http://www.eurekalert.org/pub_releases/2012-02/osu-ssc022712.php

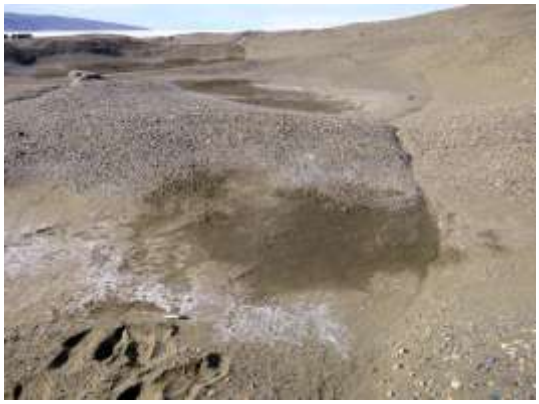
Salty soil can suck water out of atmosphere: Could it happen on Mars?

The frigid McMurdo Dry Valleys in Antarctica are a cold, polar desert, yet the sandy soils there are frequently dotted with moist patches in the spring despite a lack of snowmelt and no possibility of rain.

CORVALLIS, Ore. – A new study, led by an Oregon State University geologist, has found that that the salty soils in the region actually suck moisture out of the atmosphere, raising the possibility that such a process could take place on Mars or on other planets.

The study, which was supported by the National Science Foundation, has been published online this week in the journal Geophysical Research Letters, and will appear in a forthcoming printed edition.

Joseph Levy, a post-doctoral researcher in OSU's College of Earth, Ocean, and Atmospheric Sciences, said it takes a combination of the right kinds of salts and sufficient humidity to make the process work. But those ingredients are present on Mars and, in fact, in many desert areas on Earth, he pointed out.



These wet patches in Antarctica's McMurdo Dry Valleys are created by the salty soils sucking water out of the atmosphere. **(photo courtesy of Joseph Levy, Oregon State University)**

"The soils in the area have a fair amount of salt from sea spray and from ancient fjords that flooded the region," said Levy, who earned his doctorate at Brown University. "Salts from snowflakes also settle into the valleys and can form areas of very salty soil. With the right kinds of salts, and enough humidity, those salty soils suck the water right out of the air. "If you have sodium chloride, or table salt, you may need a day with 75 percent humidity to make it work," he added. "But if you have calcium chloride, even on a frigid day, you only need a humidity level above 35 percent to trigger the response."

Once a brine forms by sucking water vapor out of the air, Levy said, the brine will keep collecting water vapor until it equalizes with the atmosphere. "It's kind of like a siphon made from salt."

Levy and his colleagues, from Portland State University and Ohio State University, found that the wet soils created by this phenomenon were 3-5 times more water-rich than surrounding soils – and they were also full of organic matter, including microbes, enhancing the potential for life on Mars. The elevated salt content also depresses the freezing temperature of the groundwater, which continues to draw moisture out of the air when other wet areas in the valleys begin to freeze in the winter.

Though Mars, in general, has lower humidity than most places on Earth, studies have shown that it is sufficient to reach the thresholds that Levy and his colleagues have documented. The salty soils also are present on the Red Planet, which makes the upcoming landing of the Mars Science Laboratory this summer even more tantalizing.

Levy said the science team discovered the process as part of "walking around geology" – a result of observing the mysterious patches of wet soil in Antarctica, and then exploring their causes. Through soil excavations and other studies, they eliminated the possibility of groundwater, snow melt, and glacial runoff. Then they began investigating the salty properties of the soil, and discovered that the McMurdo Dry Valleys weather stations had reported several days of high humidity earlier in the spring, leading them to their discovery of the vapor transfer.

"It seems kind of odd, but it really works," Levy said. "Before one of our trips, I put a bowl of the dried, salty soil and a jar of water into a sealed Tupperware container and left it on my shelf. When I came back, the water had transferred from the jar to the salt and created brine.

"I knew it would work," he added with a laugh, "but somehow it still surprised me that it did."

Evidence of the salty nature of the McMurdo Dry Valleys is everywhere, Levy said. Salts are found in the soils, along seasonal streams, and even under glaciers. Don Juan Pond, the saltiest body of water on Earth, is found in Wright Valley, the valley adjacent to the wet patch study area.

