorders including mania, melancholia, monomania, paresis, dementia, dipsomania and epilepsy.

In 1913, Dr. James May pleaded with the precursor to the APA, the American Medico Psychological Association, to create a uniform classification system. And though by 1917, the list had grown to 22, it wasn't until 1933 that the first edition of the *Statistical Manual for Mental Diseases* appeared. After several revisions the manual as it's known today, *DSM-I*, was published in 1952. (Three years earlier the World Health

Organization's *International Statistical Classification of Diseases* included a section on mental diseases for the first time.)

That first *DSM,* which adopted much of its categorization system from the U.S. Army, listed 106 disorders.

In 1968, *DSM-II* was approved with 182 disorders and for the first time incorporated sociological and biological knowledge. A major controversy occurred following protests by gay activists from 1970 and 1973 over the inclusion of homosexuality as a disorder. It was dropped from the seventh edition of *DSM-II* in 1974, though ultimately replaced with "sexual orientation disturbance."

Also that year — under the leadership of Spitzer – *DSM-III* was created to make its nomenclature consistent with the ICD. More significantly, the *DSM-III* for the first time incorporated a research-based, empirical approach to diagnosis. When it was published in 1980, the text was now nearly 500 pages with 265 diagnostic categories.

The *DSM-IV* was completed in 1994, with a text revision in 2000. Its 297 categories embrace a "biologic" approach to diagnosis and are designed to improve communication between clinicians and researchers.

http://www.miller-mccune.com/health/infallibility-and-psychiatrys-bible-16255/

Today's College Students Lacking in Empathy

A new meta-analysis finds that today's college students have far less empathy than their forbearers.

By Erik Hayden

In the past 30 years, there was a 48 percent decrease in empathetic concern and a 34 percent decrease in perspective taking among these students. (VikramRaghuvanshi / istockphoto)

While recent books have espoused the virtues of Millenials at nearly every turn (see: *Millenials Rising* and *Generation We*), research hasn't been kind to an age group cocooned by social-networking sites and helicopter parents. From documenting a decline in personal responsibility for the environment to finding a link between Facebook and narcissism, data-crunchers are beginning to paint a less rosy picture of the next "great" generation.

The newest such study, conducted by researchers at the University of Michigan, finds a precipitous decline in the past 30 years in the percentage of college students who report having empathetic concern for others and who are willing to take on another person's perspective.

The results, which indicate that these declines have primarily occurred over the last decade, aren't merely an indictment of Millenials. Rather, the researchers hope that their work can spur greater awareness about the potential pitfalls of being isolated by personal technology, such as popular social networking sites.

"With the advances in personal technology, and such increases in competition-especially in college-it's so easy now to spend your time in college isolated in personal experiences," said researcher Edward H. O'Brien in a University of Michigan podcast.

The study, which analyzed 72 samples of academic research from 1979 to 2009, asked 18- to 25-year-old college students if they agreed or disagreed with statements such as, "I sometimes try to understand my

friends better by imagining how things look from their perspective." During the 30-year period there was a 48 percent decrease in empathetic concern and a 34 percent decrease in perspective taking among these students.

Researcher Sara Konrath, who used the nearly 14,000 responses to the Interpersonal Reactivity Index to evaluate empathy among students, is careful not to point to any one cause for these decreases. However, her study speculates that one likely contributor may be that "people simply might not have time to reach out to others and express empathy in a world filled with rampant technology revolving around personal needs and self expression."

Chief among this technology is the 800-pound gorilla, Facebook, charged by pundits as single-handedly undermining the traditional concept of the word privacy and irreversibly changing how humans interact. (To be sure: most of the charges aren't hyperbole.)

While Konrath stressed that technology itself is not the problem, the way it's used certainly can be. As anyone who has "liked" a charity or nonprofit group on Facebook can attest, showing support for others is a far cry from tangible action (i.e. donating money to the organization).

Sadly, the significant decline in empathy and perspective seems predictable to researchers, who reference numerous studies on volunteerism (an outward manifestation of empathy) echoing their results.

Once study, published in 2007 by Kelton Research, finds that while more than 90 percent of Americans reported "it was important to promote volunteerism. … Given the choice, over half chose reading, watching television, and even visiting in-laws over volunteering for or donating to charity."

To be fair, Millenials and college students represent a huge swath of America's volunteer force. A 2009 policy paper from The Higher Education Research Institute found that nearly 70 percent of college students reported the belief that it is essential to help others in need — the highest rate since 1970.

Which makes irony of Konrath's empathy research even more apparent. It appears the latest batch of college respondents seems unwilling or unable to present themselves as empathetic, understanding individuals. Even the question, "To what extent does the following statement describe you: 'I am an empathetic person'" received a puzzlingly low number of the obvious responses.

"Believe it or not, everyone doesn't answer that question [affirmatively]," Konrath said.

To take a short, interactive empathy test and see how you compare against several generations of college students, click here.

http://www.miller-mccune.com/culture/todays-college-students-lacking-in-empathy-16642/

Questioning Questions in Evaluating Polls

How you ask, what you ask and when you ask can all affect what you get in conducting polls.

By Peter M. Nardi

Learning to critically evaluate surveys and public opinion poll questions is important when faced with what may be a deceptively worded questionnaire. (Mad Jack Photography / istockphoto.com)

Recently a conservative organization's solicitation letter (aka junk mail) arrived in my mailbox pleading for funds to "clean up television." I strongly agree that there's much on TV that I would like to see changed, but my list would primarily be to eliminate stupid reality shows and idiotic cable news commentators interrupting each other in shouting matches.

This letter had something else in mind. Attached to the donation card was an "official poll" asking several questions including: "Are you in favor of television programs which major in gratuitous violence such as murder, rape, beatings, etc.?" and "Do you favor the showing of obnoxious and edited R-rated movies on network television?"

I don't think that the folks who would say "yes" to gratuitous murder (are other kinds of murder OK, then?) or favor obnoxious movies on TV are really the target group for the donation. And I also don't believe they were trying to recruit film buffs who abhor the editing of movies by anyone other than the film director. The solicitation "survey" leads recipients to check "no" for the answers, but to say "yes" to sending a check to correct these media problems.

What you see here is a technique that orients and biases questions in specific directions through the use of *loaded* words and *leading* phrases. Learning to critically evaluate surveys and public opinion poll questions are important skeptical skills to use when faced with a daily dose of possibly deceptive data, even from professional surveys trying to present honest results.

Let's look at a couple of real examples from some official surveys. The Pew Research Center for the People & the Press is a well-respected national nonpartisan public opinion research organization focused on policy issues and the media. They have done extensive work on designing surveys and illustrate the impact wording can have on responses.

Skeptic's Café Peter Nardi discusses how to use our critical skills to avoid scams, respond to rumors and debunk questionable research. Learn how to evaluate unusual claims and supposed facts by thinking out the details using essential techniques of skeptical reasoning.

One example is from their own January 2003 survey asking respondents whether they would "favor or oppose taking military action in Iraq to end Saddam Hussein's rule." When worded that way, 68 percent said they favored military action and 25 percent said they opposed it. However, when the question was written as: "favor or oppose taking military action in Iraq to end Saddam Hussein's rule even if it meant that U.S. forces might suffer thousands of casualties," a major reversal of opinion occurred. Only 43 percent said they favored military action and 48 percent said they opposed it.

Consider also these curious findings from a February 2010 CBS News/*New York Times* poll. When people were asked if they "favored or opposed gay men and lesbians serving in the military," 51 percent responded "strongly favor" and 19 percent "somewhat favor," for a total of 70 percent approval. Yet, when the wording was changed to "favored or opposed homosexuals serving in the military," 34 percent answered "strongly favor" and 25 percent "somewhat favor," for a 59 percent approval rate.

Although a majority of Americans were supportive regardless of the wording, note how using "gays and lesbians" instead of "homosexual" created a more positive outcome. Perhaps the H-word highlights the sexual too much for many people's comfort.

Another less obvious technique for leading respondents toward intended answers makes creative use of the order of poll questions. If one were to ask residents, for example, about their opinion of the effectiveness of the local mayor after first inquiring about their views on several problems facing the city (such as budget problems, potholes in the streets, crime), a different outcome would likely occur compared to asking them how their mayor is doing right at the start of the survey.

Such an explanation is what Nate Silver believes accounts for the major discrepancies between Fox News polls and other non-Fox surveys focused on the health care reform bill.

For a reasonably-worded question, "Based on what you know about the health care reform legislation being considered right now, do you favor or oppose the plan?", 53 percent of those interviewed stated they were opposed to the plan. On average, Fox's numbers across several surveys showed a 14 percentage point difference between those who favored the legislation versus those who opposed it, compared with only a 2 percent difference in non-Fox polls. One reason may be due to the placement of the health care items after a set of questions that included: "Do you think President Obama apologizes too much to the rest of the world for past U.S. policies?" and "Do you think the size of the national debt is so large it is hurting the future of the country?"

This is a wonderful case of a properly worded question on the health care plan following a set of leading and loaded questions that likely created a negative context to President Obama's policies. When the findings were announced, no mention was made of these other items and the placement of the health care item after them.

So in addition to assessing the phrasing of survey items, investigate the context in which questions appear. I'm sure you agree with me on the importance of questioning questionnaire design and its impact on survey results. Select one: a) Strongly Agree or b) Somewhat Agree.

http://www.miller-mccune.com/culture/questioning-questions-in-evaluating-polls-16481/

Outsourcing an American Education

India is considering allowing Western universities to plant satellite campuses directly in the subcontinent's fertile soil.

By Sameer Pandya

This may look like an American Ivy League college campus, but it's actually St. Stephen's College in Dehli. India is trying to pass The Foreign Educational Institutions Bill, that would allow Western universities to open satellite campuses in the country. (St. Stephen's College)

There is a bill currently making its way through the Indian parliament — The Foreign Educational Institutions Bill — that would open up for universities in the West, particularly in the U.S., a massive English-speaking market. Massive is the key word. We're talking hundreds of thousands of Indian students reaching college age who are interested in an education that would allow them to better participate in a globalizing economy.

At first glance, the passage of the bill, which is being pushed ahead by Human Resources Minister Kapil Sibal and Prime Minister Manmohan Singh, benefits Western universities by providing them with a growth opportunity and allowing access to a well-educated student population interested in an education whose brand is recognized across the world.

It equally benefits India's higher education system and the students who go through it. While India currently has two university systems — the Indian Institutes of Technology and The Indian Institutes of Management — that rival the American Ivy Leagues, the systems are simply not big enough to manage the demand from within the country. There are not enough top-class universities for the many thousands of students who qualify to attend them.

In the past and currently, India has allowed partnerships between Western and Indian universities. Brown University, for example, has a long-standing relationship with St. Stephen's College in Delhi that allows Brown students to spend a semester in India. And in a recent expansion of the relationship, select St. Stephen's students will be able to study at Brown.

But this bill is something bigger. It would allow Western universities, within certain parameters, to set up entire satellite campuses in India.

So what's the problem? Why has it taken this long for the bill to gather the steam it has? Why is there discussion about the bill if it seems to benefit everyone involved? Things, of course, are never that simple.

In an opinion piece published in the *Indian Express* earlier this month, David Finegold, the dean of the School of Management at Rutgers University, lays out 10 reasons why top universities will not flock to India. Among them are the global financial crisis, the shortage of faculty talent and local competition from significantly cheaper Indian universities.

Among Feingold's reasons, his discussion of Indian bureaucracy deserves quoting.

"Although the government is striving hard in the bill to open up the Indian higher education market to the best foreign universities, a number of factors may discourage them from investing in India: the requirement to post an $11 million bond to establish a university; the steps that will be required to get planning permission for a new campus; the uncertainty about the new body that will govern all higher education and many other forms of regulation in this sector; and the stipulation that they cannot transfer any surplus generated out of India. All of these concerns are compounded by the risk that a change in government could potentially affect their ability to operate in India."

The possible bureaucratic roadblocks in India are in marked contrast to NYU's newly opened campus in Abu Dhabi, which was paid for entirely by the Abu Dhabi government.

The reasons why the bill may be placing so many restrictions may have something to do with the history of Western involvement in education in India.

When the British were setting up their education system in India in the mid-19th century, there was debate on whether to have the instruction take place in English or in the Indian vernaculars. The historian and essayist T.B. Macaulay was appointed the president of the Committee on Public Instruction; in his famous "Minute on Indian Education," Macaulay argued that the medium of education needed to be in English because the Indian students demand it and it allows them to participate in the growing world economic system. That argument, made well over 150 years ago, sounds pretty familiar.

Macaulay went on to write: "We must at present do our best to form a class who may be interpreters between us and the millions whom we govern; a class of persons, Indian in blood and colour, but English in taste, in opinions, in morals, and in intellect."

I don't think the Indian members of parliament who are considering the bill are quoting Macaulay to themselves, but they are certainly affected by his ghost.Will the establishment of American universities mean the creation of students who look Indian, but are Western in taste and opinion? I don't think so. In our early 21st century moment, parsing out what are Western and non-Western tastes and opinions has become quite difficult.

But it does mean that the Indian government and the Western universities that wish to set up shop in India will have to enter into a careful dance that benefits them both without either feeling that one is encroaching upon the other too closely.

http://www.miller-mccune.com/culture-society/outsourcing-an-american-education-16027/

Larger Schools May Breed Less Parental Involvement

A new analysis finds that parents are less likely to volunteer when their children attend larger schools.

By Erik Hayden

Research suggests parents are less likely to volunteer when their children attend larger schools. (SochAnam / istockphoto.com)

Here's a general rule: the more parents are involved in their kids' lives, the better the results usually are.

Naturally, San Francisco Bay Area school districts are taking this truism to new heights. San Jose's Alum Rock Union Elementary School District may soon require parents to volunteer at least 30 hours per academic year — or face a potential slap on the wrist or call from the principal.

While the potential legislation can easily be criticized (what about dual working parents?), administrators might consider another option to encourage more parental involvement: make schools smaller.

New research suggests that when school sizes increase, parental involvement may decrease.

The study found that parental "free-riding" (relying on others to volunteer) increases slightly when their children make the transition from smaller middle schools to larger high schools. When schools are smaller it may add incentives — such as peer pressure — to get parents engaged in volunteering.

In parsing the sample from the older National Educational Longitudinal Study — one of the few long-range, data rich resources widely available to researchers — assistant professor Patrick Walsh of Vermont's St.

Michael's College focused closely on statistics of parental involvement and school size. His study uses this data to follow the same families as their children progress from middle to high school.

The study found that when school enrollment doubles, volunteer rates among parents can decrease up to 5 percent in these larger schools. There are many theories about why this could be: larger schools may leave parents thinking that their opinion at a parent teacher organization won't make a substantive difference, or parents may believe that volunteering may make less of an impact on their child in a larger setting.

"If volunteering helps everyone's kids, then many parents will hang back and simply enjoy the fruits of other's involvement," Walsh stated. "But when everyone does that, you end up with very little volunteering."

Nationwide, about 89 percent of parents reported attending a general school or PTO meeting in 2007. This number decreased for parent's of high school students to about 83 percent, in line with the numbers from the study. This small decline could be attributed to a "hands off" approach parents may take as children mature, but Walsh contends that the longitudinal approach of his study accounts for these "unobserved" characteristics.

"These pressures also decline at larger schools, which can be more anonymous," wrote Walsh. "If everyone blends into the crowd, the benefits of looking public-minded are lower, as are the costs of looking selfish." According to the study, parents tend to get involved in schools to ensure a certain benchmark of quality is met, but are less inclined to volunteer to make good institutions even better.

While the "simplest" solution to get more parents involved is to decrease the size of many schools, Walsh admits that this may be a pipe dream. He did offer that, "even in schools that are already large, administrators could divide the student body into 'schools within a school,' each with its own assistant principal, possibly with distinct themes and activities."

Administrators in San Jose may not have this luxury; instead they're gambling that parental involvement is just as beneficial to children when it's mandated.

Patrick Walsh's research will appear in the *Economics of Education Review*, Vol. 29.

http://www.miller-mccune.com/culture-society/larger-schools-may-breed-less-parental-involvement-16066/

Kids and TV: Maybe It's Not an Idiot Box

It may seem unlikely, but new research says that increased TV watching alone isn't likely to harm children's thinking or schooling.

By Erik Hayden

New research suggests increased TV viewing alone isn't likely to harm a child's cognitive abilities or schooling. (Ryasick / istockphoto.com)

Television has always been a menace.

Over decades, it allegedly has stifled creativity, stymied social development, inhibited academic achievement, and increased depression. At one time, a few of these charges made sense (and some still do), but now, with a hundreds of new-media options competing for eyeballs, many seem a bit quaint.

There's one criticism that could be shelved entirely: More hours of TV watching means lower test scores for young children.

New research, headed by Abdul Munasib at Oklahoma State University, finds that the amount of television watched has little discernible impact on young children's (age 5-10) academic achievement. The study's findings come at a time when 36 percent of children in the U.S. have a TV set in their bedrooms and 40 percent of 3-month-olds regularly are plunked in front of television or DVD programming.

The research, to be published in the *Economics of Education Review*, culled data from the 1990-2002 survey rounds of the National Longitudinal Survey of Youth and measured cognitive skills by using the mathematics and reading test scores from the Peabody Individual Achievement Test.

Using econometric analysis, researchers controlled for things like family structure, resources, parental control, health, urbanization level and many others among a cross section of children. While the study found a correlation between hours of television watched and lower test scores, once a variety of factors were controlled for, this relationship vanishes or "becomes too small to be of any real significance."

While the study doesn't suggest that watching TV is just as beneficial for children's development as a variety of low-tech educational tools, it stresses that television — in effect — has become a scapegoat for children who perform poorly in school.

"If a child is not very interested in school work, [he/she] is likely to do poorly at school," Munasib explained. "But clearly it would be wrong to conclude that watching more TV is what has 'caused' poor performance." In short, if research compares test scores to hours of television watched, it may find a spurious link between the two.

The problem, outlined in the study, is that some the existing research on television viewing and academic achievement is "purely descriptive" in nature — meaning that, in general, the studies don't control for other factors that may influence test scores.

This distinction is important, because research that makes headlines often points a critical finger squarely at television and not on a number of other factors that could influence test scores. Besides, Munasib isn't so sure that children who watch less TV are therefore more likely to do better in school.

"It's certainly true that those who are watching fewer hours of television have more time for studies," Munasib wrote to Miller-McCune.com. "However, whether they actually do so is another issue; the extra time may simply be wasted in some other way that does not impact test scores in any positive way."

His point: Television isn't the only distraction that today's children are likely to encounter when deciding whether or not to complete their homework. With more than 97 percent of adolescents (age 12-17) playing video games and becoming proficient at these systems at a younger and younger age, TV is just the tip of the idle-diversion iceberg.

Munasib's research is not a broadside on the reams of scholarly reporting that insists television watching is bad for children, but it does inform legislators that "proactive policies to reduce television exposure" may not be the most effective way to increase children's test scores and cognitive development.

"If the government passes legislation to encourage lower TV hours for children while everything else [in the school system] remains the same, it is unlikely to improve children's test scores," he wrote.

http://www.miller-mccune.com/culture-society/kids-and-tv-maybe-its-not-an-idiot-box-15160/

Criminalizing the Science You Don't Cotton To

Researchers fear that a lawsuit aimed at the developer of the "hockey stick" temperature map is actually a political salvo at science.

By Emily Badger

A lawsuit aimed at the developer of the "hockey stick" temperature map could be construed as political salvo at science. (istockphoto.com)

Virginia's recently elected attorney general, Ken Cuccinelli, has his hand in just about every divisive issue of the day. He is leading his own charge against the constitutionality of the health care bill, he is suing the Environmental Protection Agency to block it from regulating greenhouse gas emissions, and he is tussling with state universities over whether they can bar discrimination based on sexual orientation.

But the local fight with potentially the broadest reach is the one Cuccinelli has picked against a single scholar — Penn State climatologist Michael Mann.

Mann is the author of what's known in climate research circles as the "hockey stick graph" that charted rapidly rising temperatures in the 20th century. He came to wider attention last November as one of the researchers at the heart of the "climategate" e-mail controversy.

Critics accused Mann and other scientists of manipulating data to portray a climate threat that doesn't really exist. Their research, though, has since been cleared by Penn State, as well as the University of East Anglia, from which the disputed e-mails were originally stolen.

Cuccinelli, still a skeptic, is now investigating Mann's 1999-2005 stint at the University of Virginia using an unlikely tool — the Fraud Against Taxpayers Act. He wants to know if Mann defrauded taxpayers in search of grant money for his research, and last month he served the university with an extensive "Civil Investigative Demand" for documents.

The case touches off a number of unsettling issues around academic freedom, scientific integrity and the role of politics in research. And it has implications, academics worry, not just for scientists.

"The largest one is the precedent that it sets," said Francesca Grifo, who directs the scientific integrity program with the Union of Concerned Scientists. "If he gets away with this, then there are ever so many fields, ever so many kinds of both ideologically and economically motivated harassment of this type that could rain down on scientists in any state."

THE IDEA LOBBY

Miller-McCune's Washington correspondent Emily Badger follows the ideas informing, explaining and influencing government, from the local think tank circuit to academic research that shapes D.C. policy from afar.

UCS helped rally more than 800 academics and scientists in the state of Virginia to sign a letter last week urging Cuccinelli to drop the investigation. The board of the American Association for the Advancement of Science has similarly weighed in, calling the attorney general's move an "apparently political action." Other letters appealing to Cuccinelli or supporting the university in its response have come from the UVA law school, the American Association of University Professors and the American Civil Liberties Union of Virginia.

Whether Cuccinelli abandons the case or not, many of these organizations fear it already has had a chilling effect and could deter scientists from work in politically controversial fields — or, more specifically, could deter work on climate change down the road in Virginia.

"If this thing goes through, if he keeps going, there's no way I'm going to want to be a climate scientist in the state of Virginia," said Amato Evan, an assistant professor in the environmental sciences department at UVA where Mann worked. "It just sounds like you're setting yourself up for some kind of trouble somewhere down the line."

He worries, too, about the meager explanation Cuccinelli has given for the inquiry. The attorney general has said he is investigating misuse of taxpayer dollars, not Mann's scientific conclusions, although the two appear inextricably linked.

"I can't figure out the motive other than to really position himself as a sweetheart of the Tea Party," Evan said. "As a scientist, I feel like who's next? Two, three years from now, when he wants to run as governor, if I'm doing really good work, if I'm very well known for the work that I keep doing on climate change, is he going to come and start harassing me, too, as a way of making himself more politically viable? For me, that's a huge concern."

Jeff Holt, an associate professor of neuroscience at UVA who also signed the UCS letter, sees Cuccinelli's investigation distorting the fundamental scientific process. Early hypotheses are often proven wrong or are later adjusted with new data through peer review — that's how science works. Research fraud does exist, but it's rooted out and discredited by other scientists.

"The idea that you have a criminal investigation into what would be normally a conventional academic process, a scientific process, seems very misplaced," Holt said.

Cuccinelli's foray where other scientific panels before him have already gone also raises the question of whether it's ever appropriate for politicians to assess the validity of technical research.

Mann's original grant proposals were likely vetted by more scientific expertise than exists in Cuccinelli's office, Evan said.

"It's not their job," Grifo added of politicians in general. "They have many important roles to play in the scientific enterprise."

Elected officials appropriate funds for science, for example, and confirm agency heads.

"But this is not one of them," Grifo said.

http://www.miller-mccune.com/politics/criminalizing-the-science-you-dont-cotton-to-16517/

Asteroid probe 'on home straight'

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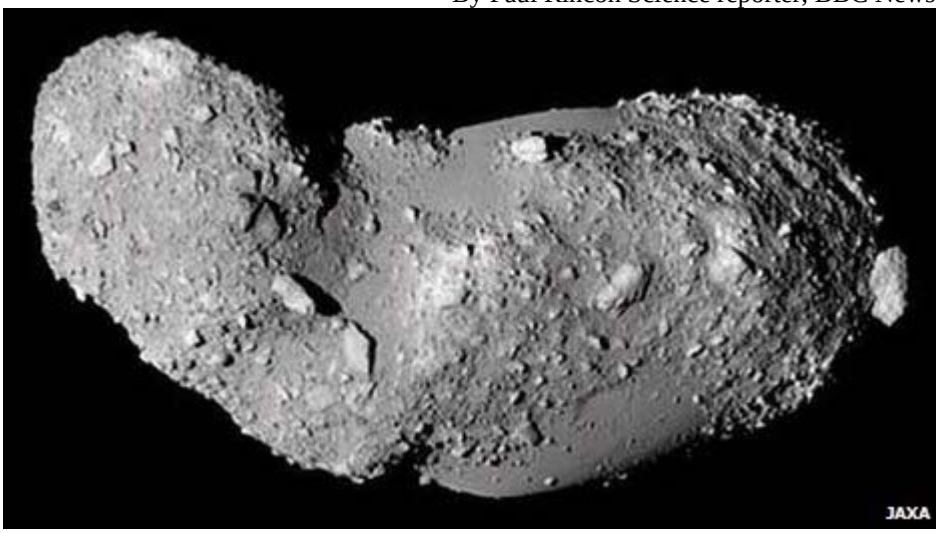
By Paul Rincon Science reporter, BBC News



Hayabusa returned astonishing images from its encounter with Itokawa

An unmanned Japanese spacecraft designed to return samples from an asteroid has completed an important step on its journey back to Earth.

Hayabusa achieved the second and largest of four engine firings designed to guide the probe back home.

The probe visited the asteroid Itokawa in 2005, making close approaches designed to capture soil samples.

But the mission has been plagued by technical glitches affecting the engines and communications with Earth.

It remains unclear whether the probe managed to grab any material from Itokawa; scientists will have to open the capsule to find out.

At the weekend, the Japanese Space Agency (Jaxa) announced that Hayabusa had successfully completed its second Trajectory Correction Manoeuvre (TCM), guiding the spacecraft to Earth's "outer rim".

The craft is now roughly 7,600,000km from our planet, according to Jaxa.

The spacecraft is scheduled to return to Earth on 13 June.

At a distance of 40,000km from Earth, the Hayabusa "mothership" will release its sample return capsule.

Shielding should protect the capsule from the high temperatures it will experience during re-entry. Parachutes will then deploy to slow the capsule's speed for its touchdown in the Australian outback.

It is due to land at the Woomera Test Facility in South Australia at around 1400 GMT.

Scientists will be on tenterhooks as they wait for the capsule to be opened.

Even if Hayabusa failed to grab large samples at Itokawa, the capsule may still contain some residues from the asteroid which could be analysed in laboratories.

Researchers have already been able to study remote sensing data sent back to Earth by the spacecraft during its encounter with the asteroid.

Hayabusa - which means "Falcon" in Japanese - was launched from the Kagoshima Space Center in Japan on 9 May 2003.

It arrived at Itokawa in September 2005, returning astonishing images of the potato-shaped asteroid's jagged terrain.

Hayabusa made two "touchdowns" designed to collect rocks and soil for return to Earth. But it apparently failed to fire a metal bullet designed to gather the samples.

Asteroids contain primordial material left over from the formation of the Solar System billions of years ago.

A fuel leak in 2005 left Hayabusa's chemical propellant tanks empty, so engineers had to use the spacecraft's ion engines to guide the spacecraft home.

Ion thrusters are highly efficient but have a low acceleration. This means that each trajectory correction takes much longer to complete than it would with chemical engines.

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http://news.bbc.co.uk/2/hi/science_and_environment/10196807.stm

Early American colonists 'were hit by severe drought'

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The colonists arrived seeking gold and a route to the orient

A study of discarded oyster shells has reinforced the idea that the first British colonists in America had to endure an unusually severe drought.

Founded in 1607, Jamestown in Virginia was the first successful English settlement in North America.

Chemical analysis of shells thrown away from 1611-1612 shows that the James River where the oysters were harvested was much saltier then than it is today.

This was due to decreased flow from surrounding freshwater rivers.

For this to have been the case, rainfall must have been much lower when these oysters were growing.

US researchers have published details of the work in Proceedings of the National Academy of Sciences (PNAS) journal.

After sailing from London, the colonists selected Jamestown island, on the James River (named in honour of their king), as a secure location for their settlement.

The location had the advantage of a deep water channel allowing the English ships to ride close to shore.

But the island was swampy and overrun by mosquitoes.

And the latest evidence, combined with previous data, suggests the colonists could not have chosen a worse time to establish their settlements.

Juliana Harding from the College of William and Mary in Gloucester Point, US, and colleagues analysed oyster shells retrieved in 2006 from a well dug by the colonists.

The well was in use only for a short time before being converted into a rubbish pit, either because it ran dry or was infiltrated by salty water.

The team looked at values for a particular isotope, or form, of oxygen laid down in the shells.

The levels of this isotope - known as oxygen-18 - in oyster shells are controlled by the temperature and salinity of the water they grow in.

The team compared oxygen-18 values in the 17th Century James River oyster shells with those from their modern day counterparts.

They found that the winter salinity of the river was much higher during the early 1600s than it is today.

This suggests winter rainfall was considerably lower than modern levels, confirming historical accounts of drought conditions at the time.

Previous data based on tree rings and historical documents show that the arrival of the English colonists in Virginia coincided with a severe regional drought.

The years 1606-1612 were the driest in nearly eight centuries.

"Shortages of food and fresh drinking water, combined with poor leadership, nearly destroyed the colony during its first decade," the authors of the latest study write in PNAS.

During what became known as the "Starving Time" from 1609-1610, some 80% of the colonists died.

Seasonal cycles in oxygen-18 values, along with archaeological data, allowed the researchers to show that the oysters were collected in different seasons between 1611 and 1612.

http://news.bbc.co.uk/2/hi/science_and_environment/10200347.stm

China aims to become supercomputer superpower

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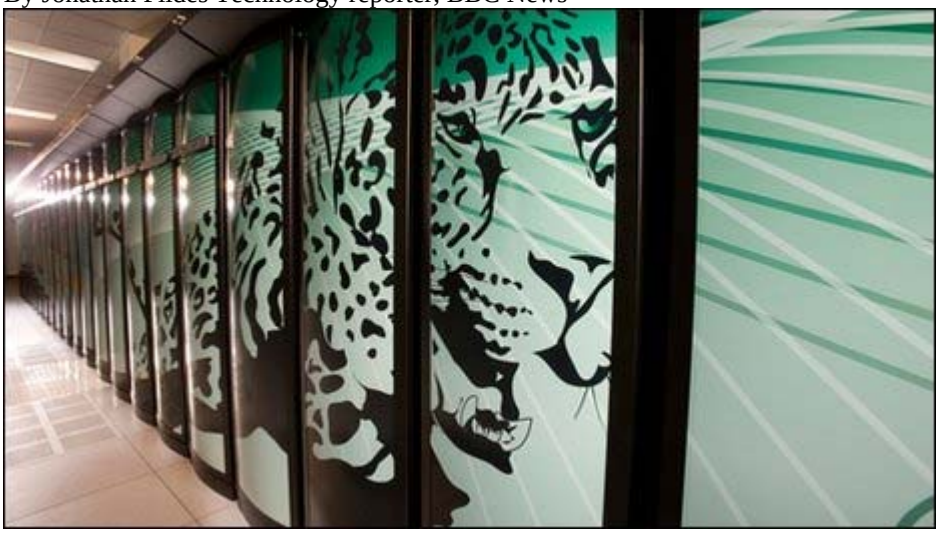
By Jonathan Fildes Technology reporter, BBC News



The US owned Jaguar has a top speed of 1.75 petaflops

China is ramping up efforts to become the world's supercomputing superpower.

Its Nebulae machine at the National Super Computer Center in Shenzhen, was ranked second on the biannual Top 500 supercomputer list.

For the first time, two Chinese supercomputers appear in the list of the top 10 fastest machines.

However, the US still dominates the list with more than half the Top 500, including the world's fastest, known as Jaguar.

The Cray computer, which is owned by the Oak Ridge National Laboratory in Tennessee, has a top speed of 1.75 petaflops.

One petaflop is the equivalent of 1,000 trillion calculations per second.

It is used by scientists conducting research in astrophysics, climate science and nuclear energy.

How fast is the Jaguar Supercomputer?

The Jaguar supercomputer performs 1,750 trillion calculations a second. How long does it take an average PC to match its performance in different time periods?

Supercomputer time
PC time

By comparison, China has 24 machines in the list. Its fastest has a top speed of 1.20 petaflops, more than double the speed of its previous top supercomputer. However, it has a theoretical top speed of nearly 3 petaflops, which would make it the fastest in the world.