"The conditions for creating this new water source into the permafrost are perfect," Levy said, "but this isn't the only place where this could or does happen. It takes an arid region to create the salty soils, and enough humidity to make the transference work, but the rest of it is just physics and chemistry."

Other authors on the study include Andrew Fountain, Portland State University, and Kathy Welch and W. Berry Lyons, Ohio State University.

http://www.eurekalert.org/pub_releases/2012-02/jhmi-hll022312.php

Hearing loss linked to 3-fold risk of falling

Hearing loss has been linked with a variety of medical, social and cognitive ills, including dementia. However, a new study led by a Johns Hopkins researcher suggests that hearing loss may also be a risk factor for another huge public health problem: falls.

The finding could help researchers develop new ways to prevent falls, especially in the elderly, and their resulting injuries that generate billions in health care costs in the United States each year, by some estimates.

To determine whether hearing loss and falling are connected, Frank Lin, M.D., Ph.D., at Johns Hopkins, and his colleague Luigi Ferrucci, M.D., Ph.D., of the National Institute on Aging, used data from the 2001 to 2004 cycles of the National Health and Nutrition Examination Survey. This research program has periodically gathered health data from thousands of Americans since 1971.

During those years, 2,017 participants ages 40 to 69 had their hearing tested and answered questions about whether they had fallen over the past year. Researchers also collected demographic information, including age, sex and race, and tested participants' vestibular function, a measure of how well they kept their balance. Their findings are published in the Archives of Internal Medicine.

Lin, an assistant professor at the Johns Hopkins University School of Medicine and the university's Bloomberg School of Public Health, and Ferrucci found that people with a 25-decibel hearing loss, classified as mild, were nearly three times more likely to have a history of falling. Every additional 10-decibels of hearing loss increased the chances of falling by 1.4 fold. This finding still held true, even when researchers accounted for other factors linked with falling, including age, sex, race, cardiovascular disease and vestibular function. Even excluding participants with moderate to severe hearing loss from the analysis didn't change the results. Lin, an otologist and epidemiologist, says among the possible explanations for the link is that people who can't hear well might not have good awareness of their overall environment, making tripping and falling more likely.

Another reason hearing loss might increase the risk of falls, Lin adds, is cognitive load, in which the brain is overwhelmed with demands on its limited resources. "Gait and balance are things most people take for granted, but they are actually very cognitively demanding," Lin says. "If hearing loss imposes a cognitive load, there may be fewer cognitive resources to help with maintaining balance and gait."

Funding support for this study was provided by the National Institutes of Health.

***More information**, go to: http://www.hopkinsmedicine.org/otolaryngology/our_team/faculty/lin_frank.html*

http://nyti.ms/zfpKtT

They're, Like, Way Ahead of the Linguistic Currrrve

From Valley Girls to the Kardashians, young women have long been mocked for the way they talk.

By DOUGLAS QUENQUA

Whether it be uptalk (pronouncing statements as if they were questions? Like this?), creating slang words like "bitchin' " and "ridic," or the incessant use of "like" as a conversation filler, vocal trends associated with young women are often seen as markers of immaturity or even stupidity. Right?

But linguists - many of whom once promoted theories consistent with that attitude - now say such thinking is outmoded. Girls and women in their teens and 20s deserve credit for pioneering vocal trends and popular slang, they say, adding that young women use these embellishments in much more sophisticated ways than people tend to realize.

"A lot of these really flamboyant things you hear are cute, and girls are supposed to be cute," said Penny Eckert, a professor of linguistics at Stanford University. "But they're not just using them because they're girls. They're using them to achieve some kind of interactional and stylistic end."

Paul Hoppe

The latest linguistic curiosity to emerge from the petri dish of girl culture gained a burst of public recognition in December, when researchers from Long Island University published a paper about it in The Journal of Voice. Working with what they acknowledged was a very small sample - recorded speech from 34

women ages 18 to 25 - the professors said they had found evidence of a new trend among female college students: a guttural fluttering of the vocal cords they called "vocal fry."

A classic example of vocal fry, best described as a raspy or croaking sound injected (usually) at the end of a sentence, can be heard when Mae West says, "Why don't you come up sometime and see me," or, more recently on television, when Maya Rudolph mimics Maya Angelou on "Saturday Night Live."