The fastest machine in the UK - which has 38 supercomputers on the list - is housed at the University of Edinburgh. It has a top speed of 0.27 petaflops.

"The Top 500 list definitely has an element of flag waving," said Dr Jon Lockley, manager of the Oxford Supercomputing Centre.

Quick thinking

He said China was rapidly becoming a "player" in high performance computing.

Dawning, the company behind the fastest Chinese machine, is reportedly building an even faster machine for the National Supercomputer Center in Tianjin. In addition, it is also developing home-grown silicon chips to power the behemoths.

"Their use of high-performance computers is really systematic of their industrial emergence," Dr Lockley told BBC News.

The machines tend to be used for industrial research, such as aircraft design and petroleum exploration.

Dr Lockley said this was becoming increasingly common around the world.

"Whenever possible, everything is done in a supercomputer," he said.

"Look at Formula One - it's getting rid of all of its wind tunnels and replacing them with supercomputers. It's the same in the aerospace industry as well.

"It means you can all the modelling in the supercomputer and then do just one real world test."

Many of the US machines, by contrast, are owned by the government and are used to monitor the nuclear weapon stockpile.

The spooks have got some pretty big machines

Jon Lockley Oxford Supercomputing Centre

The US has one other petaflop machine - owned by the US Department of Energy. Roadrunner, as it is known, held the top spot until Jaguar displaced it in 2009.

All others machines on the list run at so-called teraflop speeds.

A teraflop is the equivalent of one trillion calculations per second.

Spy machines

However, scientists are already thinking about so-called exascale machines which would be able to crunch through one quintillion (one million trillion) calculations per second.

An exascale computer has been proposed to process data from the Square Kilometre Array (SKA), a series of thousands of telescopes spread over 3,000km. The telescope will be based in either Australia or South Africa.

"At that sort of size the challenge is trying to programme the machines,"" said Dr Lockley.

"It has to be fault tolerant - you can't have a situation where an entire task falls over if one bit fails."

The top 500 list was published at the International Supercomputing Conference in Hamburg, Germany.

It ranks machines by speed. However, according to Dr Lockley, determining which machine is the quickest is a difficult issue.

"It's measured against a theoretical benchmark - if you ran a real-world application you might get a very different answer".

It is also a voluntary list and therefore does not include all machines, such as those at the Oxford Supercomputing Centre and many classified machines owned by governments.

"The spooks have got some pretty big machines," said Dr Lockley.

http://news.bbc.co.uk/2/hi/technology/10181725.stm

Hopes for breast cancer vaccine

A radiologist studies mammograms

American scientists say they have developed a vaccine which has prevented breast cancer from developing in mice.

The researchers - whose findings are published in the journal, Nature Medicine - are now planning to conduct trials of the drug in humans.

But they warn that it could be some years before the vaccine is widely available.

The immunologist who led the research says the vaccine targets a protein found in most breast tumours.

Vincent Tuohy, from the Cleveland Clinic Lerner Research Institute, said: "We believe that this vaccine will someday be used to prevent breast cancer in adult women in the same way that vaccines have prevented many childhood diseases.

Unique challenge

"If it works in humans the way it works in mice, this will be monumental. We could eliminate breast cancer."

In the study, genetically cancer-prone mice were vaccinated - half with a vaccine containing á-lactalbumin and half with a vaccine that did not contain the antigen.

None of the mice vaccinated with á-lactalbumin developed breast cancer, while all of the other mice did.

The US has approved two cancer-prevention vaccines, one against cervical cancer and one against liver cancer.

However, these vaccines target viruses - the human papillomavirus (HPV) and the Hepatitis B virus (HBV) - not cancer formation itself.

In terms of developing a preventive vaccine, cancer presents problems not posed by viruses - while viruses are recognised as foreign invaders by the immune system, cancer is not.

Cancer is an over-development of the body's own cells. Trying to vaccinate against this cell over-growth would effectively be vaccinating against the recipient's own body, destroying healthy tissue.

Caitlin Palframan, of charity Breakthrough Breast Cancer, said: "This research could have important implications for how we might prevent breast cancer in the future.

"However, this is an early stage study, and we look forward to seeing the results of large-scale clinical trials to find out if this vaccine would be safe and effective in humans."

She added there were already steps women could take to reduce the risk of breast cancer, including reducing alcohol consumption, maintaining a healthy weight and taking regular exercise.

Cancer Research UK's professor of oncology, Robert Hawkins, said: "This very early study describes an interesting approach to the prevention of breast cancer.

"It will be several years before this vaccine can be tested fully to assess its safety and effectiveness as a way to stop the disease developing in women."

Breast cancer is the most common cancer in the UK, affecting more than 45,500 women every year.

http://news.bbc.co.uk/2/hi/health/8714085.stm

Men's skin cancer death rate doubles over 30 years

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Rates have soared since the 1970s

By Jane Elliott and video by Anna-Marie Lever BBC News

Consultants from St Thomas' Hospital, London, talk about when a good mole goes bad.

The rate of men dying from the deadliest form of skin cancer has doubled over the past three decades.

Figures from Cancer Research UK show a steep increase in deaths from malignant melanoma, especially in elderly men.

In the late 1970s fewer than 400 (1.5 per 100,000) men died from melanoma but that figure has now risen to over 1,100 (3.1 per 100,000).

Yet the cancer is preventable if people avoid sunburn and deal with 'worrying' moles early, the charity said.

The death rates for women have also risen, from 1.5 to 2.2 per 100,000.

The figures also reveal that although more women are diagnosed in the first place, more men die from the disease.

In men aged over 65 deaths have risen from 4.5 per 100,000 to 15.2 per 100,000 over the past 30 years.

Caroline Cerny, from Cancer Research UK, said men needed to learn to look after their skin.

"Too often men leave it up to their partners or mothers to remind them to use sunscreen or cover up with a shirt and hat, and even to visit the doctor about a worrying mole," she said.

Be vigilant

The figures suggest men are either not aware of skin cancer symptoms or are ignoring them and putting off going to see their GP, she added.

If you are worried about a mole, go to a GP

Dr Jonathan Bowling

"It's crucial that people go to their doctor as soon as they notice any unusual changes to their skin or moles - the earlier the cancer is diagnosed the easier it will be to treat."

Care services minister Paul Burstow said that the figures were worrying and everyone needed to be vigilant.

"Seeing many people with sunburn from the recent sunny weather is a reminder of how easy it is to damage your skin," he said.

Dermatologist Dr Jonathan Bowling, from the Radcliffe Hospitals Trust and the private Cadogan clinic, said it was vital that anyone with any concerns about their moles seek help from a qualified dermatologist.

"If you are worried about a mole, go to a GP," he said.

"Either he can refer you, or if you are still worried you can ask to see a dermatologist."

http://news.bbc.co.uk/2/hi/health/10172892.stm

Comparing income with peers causes unhappiness

Page last updated at 7:17 GMT, Saturday, 29 May 2010 8:17 UK

By Emma Wilkinson Health reporter, BBC News

The study looked at the importance people placed on their income

Comparing your income with those of family and friends is a recipe for unhappiness, a study has suggested.

Researchers analysing data from a Europe-wide survey found three-quarters of those asked thought it important to compare their incomes with others.

But those who compared salaries seem less content, especially if they looked at those of friends and family rather than work colleagues.

The paper in the Economic Journal also found the poor were most affected.

The researchers, from the Paris School of Economics, used data from the European Social Survey covering 19,000 participants in 24 countries.

They found that those who compared their incomes with others tended to be less happy.

Continue reading the main story

We need to know what comes first - is it those who are glass half empty types who do the comparisons as a consequence of that, or is it the comparison that makes them unhappy?

Professor Cary Cooper Lancaster University Management School

The responses showed that the greater the importance people attached to such comparisons, the lower they ranked themselves on measures of satisfaction with life and standard of living, as well as on feeling depressed.

There was no difference seen between men and women in how much they compare their income with those around them.

But limiting comparisons to work colleagues seems to be the most innocuous - as comparisons with friends appeared to be twice as painful as comparisons with colleagues.

People in poorer countries were found to compare their incomes more than people in richer ones and, within countries, poorer people were more likely to compare their incomes than richer people.

Glass half empty

The researchers suggest that when it comes to comparing your salary with colleagues' earnings, it may help boost feelings about the prospects for potential future income.

They concluded: "Constantly looking over one's shoulder seems to make the world a less happy - and more unequal - place."

Study leader Professor Andrew Clark added that the larger effect seen in poorer groups was a surprise.

"I had thought that richer people would compare more because if you're down towards the bottom what really matters is just getting the minimum required, but it didn't come out that way."

Professor Cary Cooper, an expert in organisational psychology and health at Lancaster University Management School, said the kind of people who constantly compare themselves with others tend to be unsure of themselves.

"We need to know what comes first - is it those who are glass half empty types who do the comparisons as a consequence of that, or is it the comparison that makes them unhappy?"

He said comparisons with school and university friends were probably most damaging.

"With work colleagues it's a fairness issue, but with school friends who had the same opportunities as you you might think 'They've done much better than me so I must be less competent'.

"I would advise people to not compare themselves and be happy with who they are and the situation they're in - remember those you're comparing yourself with may not actually be more content."

http://news.bbc.co.uk/2/hi/health/10182993.stm

Snail 'meth' experiment yields drug addiction clue

Page last updated at 1:35 GMT, Friday, 28 May 2010 2:35 UK

The snails' are useful "models" in the study of learning and memory

In an unusual experiment, scientists have used pond snails to study the effects of methamphetamine, better known as crystal meth, on the brain.

They discovered that the drug enhanced the creatures' abilities to learn and remember a task.

This gives insight into how some addictive drugs produce memories that are hard to forget, and that can even cause addicts to relapse.

The scientists described the discovery in the Journal of Experimental Biology.

The humble snail could help prevent and treat memory disorders

Professor George Kemenes University of Sussex

Barbara Sorg from Washington State University in the US led the research team. She explained that the snails provided a "simple model" enabling scientsts to examine the effects of drugs on an individual brain cell.

"These drugs of abuse produce very persistent memories," explained Dr Sorg. "It's a learning process - drug addiction is learning unwittingly.

"All of these visual, environmental and odour cues are being paired with the drug.

So addicts might be able to kick their habit in a treatment centre, but when they return to their old haunts, all those cues trigger craving and relapse."

The ultimate question, said Dr Sorg, is why is it so hard to forget these memories?

To take the first step in answering that question, she and her team examined the effects of crystal meth on the snails, by comparing the performance of drugged and "un-drugged" snails in a simple breathing task.

"The snails normally live in stagnant water and they breathe through their skin," explained Dr Sorg. "But when the water gets low in oxygen, they surface and open up a breathing tube.

The scientists trained the snails not to surface by "poking" this breathing tube with a small stick.

"They don't like that, said Dr Sorg, "so they learn through trial and error not to come up to the surface - they form a memory."

The researchers found that if the snails were exposed to a low concentration of methamphetamine before the breathing task, this "primed them" to form a more persistent memory of it.

The un-drugged snails would generally forget the task 24 hours after training. But methamphetamine-treated snails would retain the memory for longer.

"The drug is not present in their system any longer, but something has happened in their cells that primes them for learning," said Dr Sorg.

Having seen this drug-enhanced or "pathological" memory-making in action, the scientists now want to know what is changing within an individual brain cell.

Dr Sorg's colleague, Professor Kenneth Lukowiak from the University of Calgary in Canada had previously identified the one critical cell, or neuron, in the brain of these snails that is crucial to learning and remembering how to regulate their breathing.

This cell releases a signalling chemical called dopamine; a chemical that, in mammals, is involved in the brain circuitry associated with addiction.

"That's why we decided [this snail] would be a good system to study," said Dr Sorg.

"Now we want to look in that brain cell and find what has changed. It's a big task but some recent studies in our lab point to changes at the level of the cell's DNA that are caused by the drug."

The researchers say that this work lays the foundations for ultimately targeting memory in the treatment of drug addiction and other disorders, such as post traumantic stress disorder.

The ultimate idea would be to target specific memories - these pathological memories - to be forgotten or diminished.

Dr Sorg concluded: "If we know something about how these memories are formed, and just as importantly, how they're forgotten, and if we can understand something about the process that promotes forgetting in a single cell, we might be able to translate that to higher animals, including humans."

Professor George Kemenes from the University of Sussex, studies memory in molluscs in work that is funded by the UK's Medical Research Council.

"Molecular level findings in snails can be highly instructive for learning and memory research in mammals, and can help us to understand how humans learn and remember," he said.

"Ultimately, the humble snail could help prevent and treat memory disorders or even enhance normal memory."

http://news.bbc.co.uk/2/hi/science_and_environment/10172214.stm

On the Verge of 'Vital Exhaustion'?

By BENEDICT CAREY

Decades ago modern medicine all but stamped out the nervous breakdown, hitting it with a combination of new diagnoses, new psychiatric drugs and a strong dose of professional scorn. The phrase was overused and near meaningless, a self-serving term from an era unwilling to talk about mental distress openly.

But like a stubborn virus, the phrase has mutated.

In recent years, psychiatrists in Europe have been diagnosing what they call "burnout syndrome," the signs of which include "vital exhaustion." A paper published last year defined three types: "frenetic," "underchallenged," and "worn out" ("exasperated" and "bitter" did not make the cut).

This is the latest umbrella term for the kind of emotional collapses that have plagued humanity for ages, stemming at times from severe mental difficulties and more often from mild ones. There have been plenty of others. In the early decades of the 20th century, many people simply referred to a crackup, including "The Crack-Up," F. Scott Fitzgerald's 1936 collection of essays describing his own. And before that there was neurasthenia, a widely diagnosed and undefined nerve affliction causing just about any symptom people cared to add.

Yet medical historians say that, for versatility and descriptive power, it may be hard to improve upon the "nervous breakdown." Coined around 1900, the phrase peaked in usage during the middle of the 20th century and echoes still. One recent study found that 26 percent of respondents to a national survey in 1996 reported

that they had experienced an “impending nervous breakdown,” compared with 19 percent from the same survey in 1957.

“ ‘Nervous breakdown’ is one of those sturdy old terms, like ‘melancholia’ and ‘nervous illness,’ that haven’t really been surpassed, although they sound antiquated,” the historian Edward Shorter, co-author with Max Fink of the book “Endocrine Psychiatry: Solving the Riddle of Melancholia,” said in an e-mail message.

Never a proper psychiatric diagnosis, the phrase always struck most doctors as inexact, pseudoscientific and often misleading. But those were precisely the qualities that gave it such a lasting place in the popular culture, some scholars say. “It had just enough medical sanction to be useful, but did not depend on medical sanction to be used,” said Peter N. Stearns, a historian at George Mason University near Washington, D.C.

A nervous breakdown was no small thing in the 1950s or ’60s, at least by the time a person arrived at a doctor’s office. Psychiatrists today say that, most often, it was code for an episode of severe depression — or psychosis, the delusions that often signal schizophrenia.

“I don’t remember people who got that label ever using it as their own complaint — it was very much stigmatized,” said Dr. Nada L. Stotland, a former president of the American Psychiatric Association and a professor at Rush Medical College in Chicago, who began practicing in the 1960s. “Whether it was ‘nervous exhaustion’ or ‘nervous breakdown,’ anything that sounded psychiatric was stigmatized at that time. It was shameful, humiliating.”

The vagueness of the phrase made it impossible to survey the prevalence of any specific mental problem: It could mean anything from depression to mania or drunkenness; it might be the cause of a bitter divorce or the result of a split. And glossing over those details left people who suffered from what are now well-known afflictions, like postpartum depression, entirely in the dark, wondering if they were alone in their misery.

But that same imprecision allowed the speaker, not medical professionals, to control its meaning. People might be on the verge of, or close to, a nervous breakdown; and it was common enough to have had “something like” a nervous breakdown, or a mild one. The phrase allowed a person to disclose as much, or as little, detail about a “crackup” as he or she saw fit. Vagueness preserves privacy.

Dr. Shorter said that the term “nervous” has traditionally been a “weasel word” for mental troubles, implying that the cause was something physical beyond the person’s control — their damaged nerves, not their mind. And a breakdown, after all, is something that happens to cars. It’s a temporary problem; or at least, not necessarily chronic.

Through the ages, every generation has attributed its own catchall diagnosis to larger cultural changes. Industrialization. Modernization. The digital age. The 19th-century philosopher William James reportedly called neurasthenia, from which he claimed to suffer himself, “Americanitis,” in part the result of the accelerating pace of American life. So it was with breakdowns. The causes were largely external — and recovery a matter of better managing life’s demands.

“People accepted the notion of nervous breakdown often because it was construed as a category that could handled without professional help,” concluded a 2000 analysis by Dr. Stearns, Megan Barke and Rebecca Fribush. The popularity of the phrase, they wrote, revealed “a longstanding need to keep some distance from purely professional diagnoses and treatments.”

Many did just that, and returned to work and family. Others did not. They needed a more specific diagnosis, and targeted treatment. By the 1970s, more psychiatric drugs were available, and doctors directly attacked the idea that people could effectively manage breakdowns on their own.

Psychiatrists proceeded to slice problems like depression and anxiety into dozens of categories, and public perceptions shifted, too. In 1976, 26 percent of people admitted seeking professional help, up from 14 percent in 1947, according to Dr. Stearns's analysis. And "nervous breakdown" began to fade from use.

The same fate may or may not await "burnout syndrome," which for now has backing from some doctors and medical researchers. But it has another 30 years to outlast the classic "breakdown."

http://www.nytimes.com/2010/06/01/health/01mind.html?nl=health&emc=healthupdateema1

For Very Young, Peril Lurks in Lithium Cell Batteries

By TARA PARKER-POPE

Stuart Bradford

Last fall, 13-month-old Aidan Truett of Hamilton, Ohio, developed what seemed like an upper respiratory infection. He lost interest in food and vomited a few times, but doctors attributed it to a virus. After nine days of severe symptoms and more doctor visits, the hospital finally ordered an X-ray to look for pneumonia.What they found instead was totally unexpected. The child had ingested a "button" battery, one of those flat silver discs used to power remote controls, toys, musical greeting cards, bathroom scales and other home electronics.

The battery was surgically removed the next day, and Aidan was sent home. But what neither the doctors nor his parents realized was that the damage had been done. The battery's current had set off a chemical reaction in the child's esophagus, burning through both the esophageal wall and attacking the aorta. Two days after the battery was removed, Aidan began coughing blood, and soon died from his injuries.

To this day, Aidan's parents don't know where the battery came from. "This is something I would never want another parent to live with," said Michelle Truett, Aidan's mother. "I was oblivious as to how dangerous they were, and I want more people to know the danger."

Such deaths are extremely rare. There were fewer than 10 documented during the last six years. But ingestion of lithium cell batteries, which children may mistake for candy and elderly adults for medication, is a surprisingly common problem, documented this week in two reports in the medical journal Pediatrics.

About 3,500 cases of button cell battery ingestion are reported annually to poison control centers. But while swallowing batteries has occurred for years, the development of larger, stronger lithium cell batteries has increased the risk of severe complications.

Data from the National Capital Poison Center in Washington found a sevenfold increase in severe complications from button cell ingestions in recent years. Moderate to severe cases have risen from less than a half percent (about a dozen cases per year) to about 3 percent (nearly 100 cases per year), based on a review of 56,000 cases since 1985.

Among the serious complications, the chemical reaction triggered by the batteries can damage vocal cords, leaving children with a lifelong whisper. Damage to the gastrointestinal tract means some children require feeding tubes and multiple surgeries. “The injuries are so much more serious,” said Dr. Toby Litovitz, director and lead author of both articles in Pediatrics. “It’s like drain opener or lye. It’s not something you want in the esophagus of your child.”

The batteries that pose the greatest risk are those that begin with the number 20, which stands for 20 millimeters. They are newer and stronger than older models. Batteries numbered 2032, 2025 and 2016 are responsible for more than 90 percent of serious injuries.

“Industry has shifted to this battery, and it has very popular appeal,” Dr. Litovitz said. “There are a lot of reasons why we want to use this battery, but the problem is we’ve got to use it in a safer way.” Federal safety rules require toys that use the batteries to have battery compartments that are locked with screws. But devices intended for adults — like bathroom scales and remote controls — often hold the batteries in with a simple plastic cover that can fall off or be removed easily.

That’s what happened when 13-month-old Kaiden Vasquez of Bristow, Va., picked up the remote control to his parent’s iPod docking station. Somehow, he dislodged the battery and swallowed it. But his parents did not notice the missing battery when he began crying hysterically and could not be calmed. Emergency room doctors diagnosed a stomach flu, but a week later the child’s pediatrician took an X-ray and saw what he thought was a quarter. When the round item was removed, doctors discovered the battery and kept Kaiden for observation. The battery had burned a hole in his esophagus and trachea and he required a feeding tube and two months of home nursing care.

Kaiden, who will be 3 in July, has recovered, although severe reflux after the incident damaged his teeth. “I don’t allow any of those disc batteries into my home,” said Kaiden’s mother, Amy Vasquez, who has three other young children. “I never thought a remote would do so much damage to my child.”

Battery ingestion is also a problem among the elderly, who often mistake hearing aid batteries for medication. But in those cases, the battery typically doesn’t get stuck because the digestive tract is larger and the battery used in hearing aids is smaller.When children ingest batteries, it’s usually not because they found one loose in the home. In 60 percent of the cases involving children under age 6, the child has removed the battery from the electronic device. The problem is that most parents are not even aware when it happens, yet studies show the battery begins to cause severe damage within just two hours of ingestion. “It’s really a tight timeline, because a lot of these cases aren’t witnessed,” Dr. Litovitz said. “Children present with symptoms that are nonspecific, the parent doesn’t know the battery was ingested — that makes it difficult for the doctor to diagnose.”

Dr. Litovitz said the problem needed to be addressed by manufacturers of electronic products, who should secure the battery compartments in all devices, not just toys.“Children have ready access to remote controls, watches, garage door openers,” she said. “Our major pitch is to get the industry to do something about the battery compartment, but parents also need to know that they need to be dealing with these batteries with a lot more vigilance and keeping them out of reach of the child.”

Cara George of Littleton, Colo., has been working to raise awareness about lithium batteries ever since her 18-month-old daughter, Brenna, died after ingesting one nearly two years ago. “I want to raise awareness for parents, for doctors, for the community,” she said. “I think there should be warnings on every item the batteries are in. They are in greeting cards and children’s books that talk. They’re everywhere.”

http://well.blogs.nytimes.com/2010/05/31/for-very-young-peril-lurks-in-lithium-cell-batteries/?ref=health

Seeking an Objective Test for Attention Disorder

By KATHERINE ELLISON

WALNUT CREEK, Calif. — I'm sitting in front of a gray plastic console that resembles an airplane cockpit. Each time I move, a small reflector on a makeshift tiara resting on my forehead alerts an infrared tracking device pointing down at me from above a computer monitor.

Watching the screen, I'm supposed to click a mouse each time I see a star with five or eight points, but not for stars with only four points.

It's a truly simple task, and I'm a college-educated professional.

So why do I keep getting it wrong? Halfway into the 20-minute session, I find myself clicking at a lot of four-point stars, while sighing and cursing with each new mistake and stamping my feet, sending further unflattering information to the contraption via tracking straps taped to my legs.

Dr. Martin H. Teicher, the Harvard psychiatrist who invented the test, has an explanation for my predicament.

"You have some objective evidence for an impairment in attention," he said — in other words, a "very subtle" case of attention deficit hyperactivity disorder. (Indeed, I had already received a diagnosis three years earlier.) Not only did I click too many times when I shouldn't have, and occasionally vice versa, but subtle shifts in my head movements, tracked by the device's motion detector, suggested that I tended to shift attention states, from on-task to impulsive to distracted and back. Dr. Teicher's invention, the Quotient A.D.H.D. System, is only one of several continuing efforts to find a biomarker — i.e., distinctive biological evidence — for this elusive disorder.

Most mainstream researchers consider A.D.H.D. to be an authentic neurological deficit that, left untreated, can ruin not only school report cards, but lives. Nonetheless the quest for objective evidence has gained new urgency in recent years. Many critics say the disorder is being rampantly overdiagnosed by pill-pushing doctors in league with the drug industry, abetted by a culture of overanxious parents and compliant educators.

These critics say that the standard treatment — stimulant medications like Ritalin and Adderall — carries a high risk for side effects and abuse in children whose attention problems might have no biological cause.

Yet despite the perils of faulty diagnosis, the most common way of detecting the disorder has nothing directly to do with biology. Instead, patients — along with their parents and teachers, in the case of children — are asked to respond to a checklist of questions about symptoms that most mortals suffer at one time or another. Do you (or your child) often make careless mistakes? Do you often seem not to listen when spoken to directly? Do you often not follow through on instructions?

This method, similar to the way doctors diagnose most mental illnesses, is so subjective that the answers, and the diagnosis, may depend on how distressed a patient, a parent or a teacher is feeling on a given day. Moreover, parents and teachers, and indeed mothers and fathers, can disagree, obliging a doctor to choose whom to believe.

All this helps explain why an objective test has become “the holy grail” for many researchers, said Stephen Hinshaw, chairman of the psychology department at the University of California, Berkeley. Still, he and other experts are not convinced that any one test developed so far has proved better than the prevailing checklist method.

Many psychologists who offer comprehensive testing of children with undiagnosed learning problems include some variation of the Continuous Performance Test, a computerized assessment that measures distractibility; it is similar to Dr. Teicher’s invention, but without the motion detector. In Southern California, meanwhile, Dr. Daniel G. Amen has built a business empire on his assertion that he can detect A.D.H.D. with a brain scan using a technology called Spect, for single photon emission computed tomography — a claim still unestablished in peer-reviewed reports of clinical trials.

In contrast, Dr. Teicher has reported on trials of his test’s efficacy in the Journal of the American Academy of Child and Adolescent Psychiatry. The Food and Drug Administration approved sales of the device in 2002, and several insurers, including Aetna and Blue Cross, now cover the test, according to Carrie Mulherin, a vice president at BioBehavioral Diagnostics, a startup company in Westford, Mass., that is marketing Dr. Teicher’s system (and paying him royalties; the list price is $19,500).

To date, more than 70 clinicians in 21 states have bought or leased a Quotient system, Ms. Mulherin said.

Dr. M. Randall Bloch, the Walnut Creek psychiatrist who was demonstrating the program for me recently, has been leasing it since last September, while considering a purchase. “I think it’s really cool,” he said. “It would be great to have more objectivity.”

In addition to his lease payments, Dr. Bloch pays BioBehavioral Diagnostics $55 for each patient taking the test, while charging insurance companies as much as $200. While he says he wouldn’t diagnose the disorder on the basis of test scores alone, he has found the system a useful way to seal the diagnosis with patients or their parents who may be reluctant to try medication.

The Quotient system has also helped Dr. Bloch discourage patients who have claimed to have attention problems but who, he suspects, were merely interested in taking stimulants for fun, or in hopes of more productivity.

“You can tell if they’re trying to game the test,” he told me, pointing to a colored graph on my own assessment denoting attention states. Green marks attentive, yellow is impulsive, red is distracted and blue is “disengaged.” A lot of blue might lead to the suspicion that someone is failing on purpose.

While I switched among green, red and yellow, I didn’t have any blue on my graph.

“You were working hard,” Dr. Bloch said, approvingly.

“It’s how I cope,” I muttered.

Dr. Teicher said the Quotient system offered an efficient way to figure out the most helpful kind and dose of medication to treat attention problems.

“The stimulants work very quickly,” he explained. “So once we’ve tested a child, we could give him a dose, wait 90 minutes, and if he’s a responder, his performance will improve enormously. If not, we can bring him back the following week and try a different medication. This is a process that normally takes months or years.”

The key to his system, he said, is what he suspects will eventually be confirmed as a valid biological marker for A.D.H.D.: an unstable control of head movements and posture, particularly while paying attention to a boring task.

Last fall the National Institutes of Health awarded Dr. Teicher a $1 million grant from the federal stimulus package to delve further into the quest for a definitive test or biomarker for the disorder. He plans to focus his research on three detective strategies: his Quotient system, magnetic resonance imaging to compare blood flows in different brain regions, and the ActiGraph, an activity monitor widely used by medical researchers.

James M. Swanson, a developmental psychologist and attention researcher at the University of California, Irvine, praised Dr. Teicher’s research, echoing his concerns about the need for a more objective test to detect the disorder. But he questioned whether the Quotient system produces more reliable diagnoses than a doctor’s dogged questioning of a child’s parents and teachers, and also whether it is an appropriate way to figure out the right dose of medication. “It’s essentially a dull, boring task,” he said of the Quotient system, “so do you want to medicate your child to pay attention to dull, boring tasks?”

As I left Dr. Bloch’s office with my printed-out assessment, I pondered some questions of my own. How much of my supposed impairment is rooted in my brain, and how much in a culture that daily trains me to yank my focus between e-mail and cellphone calls? Do I need Ritalin or a meditation retreat — or just more interesting work, or maybe more peaceful children?

I could use an objective test for this one. Is anyone working on it?

Katherine Ellison, a journalist in California, is the author of “Buzz: A Year of Paying Attention,” to be published in October.

http://www.nytimes.com/2010/06/01/health/01attention.html?ref=health

Happiness May Come With Age, Study Says

By NICHOLAS BAKALAR

It is inevitable. The muscles weaken. Hearing and vision fade. We get wrinkled and stooped. We can't run, or even walk, as fast as we used to. We have aches and pains in parts of our bodies we never even noticed before. We get old.

It sounds miserable, but apparently it is not. A large Gallup poll has found that by almost any measure, people get happier as they get older, and researchers are not sure why.

"It could be that there are environmental changes," said Arthur A. Stone, the lead author of a new study based on the survey, "or it could be psychological changes about the way we view the world, or it could even be biological — for example brain chemistry or endocrine changes."

The telephone survey, carried out in 2008, covered more than 340,000 people nationwide, ages 18 to 85, asking various questions about age and sex, current events, personal finances, health and other matters.

The survey also asked about "global well-being" by having each person rank overall life satisfaction on a 10-point scale, an assessment many people may make from time to time, if not in a strictly formalized way.

Finally, there were six yes-or-no questions: Did you experience the following feelings during a large part of the day yesterday: enjoyment, happiness, stress, worry, anger, sadness. The answers, the researchers say, reveal "hedonic well-being," a person's immediate experience of those psychological states, unencumbered by revised memories or subjective judgments that the query about general life satisfaction might have evoked.

The results, published online May 17 in the Proceedings of the National Academy of Sciences, were good news for old people, and for those who are getting old. On the global measure, people start out at age 18 feeling pretty good about themselves, and then, apparently, life begins to throw curve balls. They feel worse and worse until they hit 50. At that point, there is a sharp reversal, and people keep getting happier as they age. By the time they are 85, they are even more satisfied with themselves than they were at 18.

In measuring immediate well-being — yesterday's emotional state — the researchers found that stress declines from age 22 onward, reaching its lowest point at 85. Worry stays fairly steady until 50, then sharply drops off. Anger decreases steadily from 18 on, and sadness rises to a peak at 50, declines to 73, then rises slightly again to 85. Enjoyment and happiness have similar curves: they both decrease gradually until we hit 50, rise steadily for the next 25 years, and then decline very slightly at the end, but they never again reach the low point of our early 50s.

Other experts were impressed with the work. Andrew J. Oswald, a professor of psychology at Warwick Business School in England, who has published several studies on human happiness, called the findings important and, in some ways, heartening. "It's a very encouraging fact that we can expect to be happier in our early 80s than we were in our 20s," he said. "And it's not being driven predominantly by things that happen in life. It's something very deep and quite human that seems to be driving this."

Dr. Stone, who is a professor of psychology at the State University of New York at Stony Brook, said that the findings raised questions that needed more study. "These results say there are distinctive patterns here," he said, "and it's worth some research effort to try to figure out what's going on. Why at age 50 does something seem to start to change?"

The study was not designed to figure out which factors make people happy, and the poll's health questions were not specific enough to draw any conclusions about the effect of disease or disability on happiness in old age. But the researchers did look at four possibilities: the sex of the interviewee, whether the person had a partner, whether there were children at home and employment status. "These are four reasonable candidates," Dr. Stone said, "but they don't make much difference."

For people under 50 who may sometimes feel gloomy, there may be consolation here. The view seems a bit bleak right now, but look at the bright side: you are getting old.

http://www.nytimes.com/2010/06/01/health/research/01happy.html?ref=health

In Asia, Cutting Arsenic Risk in Water Through Well-Drilling Techniques

By DONALD G. McNEIL Jr.