Not surprisingly, gadflies in cyberspace were quick to pounce on the study - or, more specifically, on the girls and women who are frying their words. "Are they trying to sound like Kesha or Britney Spears?" teased The Huffington Post, naming two pop stars who employ vocal fry while singing, although the study made no mention of them. "Very interesteeeaaaaaaaaang," said Gawker.com, mocking the lazy, drawn-out affect.

Do not scoff, says Nassima Abdelli-Beruh, a speech scientist at Long Island University and an author of the study. "They use this as a tool to convey something," she said. "You quickly realize that for them, it is as a cue."

Other linguists not involved in the research also cautioned against forming negative judgments.

"If women do something like uptalk or vocal fry, it's immediately interpreted as insecure, emotional or even stupid," said Carmen Fought, a professor of linguistics at Pitzer College in Claremont, Calif. "The truth is this: Young women take linguistic features and use them as power tools for building relationships."

The idea that young women serve as incubators of vocal trends for the culture at large has longstanding roots in linguistics. As Paris is to fashion, the thinking goes, so are young women to linguistic innovation.

"It's generally pretty well known that if you identify a sound change in progress, then young people will be leading old people," said Mark Liberman, a linguist at the University of Pennsylvania, "and women tend to be maybe half a generation ahead of males on average."

Less clear is why. Some linguists suggest that women are more sensitive to social interactions and hence more likely to adopt subtle vocal cues. Others say women use language to assert their power in a culture that, at least in days gone by, asked them to be sedate and decorous. Another theory is that young women are simply given more leeway by society to speak flamboyantly.

But the idea that vocal fads initiated by young women eventually make their way into the general vernacular is well established. Witness, for example, the spread of uptalk, or "high-rising terminal."

Starting in America with the Valley Girls of the 1980s (after immigrating from Australia, evidently), uptalk became common among young women across the country by the 1990s.

In the past 20 years, uptalk has traveled "up the age range and across the gender boundary," said David Crystal, a longtime professor of linguistics who teaches at Bangor University in Wales. "I've heard grandfathers and grandmothers use it," he said. "I occasionally use it myself."

Even an American president has been known to uptalk. "George W. Bush used to do it from time to time," said Dr. Liberman, "and nobody ever said, 'Oh, that G.W.B. is so insecure, just like a young girl.' "

The same can be said for the word "like," when used in a grammatically superfluous way or to add cadence to a sentence. (Because, like, people tend to talk this way when impersonating, like, teenage girls?) But in 2011, Dr. Liberman conducted an analysis of nearly 12,000 phone conversations recorded in 2003, and found that while young people tended to use "like" more often than older people, men used it more frequently than women.

And, actually? The use of "like" in a sentence, "apparently without meaning or syntactic function, but possibly as emphasis," has made its way into the Webster's New World College Dictionary, Fourth Edition - this newspaper's reference Bible - where the example given is: "It's, like, hot." Anyone who has seen a television show featuring the Kardashian sisters will be more than familiar with this usage.

"Like" and uptalk often go hand in hand. Several studies have shown that uptalk can be used for any number of purposes, even to dominate a listener. In 1991, Cynthia McLemore, a linguist at the University of Pennsylvania, found that senior members of a Texas sorority used uptalk to make junior members feel obligated to carry out new tasks. ("We have a rush event this Thursday? And everyone needs to be there?")

Dr. Eckert of Stanford recalled a study by one of her students, a woman who worked at a Jamba Juice and tracked instances of uptalking customers. She found that by far the most common uptalkers were fathers of young women. For them, it was "a way of showing themselves to be friendly and not asserting power in the situation," she said.

Vocal fry, also known as creaky voice, has a long history with English speakers. Dr. Crystal, the British linguist, cited it as far back as 1964 as a way for British men to denote their superior social standing. In the United States, it has seemingly been gaining popularity among women since at least 2003, when Dr. Fought, the Pitzer College linguist, detected it among the female speakers of a Chicano dialect in California.

A 2005 study by Barry Pennock-Speck, a linguist at the University of Valencia in Spain, noted that actresses like Gwyneth Paltrow and Reese Witherspoon used creaky voice when portraying contemporary American

characters (Ms. Paltrow used it in the movie “Shallow Hal,” Ms. Witherspoon in “Legally Blonde”), but not British ones in period films (Ms. Paltrow in “Shakespeare in Love,” Ms. Witherspoon in “The Importance of Being Earnest”).