Arsenic is so common in groundwater in Bangladesh, Nepal, western India, Myanmar, Cambodia and Vietnam — all heavily populated countries in the flood plains draining the Himalayas — that their drinking water has been called "the largest poisoning of a population in history."

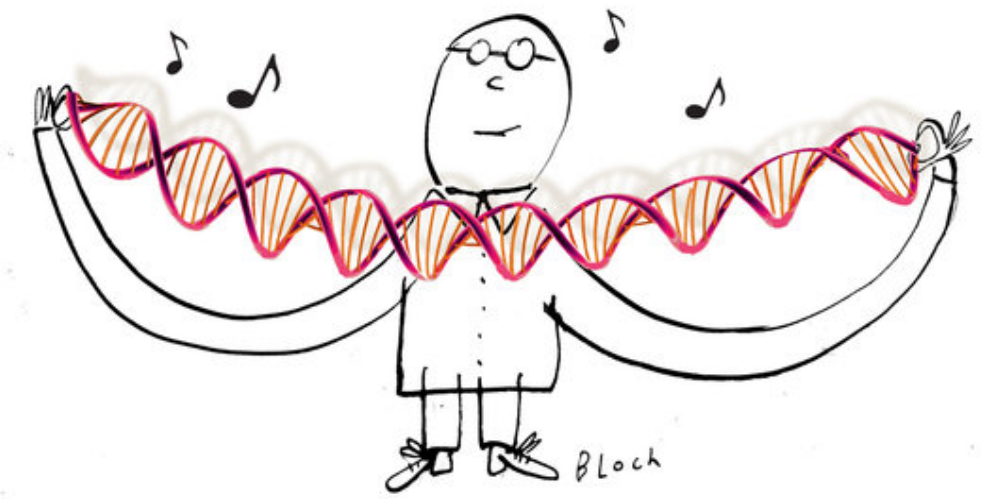
But a recent study in Science magazine suggests simple well-drilling techniques that could lower the risk. The arsenic comes from eroding Himalayan coal seams and rocks containing sulfides; it is released into the groundwater only under certain chemical conditions deep underground. Some of those are affected by human activities, including pumping out huge volumes of water for irrigation. Different-colored sands may indicate how likely an aquifer is to be dangerous: rusty orange sands full of iron oxides often have less dissolved arsenic in the water around them than gray-colored sands do. Any village may have many orange and gray layers at different depths underneath it, and villagers may unknowingly live near both safe and dangerous wells. But testing is usually inadequate.

Therefore, the authors — geologists from Stanford, Columbia and the University of Delaware — suggest that wells for drinking water should be drilled in deep orange sands and connected to low-pressure hand pumps, while wells connected to high-pressure pumps for crop irrigation should be kept out of those deep aquifers so they do not empty them of safe water, which would cause arsenic-laden water to migrate downward into them.

http://www.nytimes.com/2010/06/01/health/01glob.html?ref=health

Peering Over the Fortress That Is the Mighty Cell

By NATALIE ANGIER



When J. Craig Venter announced at a news conference the other day that he and his co-workers had created the first "synthetic cell," he displayed the savvy graciousness of an actor accepting an Academy Award.

Dr. Venter, the renowned genome wrassler and president of the J. Craig Venter Institute, praised his two dozen team members and described the long years of struggle that preceded their moment of triumph. He called out important figures in the audience: his editor, his literary agent, the celebrity diet doctor Dean Ornish. And he acknowledged that none of his group's work would have been possible without a lot of help from the parents — Mother Nature and Father Time.

After all, that stalwart pair was responsible for designing and gradually refining the real cells that brought the Venter team's synthetic constructs to life. There is, as yet, no escaping the cell. Every past and present lodger on the twisted bristlecone tree of life is built of cells, every cell is a microcosm of life, and neither the Venter team nor anybody else has come close to recreating the cell from scratch. If anything, the new report underscores how dependent biologists remain on its encapsulated power.

As reported in the journal Science on May 20 to international attention, the Venter team managed to recreate with bottled chemicals the entire genetic code of one species of bacterium and transplant that manufactured genome into the housing of a closely related species of bacterium. Once installed, the synthetic DNA began operating like the real thing, prompting its cellular surroundings to produce a protein work force appropriate to its needs rather than that of the original bacterial host, to copy the synthetic DNA, and to do what all bacteria love to do, which is divide over and over again.

The researchers now have many descendants of that founding microbial construct stored in a freezer, all of them nearly indistinguishable from what you'd get if you cultivated the "donor" bacterium naturally. Only on looking carefully at the genetic sequence in each cell would you find the researchers' distinguishing "watermarks," brief chemical messages inserted into the otherwise plagiarized string of one million-plus letters of bacterial DNA.

The harmless nucleic interjections include encrypted versions of the researchers' names and three apt if self-conscious quotations: "See things not as they are, but as they might be," from a biography of the physicist Robert Oppenheimer; "What I cannot build, I cannot understand," by Richard Feynman; and "To live, to err, to fall, to triumph, and to recreate life out of life," by James Joyce, which, when taken together with the fact that the physicist Murray Gell-Mann named the fundamental particles of the atomic nucleus "quarks" after a line in Joyce's "Finnegans Wake," suggests that scientists are at least as fond of the nougaty Irish novelist as is the average English major.

Other researchers were impressed by the work but were quick to keep the feat on the ground. "There's no doubt in my mind that this is a major achievement," said Steen Rasmussen, a professor of physics at the University of Southern Denmark who works in the field of synthetic biology. "But is it artificial life? Of course not."

Bonnie L. Bassler, a microbiologist at Princeton, said, "They started with a known genome, a set of genes that nature had given us, and they had to put their genome into a live cell with all the complex goo and ingredients to make the thing go."

Dr. Venter freely admitted his indebtedness to precedence. His team, he said, was "taking advantage of three and a half billion years of evolution." Throughout those preposterous eons, nature has had a chance to perfect the splendid entity of all earthly animation that is the living cell. And though researchers have made some tentative progress in their efforts to synthesize other essential elements of the cell apart from the genome, don't expect even a cheap knockoff anytime soon. "I am always awed by nature," Dr. Bassler said, "and how it manages to work so well."

There is a reason why life is built of cells, and why most cells are too small to see without a microscope. It's easy in a small space to keep critical components squeezed together and close at hand, the better for the right enzymes to encounter the right substrates in a timely fashion and a million tiny bonfires to burn. "Cells are not like an aquarium where a fish swims by now and again," said Dr. Bassler. "They're jam-packed inside. They're teeming with stuff. They're like a house filled with necessary clutter, or New York City, or a Thanksgiving table loaded with so many dishes you don't know where you might put another plate."

Much of the cell's interior is taken up by the cytoplasm, which, as several biologists have gleefully observed, pretty much has the texture of snot. The appearance of random ooze, however, is deceptive. "There's a beautiful architecture" to the cytoplasm, Dr. Bassler said. "Everything is in the right place and bumping around, and the membrane holds them together so they can't get away from each other."

When the Venter team inserted the synthetic version of the Mycoplasma mycoides genome into the cellular housing of the Mycoplasma capricolum bacterium, the newcomer took full advantage of the resident cytoplasmic wares. It used the thousands of little biodevices called ribosomes to stitch together amino acids into new proteins. It relied on complex molecular assemblages to maintain its DNA in working order and to duplicate that DNA when it was time to divide. It thanked its lucky base pairs that a greasy lipid cell membrane and stiffer bacterial wall not only kept the inside appropriately, bioactively dense, but also kept the outside appropriately out, for an exposed cytoplasm would soon be scavenged for parts, most likely by a neighboring microbe.

Considered together, the modern cell is dauntingly complex, which is why most researchers in the youngish field of synthetic biology address only one or two pieces of it at a time. Last year, George Church of Harvard Medical School and his colleagues reported that they had created an artificial ribosome. James J. Collins, the co-director of the Center for Biodynamics at Boston University, is working on a synthetic DNA toggle switch, to flip genes on and off at will.

In Denmark, Dr. Rasmussen is seeking to design the most stripped-down minimalist suggestion of a functioning cell. As he sees it, there are three basic capacities that a living cell must possess. It must have a means of channeling free energy in the environment to meet its demands: that is, it must have some form of metabolism. It must have an enclosure: a cell membrane. And it must have the informational wherewithal to reproduce itself: a genome. Dr. Rasmussen and his co-workers have devised reasonable if crude facsimiles of the three cellular non-negotiables, and they've managed to merge two of them together in any given experiment — and in one case even all three of them. The goal of contriving a self-replicating and autonomously metabolizing protocell, however, continues to elude them. "We have the instruments," he said, "but it doesn't sound like an orchestra yet."

Just pick up your baton, hum a few bars, and give it three billion years.

http://www.nytimes.com/2010/06/01/science/01angi.html?ref=health

Safety Rules Can't Keep Up With Biotech Industry

By ANDREW POLLACK and DUFF WILSON

They are the highly trained, generally well-paid employees in the vanguard of American innovation: people who work in biotechnology labs. But the cutting edge can be a risky place to work.

The casualties include an Agriculture Department scientist who spent a month in a coma after being infected by the E. coli bacteria her colleagues were experimenting with.

Another scientist, working in a New Zealand lab while on leave from an American biotechnology company, lost both legs and an arm after being infected by meningococcal bacteria, the subject of her vaccine research.

Last September, a University of Chicago scientist died after apparently being infected by the focus of his research: the bacterium that causes plague.

Whether handling deadly pathogens for biowarfare research, harnessing viruses to do humankind's bidding or genetically transforming cells to give them powers not found in nature, the estimated 232,000 employees in the nation's most sophisticated biotechnology labs work amid imponderable hazards. And some critics say the modern biolab often has fewer federal safety regulations than a typical blue-collar factory.

Even the head of the federal Occupational Safety and Health Administration acknowledges that his agency's 20th-century rules have not yet caught up with the 21st-century biotech industry.

"Worker safety cannot be sacrificed on the altar of innovation," said David Michaels, OSHA's new director. "We have inadequate standards for workers exposed to infectious materials."

The current OSHA rules governing laboratories, for example, were not written with genetic manipulation of viruses and bacteria in mind. "The OSHA laboratory standard deals with chemicals," Mr. Michaels said. "It doesn't deal with infectious agents."

Earlier this month, as a first step toward possible new regulations, the agency issued a sweeping request for information on occupational risks from infectious agents, and for suggestions on how best to reduce them.

The focus is mainly on hospital and other health care workers, but any rules are expected to also cover industry laboratory workers.

Some safety experts in the biotechnology industry argue that there is no big safety problem, and that workers are adequately protected by various voluntary guidelines on safe laboratory practices and by OSHA's general rule that employers provide a safe workplace.

"The OSHA requirement applies to all industries, including the pharmaceutical industry," said John H. Keene, a biosafety consultant to industry and former president of the American Biological Safety Association, a professional society for those involved in biolab safety.

But at least three trends are stoking concern among safety advocates. In the wake of the 2001 anthrax attacks, the federal government stepped up research involving biowarfare threats, like anthrax, Ebola and many other of the world's deadliest pathogens. Another factor is that the new techniques of so-called synthetic biology allow scientists to make wholesale genetic changes in organisms rather than just changing one or two genes, potentially creating new hazards. Just this month, the genome pioneer J. Craig Venter announced the creation of a bacterial cell containing totally synthetic DNA, which Dr. Venter described as the first species "whose parent is a computer."

The third trend involves the shifting focus of the pharmaceuticals industry — potentially the largest source of new biotechnology jobs. Drug makers, responding to competition from cheap generic medications, are moving beyond the traditional business of making pills in chemical factories to focus instead on vaccines and biologic drugs that are made in vats of living cells.

There are currently few good statistics on biolab accidents. One study, reviewing incidents discussed in scientific journals from 1979 to 2004, counted 1,448 symptom-causing infections in biolabs, resulting in 36 deaths. About half the infections were in diagnostic laboratories, where patient blood or tissue samples are analyzed, and half in research laboratories.

But that may be a "substantial underestimation," the study's authors wrote, because many incidents are never made public. The study was done by two biosafety experts and published in the book "Biological Safety: Principles and Practices."

A survey done by the Bureau of Labor Statistics in 2006 found that the rate of workplace injury and illness in corporate scientific research laboratories was well below the average for all industries. The survey included labs in industries like information technology as well as biotechnology, and excluded labs handling the most dangerous pathogens.

Allegations about a more recent case came to light only through a lawsuit. It was filed against the drug giant Pfizer by Becky McClain, a former molecular biologist at the company's largest research center, which employs 3,500 people in Groton, Conn.

Ms. McClain, now 52, says she has suffered bouts of temporary paralysis after being infected by a genetically engineered virus at the Groton lab. A jury last month awarded Ms. McClain $1.37 million, saying Pfizer had fired her for raising questions about laboratory safety.

Pfizer said it went to considerable effort to accommodate Ms. McClain and dismissed her for refusing to return to a safe workplace. The company also pointed out that OSHA had found that Ms. McClain was not fired for raising safety concerns. But the jury ruled otherwise, saying Ms. McClain was indeed fired for raising safety concerns of public interest.

The jury never actually addressed whether a workplace virus had made Ms. McClain ill, because the judge threw out that claim, in part for lack of evidence. Mr. Michaels, the OSHA director, declined to comment on the McClain verdict, but said the issues under dispute in her case underscored the gaps in regulatory protection for lab workers.

For almost all private businesses, OSHA requires employers to report workplace deaths and serious accidents. But the information is usually kept in-house by employers and given to OSHA only if requested during an annual spot check of 80,000 companies — a small fraction of the approximately seven million employers bound by OSHA regulations.

Moreover, OSHA does not have jurisdiction over many academic and government biolabs, where there have been dozens of known cases of worker illness or at least exposure to harmful agents.

Many laboratories in both the public and private sectors adhere to practices in a safety manual published jointly by the Centers for Disease Control and Prevention and the National Institutes of Health. Employees of government biolabs and others that receive federal research grants for genetic engineering are covered in part by stricter guidelines from the National Institutes of Health, and some companies voluntarily follow those guidelines. But other private industry workers are dependent on OSHA.

Mr. Michaels said that rather than trying to establish new rules for each infectious agent or for any specific hazards, he expected OSHA to eventually require employers, in consultation with their employees, to identify all potential hazards in their workplaces and to take steps to reduce them. OSHA would then have the power to cite employers for failure to adequately implement this process.

“OSHA has 2,000 inspectors for 130 million-plus workers in seven million workplaces,” Mr. Michaels said. “We can’t take them on one at a time.”

Despite the fact that some worker advocates are pointing to Ms. McClain’s case as representative of broader problems, they are hard pressed to cite other examples of workers in biotechnology companies being harmed.

But these advocates contend that the reason more cases in private industry are not coming to light is that current rules do not put enough pressure on companies to report them. And OSHA’s general safety requirement is notoriously difficult to enforce.

“We don’t know how many Becky McClains there are,” said Adam M. Finkel, who worked for OSHA both as a regional administrator and a director of health standards. “Everybody knows there’s new stuff being made every day that’s incredibly dangerous, but nobody knows how to get their arms around it.”

http://www.nytimes.com/2010/05/28/business/28hazard.html?ref=health

Weighing the Evidence on Exercise

By GRETCHEN REYNOLDS

How exercise affects body weight is one of the more intriguing and vexing issues in physiology. Exercise burns calories, no one doubts that, and so it should, in theory, produce weight loss, a fact that has prompted countless people to undertake exercise programs to shed pounds. Without significantly changing their diets, few succeed. “Anecdotally, all of us have been cornered by people claiming to have spent hours each week walking, running, stair-stepping, etc., and are displeased with the results on the scale or in the mirror,” wrote Barry Braun, an associate professor of kinesiology at the University of Massachusetts at Amherst, in the American College of Sports Medicine’s February newsletter. But a growing body of science suggests that exercise does have an important role in weight loss. That role, however, is different from what many people expect and probably wish. The newest science suggests that exercise alone will not make you thin, but it may determine whether you stay thin, if you can achieve that state. Until recently, the bodily mechanisms involved were mysterious. But scientists are slowly teasing out exercise’s impact on metabolism, appetite and body composition, though the consequences of exercise can vary. Women’s bodies, for instance, seem to react differently than men’s bodies to the metabolic effects of exercise. None of which is a reason to abandon exercise as a weight-loss tool. You just have to understand what exercise can and cannot do.

“In general, exercise by itself is pretty useless for weight loss,” says Eric Ravussin, a professor at the Pennington Biomedical Research Center in Baton Rouge, La., and an expert on weight loss. It’s especially useless because people often end up consuming more calories when they exercise. The mathematics of weight loss is, in fact, quite simple, involving only subtraction. “Take in fewer calories than you burn, put yourself in negative energy balance, lose weight,” says Braun, who has been studying exercise and weight loss for years. The deficit in calories can result from cutting back your food intake or from increasing your energy output — the amount of exercise you complete — or both. When researchers affiliated with the Pennington center had

volunteers reduce their energy balance for a study last year by either cutting their calorie intakes by 25 percent or increasing their daily exercise by 12.5 percent and cutting their calories by 12.5 percent, everyone involved lost weight. They all lost about the same amount of weight too — about a pound a week. But in the exercising group, the dose of exercise required was nearly an hour a day of moderate-intensity activity, what the federal government currently recommends for weight loss but "a lot more than what many people would be able or willing to do," Ravussin says. At the same time, as many people have found after starting a new exercise regimen, working out can have a significant effect on appetite. The mechanisms that control appetite and energy balance in the human body are elegantly calibrated. "The body aims for homeostasis," Braun says. It likes to remain at whatever weight it's used to. So even small changes in energy balance can produce rapid changes in certain hormones associated with appetite, particularly acylated ghrelin, which is known to increase the desire for food, as well as insulin and leptin, hormones that affect how the body burns fuel.

The effects of exercise on the appetite and energy systems, however, are by no means consistent. In one study presented last year at the annual conference of the American College of Sports Medicine, when healthy young men ran for an hour and a half on a treadmill at a fairly high intensity, their blood concentrations of acylated ghrelin fell, and food held little appeal for the rest of that day. Exercise blunted their appetites. A study that Braun oversaw and that was published last year by The American Journal of Physiology had a slightly different outcome. In it, 18 overweight men and women walked on treadmills in multiple sessions while either eating enough that day to replace the calories burned during exercise or not. Afterward, the men displayed little or no changes in their energy-regulating hormones or their appetites, much as in the other study. But the women uniformly had increased blood concentrations of acylated ghrelin and decreased concentrations of insulin after the sessions in which they had eaten less than they had burned. Their bodies were directing them to replace the lost calories. In physiological terms, the results "are consistent with the paradigm that mechanisms to maintain body fat are more effective in women," Braun and his colleagues wrote. In practical terms, the results are scientific proof that life is unfair. Female bodies, inspired almost certainly "by a biological need to maintain energy stores for reproduction," Braun says, fight hard to hold on to every ounce of fat. Exercise for many women (and for some men) increases the desire to eat.

Thankfully there has lately been some more encouraging news about exercise and weight loss, including for women. In a study published late last month in The Journal of the American Medical Association, researchers from Harvard University looked at the weight-change histories of more than 34,000 participants in a women's health study. The women began the study middle-aged (at an average of about 54 years) and were followed for 13 years. During that time, the women gained, on average, six pounds. Some packed on considerably more. But a small subset gained far less, coming close to maintaining the body size with which they started the study. Those were the women who reported exercising almost every day for an hour or so. The exercise involved was not strenuous. "It was the equivalent of brisk walking," says I-Min Lee, a researcher at Harvard Medical School and Brigham and Women's Hospital and the lead author of the study. But it was consistently engaged in over the years. "It wasn't something the women started and stopped," Lee says. "It was something they'd been doing for years." The women who exercised also tended to have lower body weights to start with. All began the study with a body-mass index below 25, the high end of normal weight. "We didn't look at this, but it's probably safe to speculate that it's easier and more pleasant to exercise if you're not already heavy," Lee says. On the other hand, if you can somehow pry off the pounds, exercise may be the most important element in keeping the weight off. "When you look at the results in the National Weight Control Registry," Braun says, "you see over and over that exercise is one constant among people who've maintained their weight loss." About 90 percent of the people in the registry who have shed pounds and kept them at bay worked out, a result also seen in recent studies. In one representative experiment from last year, 97 healthy, slightly overweight women were put on an 800-calorie diet until they lost an average of about 27 pounds each. Some of the women were then assigned to a walking program, some were put on a weight-training regimen and others were assigned no exercise; all returned to their old eating habits. Those who stuck with either of the exercise programs regained less weight than those who didn't exercise and, even more striking, did not regain weight around their middles. The women who didn't exercise regained their weight and

preferentially packed on these new pounds around their abdomens. It's well known that abdominal fat is particularly unhealthful, contributing significantly to metabolic disruptions and heart disease.

Scientists are "not really sure yet" just how and why exercise is so important in maintaining weight loss in people, Braun says. But in animal experiments, exercise seems to remodel the metabolic pathways that determine how the body stores and utilizes food. For a study published last summer, scientists at the University of Colorado at Denver fattened a group of male rats. The animals already had an inbred propensity to gain weight and, thanks to a high-fat diet laid out for them, they fulfilled that genetic destiny. After 16 weeks of eating as much as they wanted and lolling around in their cages, all were rotund. The scientists then switched them to a calorie-controlled, low-fat diet. The animals shed weight, dropping an average of about 14 percent of their corpulence.

Afterward the animals were put on a weight-maintenance diet. At the same time, half of them were required to run on a treadmill for about 30 minutes most days. The other half remained sedentary. For eight weeks, the rats were kept at their lower weights in order to establish a new base-line weight.

Then the fun began. For the final eight weeks of the experiment, the rats were allowed to relapse, to eat as much food as they wanted. The rats that had not been running on the treadmill fell upon the food eagerly. Most regained the weight they lost and then some.

But the exercising rats metabolized calories differently. They tended to burn fat immediately after their meals, while the sedentary rats' bodies preferentially burned carbohydrates and sent the fat off to be stored in fat cells. The running rats' bodies, meanwhile, also produced signals suggesting that they were satiated and didn't need more kibble. Although the treadmill exercisers regained some weight, their relapses were not as extreme. Exercise "re-established the homeostatic steady state between intake and expenditure to defend a lower body weight," the study authors concluded. Running had remade the rats' bodies so that they ate less.

Streaming through much of the science and advice about exercise and weight loss is a certain Puritan streak, a sense that exercise, to be effective in keeping you slim, must be of almost medicinal dosage — an hour a day, every day; plenty of brisk walking; frequent long runs on the treadmill. But the very latest science about exercise and weight loss has a gentler tone and a more achievable goal. "Emerging evidence suggests that - unlike bouts of moderate-vigorous activity, low-intensity ambulation, standing, etc., may contribute to daily energy expenditure without triggering the caloric compensation effect," Braun wrote in the American College of Sports Medicine newsletter.

In a completed but unpublished study conducted in his energy-metabolism lab, Braun and his colleagues had a group of volunteers spend an entire day sitting. If they needed to visit the bathroom or any other location, they spun over in a wheelchair. Meanwhile, in a second session, the same volunteers stood all day, "not doing anything in particular," Braun says, "just standing." The difference in energy expenditure was remarkable, representing "hundreds of calories," Braun says, but with no increase among the upright in their blood levels of ghrelin or other appetite hormones. Standing, for both men and women, burned multiple calories but did not ignite hunger. One thing is going to become clear in the coming years, Braun says: if you want to lose weight, you don't necessarily have to go for a long run. "Just get rid of your chair."

Gretchen Reynolds writes the Phys Ed column for the magazine. She is writing a book about the frontiers of fitness.

http://www.nytimes.com/2010/04/18/magazine/18exercise-t.html

The Anatomy of Desire

By DANIEL BERGNER

The two mannequins stood side by side in the back of the white van. Johan Karremans, a psychologist at Radboud University in the Netherlands, along with his student and collaborator, Sander Arons, clothed the plastic women identically in tight black tops and dark skirts. Arons then drove the van around the country to the homes of blind men.

The cargo van is one of two mobile labs belonging to the university's psychology department. Sometimes, outside an elementary school, children climb into the back of a van to have their brain waves tested on a encephalogram machine. But this experiment, the results of which will soon be published in the journal Evolution and Human Behavior, dealt with desire — in this case the desire of heterosexual men — and was an attempt to gauge the force of culture, to weigh the learned and the innate, in determining sexual attraction.

The headless mannequins, which Karremans bought, he told me recently, "on the Dutch version of Craigslist," have adjustable waists and hips, and the researchers set each body differently, so that one had a waist-to-hip ratio of 0.7 and the other of 0.84. Based on a range of studies of male preferences done by other scientists, Karremans chose the lower ratio as an ideal, a slim yet curvy paragon, at least among Western populations. The higher ratio, by contrast, doesn't represent obesity, just a fullness that falls close to the average woman's shape.

The study involved men who had been sightless from birth. The idea was that the bombardment of visual media — of models on billboards and actresses on television and porn stars online — which may be so powerful and even dominant in molding desire, couldn't have had any direct effect on these men, who emerged from the womb into a congenital dark. Would their tastes in women's bodies match those of men who could see? How would their preferences reflect on the roles of nature and nurture, on the influence of evolution and the impact of experience, in forming our psyches?

More than a century ago, Sigmund Freud placed sex at the foundation of psychology; erotic desire was the fundamental element of the self. Psychiatric researchers have long since tended to distance themselves from much of his thinking, yet few would deny the libido's crucial part in who we are, with its neural systems radiating outward from the primal regions of the brain. So the studies of sexologists like Karremans, no matter how far-fetched or even bizarre they may sometimes seem — hot mannequins and blind men! — are often an attempt not only to parse the erotic but also to begin to understand the way our very beings are constructed.

Over the past two decades, researchers have been looking at whether cinched yet sumptuous female body shapes, corresponding to low waist-to-hip ratios, are preferred by men across societies and have been favored across time, the idea being that if the answer is yes, evolutionary factors would seem to outweigh culture in determining at least this one aspect of lust. And frequently when scientists have shown simple line drawings of women to men around the world, from Germany to Japan to Guinea-Bissau, the answer has in fact been yes; ratios of 0.7, or sometimes lower, have been rated the most attractive, no matter whether more or less overall flesh is the cultural ideal. A study of Miss Americas from the 1920s to the '80s and of Playboy centerfolds from the '50s to 1990 came up with the same result; the chosen women became thinner over the

decades, but their proportions stayed constant, right around 0.7. The evolutionary explanations for these findings share the logic that lower ratios somehow signaled ancestral men that a woman would produce more or fitter offspring, and the argument of one recent study, built on data from several thousand women and children, is that mothers with lower ratios tend to produce smarter kids, because, the researchers suggest after controlling for other factors, certain fatty acids in a woman's hip padding, delivered in the womb and through breast-feeding, are beneficial to the development of a baby's brain, while belly fat is detrimental.

Yet the Miss America and centerfold findings have been criticized for flawed statistics; a study of the nudes celebrated by the 17th-century Flemish painter Peter Paul Rubens documented W.H.R.'s a good deal higher than 0.7; and research among isolated hunter-gatherers in Tanzania and the primitive Matsigenka people in a remote rain-forest territory of Peru has countered the idea of cross-cultural consistency. In Peru, within a vast park whose core serves as a kind of societal preserve, because outsiders are almost completely barred, a pair of scientists with line drawings discovered that Matsigenka men don't favor women with lower W.H.R.'s at all. Among a Matsigenka group living just outside the park and within reach of Western media and modernity, meanwhile, the researchers reported tastes in female forms to be more similar to those of Western men, and in a nearby area, among a tribally mixed population with yet more Western contact, male preferences were no different from those in the West. Culture, in this study, appeared to mold the shape of lust.

Amid all the conflicting evidence, Karremans sent his mannequins around the Netherlands. The blind stood before them; they were told to touch the women, to focus their hands on the waists and hips. The breasts on both figures were the same, in case the men reached too high. The men extended their arms; they ran their hands over the region. Then they scored the attractiveness of the bodies. Karremans had a hunch, he told me, that their ratings wouldn't match those of the sighted men he used as controls, half of them blindfolded so that they, too, would be judging by feel. It seemed likely, he said, that visual culture would play an overwhelming part in creating the outlines of lust. And though the blind had almost surely grown up hearing attractiveness described, perhaps even in terms of hourglass shapes, it was improbable, he writes in his forthcoming journal paper, that they had heard descriptions amounting to, "The more hourglass shaped, the more attractive," which would be necessary to favor the curvier mannequin over the figure that was only somewhat less so.

But, with some statistically insignificant variation, the scores of the blind matched those of the sighted. Both groups preferred the more pronounced sweep from waist to hip. One possible explanation emphasizes the sense of smell — though the mannequins wore no perfume. By this line of thinking, certain ratios of hormones and their metabolites in the female body are associated with biological advantage, as well as with particular pheromonal scents and low W.H.R.'s. The male begins life wired, through the influence of evolution, to favor these odors and then learns, mostly through unconscious experience, to connect the cues of smell to the proportions of waist and hip. He makes this connection through sight if he can see and by touch if he can't.

The explanation may be more elusive than this simple logic. And the study's implications about nature and nurture are far from straightforward. Karremans's findings don't rule out the sway of culture, not at all. If experience played no role in etching our preferences, there would be scarcely any diversity of lust; we would all be drawn to the same forms. One nuance in the study's data points to this complexity: sighted and blind men both strongly favored the mannequin with the lower W.H.R., but this slimmer-waisted body received especially high scores from the men with sight, maybe because a life spent amid cultural signals compounds the work of evolution. Still, the gropings of Karremans's blind offer a glimpse into the ancestral depths of our desires.

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The Estrogen Dilemma

By CYNTHIA GORNEY

Here we are, two fast-talking women on estrogen, staring at a wall of live mitochondria from the brain of a rat. Mitochondria are cellular energy generators of unfathomably tiny size, but these are vivid and big because they were hit with dye in a petri dish and enlarged for projection purposes. They're winking and zooming, like shooting stars. "Oh, my God," Roberta Diaz Brinton said. "Look at that one. I love these. I love shooting mitochondria."

Brinton is a brain scientist. Estrogen, particularly in its relationship to the health of the brain, is her obsession. At present it is mine too, but for more selfish reasons. We're inside a darkened lab room in a research facility at the University of Southern California, where Brinton works. We are both in our 50s. I use estrogen, by means of a small oval patch that adheres to my skin, because of something that began happening to me nine years ago — to my brain, as a matter of fact. Brinton uses estrogen and spends her work hours experimenting with it because of her own brain and also that of a woman whose name, Brinton will say, was Dr. A. She's dead now, this Dr. A. But during the closing years of her life she had Alzheimer's, and Brinton would visit her in the hospital. Dr. A. was a distinguished psychotherapist and had vivid stories she could still call to mind about her years in Vienna amid the great European psychologists. "We'd spend hours, me listening to her stories, and I'd walk out of the room," Brinton told me. "Thirty seconds later, I'd walk back in. I'd say, 'Dr. A., do you remember me?' And she was so lovely. She'd say: 'I'm so sorry. Should I?' "

The problem with the estrogen question in the year 2010 is that you set out one day to ask it in what sounds like a straightforward way — Yes or no? Do I or do I not go on sticking these patches on my back? Is hormone replacement as dangerous in the long term as people say it is? — and before long, warring medical articles are piling up, researchers are raising their voices and gesticulating excitedly and eventually you're in

Los Angeles staring at a fluorescent rodent brain in the dark. “You want a statistic?” Brinton asked softly. Something about the shooting mitochondria has made us reverent. “Sixty-eight percent of all victims of Alzheimer’s are women. Is it just because they live longer? Let’s say it is, for purposes of discussion. Let’s say it’s just because these ladies get old. Do we just say, ‘Who cares?’ and move them into a nursing home? Or alternatively, maybe they are telling us something.”

With their brains, she means. Their sputtering, fading Alzheimer’s brains, which a few decades earlier were maybe healthy brains that might have been protected from eventual damage if those women had taken estrogen, and taken it *before* they were long past their menopause, while their own neural matter still looked as vigorous as those rat cells on the wall. This proposition, that estrogen’s effects on our minds and our bodies may depend heavily upon when we first start taking it, is a controversial and very big idea. It has a working nickname: “the timing hypothesis.” Alzheimer’s is only one part of it. Because the timing hypothesis adds another layer of complication to the current conventional wisdom on hormone replacement, it has implications for heart disease, bone disease and the way all of us women now under 60 or so — the whole junior half of the baby boomers, that is, and all our younger sisters — could end up re-examining, again, everything the last decade was supposed to have taught us about the wisdom of taking hormones.