So what does the use of vocal fry denote? Like uptalk, women use it for a variety of purposes. Ikuko Patricia Yuasa, a lecturer in linguistics at the University of California, Berkeley, called it a natural result of women’s lowering their voices to sound more authoritative.

It can also be used to communicate disinterest, something teenage girls are notoriously fond of doing.

“It’s a mode of vibration that happens when the vocal cords are relatively lax, when sublevel pressure is low,” said Dr. Liberman. “So maybe some people use it when they’re relaxed and even bored, not especially aroused or invested in what they’re saying.”

But “language changes very fast,” said Dr. Eckert of Stanford, and most people - particularly adults - who try to divine the meaning of new forms used by young women are “almost sure to get it wrong.”

“What may sound excessively ‘girly’ to me may sound smart, authoritative and strong to my students,” she said.

http://www.eurekalert.org/pub_releases/2012-02/uonc-ter022712.php

Tomb exploration reveals first archaeological evidence of Christianity from the time of Jesus

The engravings were most likely made by some of Jesus' earliest followers, within decades of his death.

The archaeological examination by robotic camera of an intact first century tomb in Jerusalem has revealed a set of limestone Jewish ossuaries or "bone boxes" that are engraved with a rare Greek inscription and a unique iconographic image that the scholars involved identify as distinctly Christian.

The four-line Greek inscription on one ossuary refers to God "raising up" someone and a carved image found on an adjacent ossuary shows what appears to be a large fish with a human stick figure in its mouth, interpreted by the excavation team to be an image evoking the biblical story of Jonah.

In the earliest gospel materials the "sign of Jonah," as mentioned by Jesus, has been interpreted as a symbol of his resurrection. Jonah images in later "early" Christian art, such as images found in the Roman catacombs, are the most common motif found on tombs as a symbol of Christian resurrection hope. In contrast, the story of Jonah is not depicted in any first century Jewish art and iconographic images on ossuaries are extremely rare, given the prohibition within Judaism of making images of people or animals.

The tomb in question is dated prior to 70 CE, when ossuary use in Jerusalem ceased due to the Roman destruction of the city. Accordingly, if the markings are Christian as the scholars involved believe, the engravings represent – by several centuries - the earliest archaeological record of Christians ever found. The engravings were most likely made by some of Jesus' earliest followers, within decades of his death. Together, the inscription and the Jonah image testify to early Christian faith in resurrection. The tomb record thus predates the writing of the gospels.

The findings will be detailed in a preliminary report by James D. Tabor, professor and chair of religious studies at the University of North Carolina at Charlotte, to be published online in www.bibleinterp.com on February 28, 2012.

"If anyone had claimed to find either a statement about resurrection or a Jonah image in a Jewish tomb of this period I would have said impossible -- until now," Tabor said. "Our team was in a kind of ecstatic disbelief, but the evidence was clearly before our eyes, causing us to revise our prior assumptions."

The publication of the academic article is concurrent with the publication of a book by Simon & Schuster entitled "The Jesus Discovery: The New Archaeological Find That Reveals the Birth of Christianity." The book is co-authored by Professor James Tabor and filmmaker/professor Simcha Jacobovici. A documentary on the discovery will be aired by the Discovery Channel in spring 2012.

The findings and their interpretation are likely to be controversial, since most scholars are skeptical of any Christian archaeological remains from so early a period. Adding to the controversy is the tomb's close proximity to a second tomb, discovered in 1980. This tomb, dubbed by some "The Jesus Family Tomb," contained inscribed ossuaries that some scholars associate with Jesus and his family, including one that reads "Jesus, son of Joseph."

"Context is everything in archaeology," Tabor pointed out. "These two tombs, less than 200 feet apart, were part of an ancient estate, likely related to a rich family of the time. We chose to investigate this tomb because of its proximity to the so-called 'Jesus tomb,' not knowing if it would yield anything unusual."

The tomb containing the new discoveries is a modest sized, carefully carved rock cut cave tomb typical of Jerusalem in the period from 20 BCE until 70 CE.