I first met Brinton at a scientific symposium at Stanford University in January that was entirely devoted to the timing hypothesis. The meeting was called Window of Opportunity of Estrogen Therapy for Neuroprotection, and it drew research scientists and physicians from all over the country. When I asked to listen in, the organizers hesitated; these are colleagues around a conference table, they pointed out. They’re probing, interrogating, poking holes in one another’s work in progress.

But I was finally permitted to take a chair in a corner, and as the day went on, I became aware of my patch, in a distracted, hallucinatory sort of way, as if I had started fixating on a smallish scar. One after another, their notes and empty coffee cups piling up around them, heart experts and brain experts and mood experts got up to talk about estrogen — experiments, clashing data, suppositions, mysteries. There are new hormone trials under way that are aimed at the 40-year-old to 60-year-old cohort, with first results due in 2012 and 2013. There are depression studies involving estrogen. There are dementia studies involving estrogen. There are menopausal lab monkeys taking estrogen, ovariectomized lab mice taking estrogen and young volunteers undergoing pharmaceutically induced menopause so researchers at the National Institutes of Health can study exactly what happens when the women’s estrogen and progesterone are then cranked back up. I typed notes into my laptop for hours, imagining the patch easing its molecules into the skin of my back, and the whole time I was typing, working hard to follow the large estrogen-replacement thoughts of the scientists around the table, I had one small but persistent estrogen-replacement thought of my own: If I make the wrong decision about this, I am so screwed.

I started taking estrogen because I was under the impression that I was going crazy, which turns out to be not as unusual a reaction to midlife hormonal upheaval as I thought. This was in 2001. The year is significant, because the prevailing belief about hormone replacement in 2001 was still, as it had been for a quarter century, the distillation of extensive medical and pharmaceutical-company instruction: that once women start losing estrogen, taking replacement hormones protects against heart disease, cures hot flashes, keeps the bones strong, has happy effects on the skin and sex life and carries a breast-cancer risk that’s worth considering but not worrying about too much, absent some personal history of breast cancer or a history of breast cancer in the immediate family.

At first, as I was trying to locate a psychiatrist who would take me on, I wasn’t aware I had reason to pay attention to advice about hormones at all. That year I turned 47, a normal age for beginning the drawn-out hormonal-confusion period called perimenopause, but I had none of the familiar signs. Menopausal holdouts run in the family; one of my grandmothers was nearly 60 by the time hers finally kicked in. My only problem was a new tendency to wake up some mornings with a great dark weight shoving my shoulders toward the

floor and causing me to weep inside my car and basically haul myself around as if it were the world's biggest effort to stand up straight and carry on a conversation. Except for its having shown up so arbitrarily and then coming and going in waves, there was nothing interesting about my version of what my husband and I came to think of as the Pit; anybody who has been through a depression knows what a stretch of semidisabling despair feels like, and for my part I had a very nice life, a terrific family and a personal interior chorus of quarreling voices demanding to know why I didn't pull up my socks and carry on, which in fact was the first question I planned to ask a psychiatrist.

But I went to my gynecologist first, so she could check my blood pressure or whatever seemed the prepsychiatrist thing to do. How often would you say you feel this way, she asked; and I said I didn't know, maybe every few weeks; and she told me to start keeping records. Note each day, she said. Check for patterns.

She was right. There was a pattern. I was falling into the Pit on schedule, around 11 days before each menstrual period, or M.P., which is one of many abbreviations I was to learn in my efforts to keep track of the ferocious hormones debate that started up in North America in 2002, one year after I stuck on the first estrogen patch that my gynecologist prescribed. The study at the center of the ruckus was called the Women's Health Initiative, or W.H.I. It was a federally financed examination of adult women's health, extraordinary in scale and ambition, that started up in the early 1990s; one of its drug trials enrolled more than 16,000 women for a multiyear comparison of hormone pills versus placebos. On July 9, 2002, W.H.I. investigators announced that they had ended the trial three years early, because they were persuaded that it was dangerous to the hormone-taking participants to let them continue.

The women on hormones were having more heart trouble than their placebo-taking counterparts, the investigators said, not less. Their risk for stroke went up. Their risk for blood clots went up. Their risk for breast cancer increased by 24 percent. The W.H.I. bulletins dominated medical news all summer and long into the fall, and so alarming were their broad-scale warnings that millions of women, myself included, gave up hormone replacement and resolved to forge ahead without it.

The patches my gynecologist prescribed worked, by the way. I didn't understand how, beyond the evident quieting of some vicious recurring hormonal hiccup, and neither did the gynecologist. But she had other women who came in sounding like me and then felt better on estrogen, and I would guess many of them, too, decided after the W.H.I. news that they could surely find other ways to manage their "mood swings," to use the wondrously bland phrasing of the medical texts. (I'm sorry, but only someone who has never experienced one could describe a day of "I would stab everyone I know with a fork if only I could stop weeping long enough to get out of this car" as a "mood swing.") We muddled along patchless, my mood swings and my patient family and I, until there came a time in 2006 when in the midst of some work stress, intense but not unfamiliar, I found myself in a particularly bad Pit episode and this time unable to pull out.

It was profoundly scary. In retrospect, I managed a surprising level of public discretion about what was going on; competence at the cover act is a skill commonly acquired by midlife women, I think, especially those with children and work lives. If the years have taught us nothing else, they have taught us how to do a half dozen things at once, at least a couple of them decently well. Like other women I have met recently with stories like this one, I relied for a few months on locked office doors, emergency midday face-washings and frequent visits to an increasingly concerned talk therapist. But one afternoon I got off my bicycle in the middle of a ride with my husband, because I had been crying so hard that I couldn't see the lane lines, and I sat down on the sidewalk and told him how much I had come to hate knowing that family obligations meant I wasn't allowed to end my life. The urgent-care people at my health clinic arranged a psychiatric consult fast, and after listening and nodding and grabbing scratch paper to draw me an explanatory graph with overlapping lines that peaked and plunged, the psychiatrist wrote me two prescriptions. One was for an antidepressant.

The other — I recognized the name as soon as she wrote it down — was for Climara, my old estrogen patch.

By this time we were four years past the 2002 W.H.I. hormone news. So I knew a few more things. I knew there had been a surge of industrious scrambling among former hormone-taking women, some of whom had tried multiple alternatives or going cold turkey and then changed their minds and re-upped on estrogen, deciding that life without it was so unpleasant that they no longer cared what the statistical prognoses said. I knew the prevailing medical sentiment had shifted slightly since the bombshell of 2002; certain articles and books still urged women to shun hormone replacement at all costs, but the more typical revised counsel was, essentially, proceed with great caution. If some menopausal malady is genuinely making you miserable, the new conventional wisdom advised, and no alternative remedy is working for you, then go ahead and take hormones — but keep the dose low and stop them as soon as possible.

I would like to be able to tell you that I weighed these matters thoughtfully, comparing my risks and benefits and bearing in mind the daunting influence of a drug industry that stands to profit handsomely from the medicalizing of normal female aging. But that would be nonsense, of course. I was too crazy. I went straight to the pharmacy and took everything they gave me.

You don't read the fine print on package labels when you're being ushered through a psychiatric crisis, but after a while, I did. By last winter I was nearing the cumulative five-year mark as an estrogen user, and although "low dose, stop soon" is often an advisory without specifics attached, five years seemed to turn up here and there as an informal outer-limit guideline. And because it had worked again, because the estrogen so clearly helped repair something that was breaking (there's no way for me to separate the effects of estrogen from the effects of the antidepressant, except that on the few occasions when I've been haphazard about replacing the estrogen patches on time, I've experienced prompt and unmistakable intimations of oncoming Pit), I now had some rational faculties with which to go looking for explanations that might help me decide what to do. This was when I first began learning that in the controversy over hormone replacement, the fine print matters a very great deal.

First of all, the kind of estrogen in my patches — there are different forms of estrogenic molecules — is called estradiol. It's not the estrogen used in the W.H.I. study. Pharmaceutical estradiol like mine comes from plants whose molecules have been tweaked in labs until they are atom for atom identical to human estradiol, the most prominent of the estrogens premenopausal women produce naturally on their own. The W.H.I. estrogen, by contrast, was a concentrated soup of a pill that is manufactured from the urine of pregnant mares. The drug company Wyeth (now owned by Pfizer) sells it in two patented products, the pills Premarin and Prempro, and it's commonly referred to as "conjugated equine estrogens."

There was more in the fine print. Two years ago, after warning me that women who haven't had a hysterectomy run a higher risk of uterine cancer when they take only estrogen as hormone replacement, a new doctor added in progesterone, which has been shown to protect the uterus. The progesterone he prescribed for me, like the estradiol, is a molecular replica of the progesterone women make naturally. It's different from the progesteronelike synthetic hormone that was used for the W.H.I. study that ended in 2002. That medication was a formulation whose multisyllabic chemical name shortens to MPA and which has a problematic back story of its own: MPA takes care of the uterine-cancer risk, but there's reason to suspect it may be a factor in promoting breast cancer. And it's ingested as a pill, which means that like equine estrogens (and unlike, for example, my patch), MPA metabolizes through the liver, possibly creating additional complications en route, before going about its business.

The biggest difference between me and the W.H.I. women, though, has to do with age and timing. I started on the patches while my own estrogen, pernicious though its spikes and plummets may have been, was still floating around at more or less full strength. The average age of the W.H.I. women was just over 63, though the study accepted women as young as 50. More significant, though, most of them were many years past their final menstrual period, which is the technical definition of menopause, when they began their trial hormones.

The bulk of the group was at least 10 years past; factoring in the oldest women, the average number of years between the volunteers' menopause and their start on the trial medications was 13.4.

Because women generally make decisions about hormones while they are in the throes of perimenopause — that term is now used to extend through the year following the final M.P. — you may find this as perplexing as I did. Why would the largest drug trial in the history of women's health select, for most of its participants, women already long past the critical phase? I heard one undiplomatic critic sum up the W.H.I. as "the wrong drugs, tested on the wrong population," and those two factors, the drugs and the population, are actually directly linked. Equine estrogens and MPA were the only forms of hormones used in the W.H.I. trials. Among other reasons, that's because drug trials are expensive; this one was huge, and Wyeth was going to provide without cost an average of eight years' worth of its equine estrogens and MPA to 40 clinical centers.

And millions of women were using those very hormones already, partly because aggressive Wyeth marketing had for three decades insisted that hormone replacement was the ticket to a vigorous and sexually satisfactory postmenopausal life. To a certain extent, evidence backed up that claim; wide-scale though less rigorous earlier studies appeared to demonstrate hormone replacement's benefits so clearly that many physicians were suggesting it almost automatically to midlife women, whether or not they had perimenopausal complaints. Hormones raised the breast-cancer risk in those earlier studies, but nearly every other health factor showed improvement when women who took hormones were compared with those who didn't. Hot flashes disappeared, osteoporosis was milder, women reported feeling better and women who took hormones showed a markedly lower rate of heart disease than women who did not.

Because heart disease ultimately kills many more women than all cancers combined, some doctors had also taken to urging older women, even those past menopause, to start hormones for cardiac-health purposes. The W.H.I. trials were supposed to provide conclusive evidence, finally, as to whether all this wide-scale prescribing was truly a sound idea. But cardiovascular disease tends to make its bids for attention — its "events," as clinicians say, like heart attack and death — when we're quite a bit past 51, the average age at which American women hit menopause. The only way the W.H.I. was going to tally up a scientifically useful number of cardiac events was to enroll plenty of women already old enough to reach that danger stage before the study's time ran out. So that's what they did, and once the final data was reparsed many times, it was clear that the trial had shown physicians something highly important about the perils of starting older postmenopausal women (that's qualifier No. 1) on pills (No. 2) containing equine estrogens (No. 3) plus MPA (No. 4).

Those four qualifiers make the chief message of the W.H.I. — that taking hormones, in the long run, is more likely to hurt you than help — far more specific than the one most women heard. For those of us not yet on the far side of menopause, or who don't match the other qualifiers (as I write this, for example, I'm zero for four), a daunting proportion of what we thought we learned about hormone replacement over the last eight years remains unsettled, more confusing than ever and conceivably — we don't know yet — wrong. "I mean, if you're a 70-year-old," says S. Mitchell Harman, a Phoenix-based endocrinologist and coordinator of one of the national trials currently examining hormones' effects on younger women, "and your question is, Should I start taking estrogen? the W.H.I. answered that for you beautifully. *No.* Unfortunately, it wasn't designed to answer that question for a 50-year-old. So now we're trying to fill in the blanks."

One afternoon last month, I reported to the Northern California site for an N.I.H.-financed cognitive trial that is part of the Kronos Early Estrogen Prevention Study that Harman is leading. Keeps, as it's called, has enrolled women at nine such sites around the country; this one was inside a medical building at the University of California, San Francisco, and the cognition test I asked to try proved to be a low-tech experience: a table with chairs, pens and pencils and a gentle-voiced psychologist asking me to do things with my brain. Number sequences repeated backward, lists of random objects to recall, designs to remember and copy — I promised not to describe specifics, because making details public could compromise the trial results. But imagine a

stranger holding up a stopwatch and giving you 30 seconds to name every dessert item you can think of. The brain charges off into a comical panic grope, and it's like a cross between a back-seat car game and the SATs.

The only grading marker, though, is self compared to self. If I were a Keeps participant, I would be on a four-year regimen of some mystery medication — either estrogen, in one of two forms (estradiol patches or equine-estrogen pills, to see whether differences emerge between the two), or placebo patches or placebo pills. Then in another year, I would retake the cognition test, which lasted about an hour and a half, so researchers could track any change. Brain function is a major element of the Keeps agenda; the other is heart health, so the test administrators would conduct annual ultrasounds of my carotid artery, to check for the thickening that signals heart disease. That's how they are trying to circumvent the doesn't-manifest-until-you're-older problem, by measuring for known warning markers rather than waiting for the actual big events. They would check my blood and cholesterol for signs of other cardiovascular trouble.

With about 730 participants, Keeps is relatively small; hormone research has been tough to finance in the post-W.H.I. years, and every scientist and physician I've spoken to said there will never again be another hormone trial as costly and ambitious as the W.H.I. A second study, based in Los Angeles, called the Early Versus Late Intervention Trial With Estradiol, is following more than 600 women — comparing a group that has been post-menopausal for an average of 15 years and that is on estradiol or on a placebo with a second, younger group that is an average of three years post-menopausal. "*This* is the age when we should really study estrogen," says Sanjay Asthana, a University of Wisconsin medical professor who is a designer of the cognition component of Keeps. "People like me are really waiting to see what this data looks like. Either way. We need to know."

Asthana is a geriatrician, with a specialty in Alzheimer's and other forms of age-related memory loss. That makes him a member of what I came to think of, in my travels among estrogen researchers this winter, as the brain contingent. Their working material includes neuroimaging; magnified slices of rodent brains; and live cells that carry on in petri dishes, shooting mitochondria around or struggling under the burden of disease. All these things allow the brain contingent to see, sometimes literally, estrogen in action. It's an amazing process. When cells are healthy, estrogenic molecules slide right in, searching for special receptors that are shaped precisely for the estrogens: the receptors are tiny locks, waiting for the right molecular keys to turn them on. Then, once they are activated by the key-turning process, the work estrogen receptors do is richly complex, if only partly understood. They prod genes into action; they raise good cholesterol; they affect the neurotransmitter chemicals associated with mood and stress, like serotonin and dopamine.

And the brain, scientists have learned in recent decades, is loaded with these receptors. Knowing this makes it easier to understand how perimenopause could start inside aging ovaries and set off such a wild cascade of effects. If you're a typical woman moving through your 40s or 50s, your lifetime egg supply is running out; as that happens, the intricate, multihormone reproductive-signaling loop grows confounded, its triggers altered by the biology of change. The brain and ovaries, the primary stops along this loop, start misreading each other's demands for action. This can make estrogen production crank up frantically, crash and then crank up again. Something also goes awry with most women's thermoregulatory systems, producing hot flashes in around three-quarters of us — nobody yet knows why, exactly, nor why certain women go on flashing for many years while some escape the whole must-remove-outer-garments-*now* phenomenon entirely. There's an admirably clear explanation of the complete process in a recent book called "Hot Flashes, Hormones and Your Health," by JoAnn Manson, a Harvard medical professor who worked with both W.H.I. and Keeps. My favorite illustration in Manson's book shows an actual woman's hormone fluctuations as measured before, during and after perimenopause; the "before" graph is a row of calm, evenly spaced ups and downs, various hormones rising and falling in counterpoint and on cue. The lines in the "after" graph are virtually flat. The "during" graph looks as if somebody dynamited a mountain range.

Not all women, Manson notes, experience disruptions as robust as this unidentified patient's. But consider the mess of internal rearrangement we're looking at: the body's overall estrogen production is waning as the ovaries start atrophying into full retirement; and here simultaneously, at least for some of us, is this great Upheaval of During. The combination of the two can be — how could it *not*, I thought, the first time I studied the three graphs — a hellacious strain on the brain. Tracing the exact mechanics is still a work in progress, but they surely include some disruption of signaling to the neurotransmitters that make us remember things, experience emotions and generally choreograph the whole thinking operation of the human self.

"There are all these fundamental cognitive functions that many perimenopausal women complain about, and one of those fundamentals is attention," Roberta Brinton, the U.S.C. scientist, told me. "When you can't hold your attention to a thought. Where you're in constant start mode, and you never reach the finish mode. That is devastating."

This was Brinton, as it happens, describing herself. It's why she first went on estrogen (estradiol, accompanied by natural progesterone) when her own perimenopause kicked in a few years ago. We were sitting in a campus garage in her Prius one day, and I asked her what made her so sure her own midlife difficulties — she had the hot flashes, which were obvious, but also the sleep disruption and the infuriating distractibility — were the product of hormonal events, not some womanly existential crisis. We get a lot of that, societally. It's meant to be empathetic. Your role in life is changing, Mrs. Brain Seized by Aliens! Your children are growing up, you're buying expensive wrinkle cream, ice cream makes you gain weight now, of course you're distraught! "Because with estrogen — " Brinton looked at me sharply, and then smiled — "I don't have attention-deficit disorder."

We walked back up to her laboratories, which are spread along a many-roomed warren full of cell incubators, centrifuges and computers. Brinton has thick black hair and a demeanor of lively, good-humored authority; it's easy to envision her as the passionate science professor in crowded lecture halls. But in her labs the work is all rats and mice, many of them surgically or genetically altered to serve as surrogates for adult humans in various stages of maturation or disease. Removing the ovaries from female rats, for example, sends them into low-estrogen mode. Mice can be ordered bred with Alzheimer's. The plaque that clogs the brains of Alzheimer's sufferers, a noxious memory-disrupting substance called beta amyloid, is available as a chemical distillate, which means Brinton's team can experiment with that too — beta amyloid dropped into the brain cells of healthy low-estrogen rodents; or estrogen dropped into cells already damaged by beta amyloid.

That's why Brinton says that the timing hypothesis — the proposition that estrogen could bring great benefit to a woman who starts it in her 50s while having the reverse effect on a woman 10 years older — makes sense even though it is still experimental. She and other scientists know there are ways estrogen improves and protects the brain when it is added to healthy tissue. It makes new cells grow. It increases what's called "plasticity," the brain's ability to change and respond to stimulation. It builds up the density and number of dendritic spines, the barbs that stick out along the long tails of brain cells, like thorns on a blackberry stem, and hook up with other neurons to transmit information back and forth. (The thinning of those spines is a classic sign of Alzheimer's.)

But when estrogen hits cells that are already sick — because they're dying off as part of the natural aging process or because they've been damaged by beta amyloid — something else seems to happen. Dropped in as a new agent, like the wrong kind of chemical solvent sloshed onto rusting metal, estrogen doesn't strengthen or repair. It appears useless. Sometimes it sets off discernible harm. You may recall additional W.H.I. news a few years ago about hormones increasing the risk for aging-related dementia; those stories emerged from a subgroup of W.H.I. participants who were all at least 65 when they started the hormones. There are arguments about that data, like nearly everything else connected to the W.H.I., but the age factor alone reinforces what Brinton and other timing-hypothesis researchers observe in the labs when they give estrogen to ailing cells. "It's like the estrogen is egging on the negative now, rather than the positive," she said. "We know that if you

give neurons estrogen, and then expose them to beta amyloid, many more will survive. But when we expose them to amyloid and *then* give them estrogen — now you don't have survival of the neurons. In some instances, you can actually exacerbate their death."

The heart contingent exploring the timing hypothesis is reasoning the same way. Monkeys get both cardiovascular disease and their own version of menopause; there is a primate team at Wake Forest University in North Carolina that has found estrogen to be a strong protectant for females against future heart disease — but only when it's given at monkey perimenopause. Give estrogen the equivalent of six human years later, says Tom Clarkson, the pathology professor who has been leading this work for decades, and there is no protective effect at all.

Clarkson, who is 78, told me that if he were 30 years younger and a woman, with hot flashes or sleep trouble or sudden crashes of mood, he would have no hesitation about taking hormones. "I absolutely believe in the timing hypothesis," he said. Then, being a scientist, he corrected himself. "I would have to say my level of certainty is 95 percent or greater," he said. "I live a life of believing in the experimental evidence."

So noted, I replied. And what if the symptoms were annoying but bearable or there were no symptoms at all? I've asked the same questions to every researcher I talked to this spring, and nearly all of them reply the same way: if they were deciding for themselves personally, they would tip the risk-benefit scale strongly in favor of hormones as a remedy for immediate ailments of perimenopause. But estrogen solely as a protectant for the heart and brain, to be taken for many years, absent any immediate serious complaints? There was a pause, and I heard Clarkson sigh. "We just don't know about that yet," he said.

The personal calculus of risk is an exhausting exercise in the modern era, what with litigation-jumpy physicians, the researchers' candid "We just don't know" and the bottomless learn-it-yourself maw of the Internet. Of all the conversations I had this winter, as I weighed and reweighed the stopping of the patch, the one that most resonates took place on a snowy morning in Washington, in the office of a nursery-school director named Julia Berry. Berry lives not far from the headquarters of the National Institutes of Health in Bethesda, Md., which is why last September she pulled from her mailbox a card the N.I.H. has been mailing to local women within a certain age range. "If you struggle with irritability, anxiety, sadness or loss of enjoyment at the time of the menopausal transition," the card reads, "please call us and help yourself while helping others."

The N.I.H., it turns out, has been quietly conducting mood and hormone studies for more than two decades under the direction of a psychiatrist named Peter Schmidt and his predecessor, David Rubinow, who is now chairman of the psychiatry department at the University of North Carolina. The research was first set into motion by Rubinow's postgraduate interest in premenstrual syndrome; the idea of giving younger women drugs to lower and flatten temporarily their estrogen and progesterone levels, essentially inducing menopause, was initially conceived to determine the role of hormones in PMS — to see whether these young women got relief when their hormones stopped the cresting and dropping of the normal menstrual cycle. (It often worked as a short-term treatment and yes, the young women often got hot flashes.) In recent years, the induced-menopause experiments have continued, among many other studies, as part of an effort to try to understand the chemistry of women like Julia Berry and me — women for whom perimenopause turns into what Berry described to me as "psychological misery, not myself and absent from the world."

Berry is 55, ponytailed and roundish and pretty. She was divorced a long time ago, raised three good kids mostly on her own and has a firm handshake and a job she loves. Her troubles started in her late 40s, in the standard way, with hot flashes and jerking awake at 3 a.m. and then escalated into something much fiercer. Like me, at the worst of it, she occasionally found herself in traffic, wishing silently for an oncoming truck that might exit her swiftly from this life without qualifying as a suicide. A physician prescribed antidepressants. They helped, with both the anguish and the flashes, but not enough. "I am one of the most

steady, even-keeled, hard to ruffle, really unflappable . . . truly," Berry told me. "I *am*. I, generally speaking, can be completely relied upon to do the sensible right thing almost all the time. Which is one of the reasons this period in my life has been so weird."

She called the N.I.H. number at once. She was quickly evaluated, enrolled in a double-blind study of the effects of estrogen on perimenopausal depression and sent home with a paper bag containing a mystery patch. When I asked Berry to describe the sensation of the next few weeks, she looked up at the ceiling for a second to think. "Kind of like having been in a smoky room, waving your arms and now seeing that the exhaust fan is taking a little at a time," she said. "My mood lifted. First time in three years I wasn't waking up at 3 in the morning. That's when I knew I wasn't on the placebo. It was very clear to me that there was something fundamentally wrong with my chemical systems, and that whatever was in this patch was setting things right, so that I could function like a regular human being — the human being I was familiar with."

What medicine doesn't know about the chemistry of mood, including clinical depression, dwarfs what medicine doesn't know about hormones. It would be handy for science if Berry and I could have made our heads available for dissection at certain points in recent years; as it is, we're able to answer as many elaborations on "I feel bad" or "I feel good" as researchers might wish to throw at us, but they still have no way of pinning down where we belong on the scale of menopausal distress, or what exactly we're doing there. We could be extra-high-volume versions of the women who are having an ordinary rough time of it, like Roberta Brinton — the women who hot-flash and can't sleep and cast about for vocabulary with which to describe feeling, as Brinton puts it, "just off." Or we could belong to some subcategory of anomalies, women with a wired-in susceptibility to depression — gene pools, childhoods, whatever — that was fired up by abrupt hormonal change.

Some psychological surveys will tell you there's no evidence for a surge of clinical depression at menopause. I believe that, given how many other phases of life can unhinge us, but I also believe — no, actually, I *know* — that there is a difficult thing that happens to some women in the perimenopausally affected brain. Hostile as I am to generalizations involving women rendered fragile by biology, here I am, and here, too, is Berry, both of us pulled out of something terrible by a pharmaceutical infusion of estrogen. Two physicians who specialize in hormones and mood, Louann Brizendine, a neuropsychiatrist at the University of California, San Francisco, and Claudio Soares, a Canadian research psychiatrist who works at McMaster University in Ontario, told me that women who seek them out tell variations of the same story Berry and I took to our doctors: I know that something is wrong with me because I also know, somewhere in the noncrazy part of myself, that there is such pleasure to be offered by the circumstances of my grown-up life.

"These women thought they were losing their minds," Brizendine told me, describing the 40-to-60-year-old patients she began seeing when she opened the Women's Mood and Hormone Clinic at the university in 1994. "In 1994 we didn't have words for it," she said. "Now we do. It's called perimenopausal depression."

Brizendine and Soares, like Schmidt and Rubinow, have found that various combinations work with varying degrees of effectiveness for many of us — hormones with an antidepressant, hormones without an antidepressant, sometimes antidepressants on their own. The alternatives-to-hormones recommendations are mostly fine things in their own right, varying from certainly useful to harmless: exercise regularly, keep the weight down, easy on the caffeine, calm yourself with deep breathing or yoga, try black cohosh. (You could start a bar brawl over the efficacy of black cohosh, but the general consensus seems to be: if it works for you, go for it.) But the troubles set off by ricocheting hormones are reliably fixed by making the hormones stop ricocheting. And the laborious weighing of hormones' benefits versus hormones' harms — maybe not at the crisis moment, for those of us at our most distraught, but later, one or two or five years down the road — is something still undertaken by millions of women along the full breadth of the perimenopausal spectrum.

How in the world to do it wisely enough so the calculation is as right for each of us as it can possibly be? JoAnn Manson's book contains the most careful checklist I've seen yet; by the time you answer all the personal-history questions the book asks you to consider, you've read 82 pages. Breast cancer is a factor, to be sure, but so are colorectal cancer, ovarian cancer, stroke, hip fracture and diabetes. If the timing hypothesis proves right and estrogen really does protect our brains and our hearts as long as we start it early enough, the calculation only grows that much more important and complex. There are moving pieces involved in working out every one of these risks in relation to everything else, and anyone who thinks there's a bumper-sticker answer to the hormones question — don't take them, you're sure to be better off — is, like me that day in the psych unit, neither listening to scientific argument nor reading the fine print.

Here's one example from the many to which researchers have pointed me this winter. Remember MPA? The synthetic progesteronelike substance used along with equine estrogens in the W.H.I.? There was a second W.H.I. hormones-versus-placebo trial, of nearly 11,000 women, that was also started in the early 1990s, just like the one that was halted in 2002. All the women enrolled in this second study had undergone hysterectomies, which meant they had zero risk for uterine cancer. So the women on medications in this trial were taking only equine estrogens — no MPA, which you'll recall is given to protect the uterus. Their study was stopped in 2004, also before its planned end date, because the estrogen-taking women were showing a higher risk of stroke than the women on the placebo. But their breast-cancer rate was *lower*. The hormone-taking women with hysterectomies in that second study, who used estrogen without MPA, showed a 23 percent lower risk of invasive breast cancer than their counterparts who were taking no hormones at all.

Nobody's persuaded that this means MPA promotes breast cancer while estrogen does not. It's clear that estrogen acts aggressively on certain breast malignancies and that any woman who has had breast cancer or has a history of it in her immediate family should stay off estrogen. This is one of the principal reasons such intense work is under way right now, in labs like Roberta Brinton's, to develop estrogenic variants — molecular substances designed to latch only to certain receptors (in the brain, say, where the activated receptors can do their good works) while ignoring receptors in the breast and uterus. And there are plenty of confounding factors, as scientists say, with regard to the women in the no-MPA trial. They all had undergone hysterectomies, for one thing; maybe whatever caused them to require uterine removal in the first place affected their reactions to the estrogen.

Or it could have been a fluke. But the MPA wrinkle adds suspicion and urgency to the timing-hypothesis questions about what really goes on when women of our demographic use hormones, and Julia Berry and I spent a long time talking about this, the adding and subtracting, the guessing and weighing, the balancing of what we think we know about ourselves against what we cannot possibly foresee. We will both, for the present, continue wearing estrogen patches. Berry turned out to be right, of course; she wasn't on the placebo, which the N.I.H. doctors told her when she finished the study. And as she hurried to fill her own patch prescription, she found her gratitude mixed with more than a little frustration. "Why did my primary-care physician give me an antidepressant when I could have had something simple, like estrogen?" she asked. "Why don't they know?"

We talked about breast cancer, because that is the nightmare illness in nearly all our calculations, for most of us the visual closest to hand. Three of my best friends have endured the full breast-cancer horror show and by now have retired their wigs. All have survived. None had been on hormone replacement. This is information that batters me steadily but not helpfully, like my ex-smoker paternal aunt's fatal lung cancer and the fact that I'm a lifetime nonsmoker and regular exerciser with extremely good cholesterol levels. How do my lowered risks from one column balance against my question marks over in another column? What to do?

"I'd rather monitor something I know can go wrong than go on living in the state I was in," Berry said. "I could have my breasts removed. I like them. But they're not my life."

We've spent a fair bit of time by now, Julia Berry and I, shaking these uncertainties out and squinting at them. Do we wear these patches forever? We don't know. What happens when we do take them off, if we do? We don't know. Have we done nothing except delay a biological process, complete with hot flashes and another round of truck-crash fantasies, that at some point we'll have to bully our way through? We don't know, nor does any researcher I talked to this spring.

And there's this: Should luck and longevity cooperate, we are going to grow old. We're already old, by the standards of our children and our ancestors, but the generation to which we belong expects to live a rich messy life full of extremely loud rock music for another 30 years after menopause. Every midlife woman I know keeps redrawing for herself the defensible lines of intervention in the "natural" sequence of human aging. Obsessive multiple plastic surgeries are silly and desperate. Muscles kept in good working order are not. Where on that spectrum is a hormones-saturated pharmaceutical patch? What if the timing hypothesis is even partly right? Suppose all we learn about replacement estrogen, in the end, is that if it's started early enough it *might* protect the heart and the brain, and that its chemistry makes some of us feel more the way we did at 40 than the way our mothers did at 65? Not an elixir of youth. More like . . . reading glasses. Or calcium supplements, or painkillers that stop the knee from hurting but carry risk warnings of their own. It has occurred to me that the better analogy might be a 13-year-old trying to ward off puberty by binding her breasts, but most of the time I don't think so, and if I do try stopping the patches, I know this to a certainty: I will keep a few extras in reserve, just in case.

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http://www.nytimes.com/2010/04/18/magazine/18estrogen-t.html?ref=magazine