The tomb was exposed in 1981 by builders and is currently several meters under the basement level of a modern condominium building in East Talpiot, a neighborhood of Jerusalem less than two miles south of the Old City. Archaeologists entered the tomb at the time, were able to briefly examine it and its ossuaries, take preliminary photographs, and remove one pot and an ossuary, before they were forced to leave by Orthodox religious groups who oppose excavation of Jewish tombs.

The ossuary taken, that of a child, is now in the Israel State Collection. It is decorated but has no inscriptions. The archaeologists mention "two Greek names" but did not notice either the newly discovered Greek inscription or the Jonah image before they were forced to leave. The tomb was re-sealed and buried beneath the condominium complex on what is now Don Gruner Street in East Talpiot.

The adjacent "Jesus tomb," was uncovered by the same construction company in 1980, just one year earlier. It was thoroughly excavated and its contents removed by the Israel Antiquities Authority. This tomb's controversial ossuaries with their unusual cluster of names (that some have associated with Jesus and his family) are now part of the Israel State Collection and have been on display in various venues, including the Israel Museum. These ossuaries will be in an exhibit running from late February through April 15 at Discovery Times Square.

In 2009 and 2010, Tabor and Rami Arav, professor of archaeology at the University of Nebraska at Omaha, working together with Jacobovici, obtained a license to excavate the current tomb from the Israel Antiquities Authority under the academic sponsorship of the University of North Carolina at Charlotte. Because of its physical location under a modern building (making direct access nearly impossible), along with the threat of Orthodox Jewish groups that would protest any such excavation, Tabor's team determined to employ a minimally invasive procedure in examining the tomb.

Funding for the excavation was provided by the Discovery Channel/Vision Television/Associated Producers. Jacobovici's team at the Toronto based Associated Producers developed a sophisticated robotic arm to carry high definition cameras, donated by General Electric. The robotic arm and a second "snake camera" were inserted through two drill holes in the basement floor of the building above the tomb. The probe was successful and the team was able to reach all the ossuaries and photograph them on all sides, thus revealing the new inscriptions.

Beyond the possible Christian connection, Tabor noted that the tomb's assemblage of ossuaries stands out as clearly extraordinary in the context of other previously explored tombs in Jerusalem.

"Everything in this tomb seems unusual when contrasted with what one normally finds inscribed on ossuaries in Jewish tombs of this period," Tabor said. "Of the seven ossuaries remaining in the tomb, four of them have unusual features."

There are engravings on five of the seven ossuaries: an enigmatic symbol on ossuary 2 (possibly reading Yod Heh Vav Heh or "Yahweh" in stylized letters that can be read as Greek or Hebrew, though the team is uncertain); an inscription reading "MARA" in Greek letters (which Tabor translates as the feminine form of "lord" or "master" in Aramaic) on ossuary 3; an indecipherable word in Greek letters on ossuary 4 (possibly a name beginning with "JO…"); the remarkable four-line Greek inscription on ossuary 5; and finally, and most importantly, a series of images on ossuary 6, including the large image of a fish with a figure seeming to come out of its mouth.

Among the approximately 2000 ossuaries that have been recovered by the Israel Antiquities Authority, only 650 have any inscriptions on them, and none have inscriptions comparable to those on ossuaries 5 and 6.

Less than a dozen ossuaries from the period have epitaphs but, according to Tabor, these inscribed messages usually have to do with warnings not to disturb the bones of the dead. In contrast, the four-line Greek inscription contains some kind of statement of resurrection faith.

Tabor noted that the epitaph's complete and final translation is uncertain. The first three lines are clear, but the last line, consisting of three Greek letters, is less sure, yielding several possible translations: "O Divine Jehovah, raise up, raise up," or "The Divine Jehovah raises up to the Holy Place," or "The Divine Jehovah raises up from [the dead]."

"This inscription has something to do with resurrection of the dead, either of the deceased in the ossuary, or perhaps, given the Jonah image nearby, an expression of faith in Jesus' resurrection," Tabor said.

The ossuary with the image that Tabor and his team understand to be representing Jonah also has other interesting engravings. These also may be connected to resurrection, Tabor notes. On one side is the tail of a fish disappearing off the edge of the box, as if it is diving into the water. There are small fish images around its border on the front facing, and on the other side is the image of a cross-like gate or entrance - which Tabor interprets as the notion of entering the "bars" of death, which are mentioned in the Jonah story in the Bible.

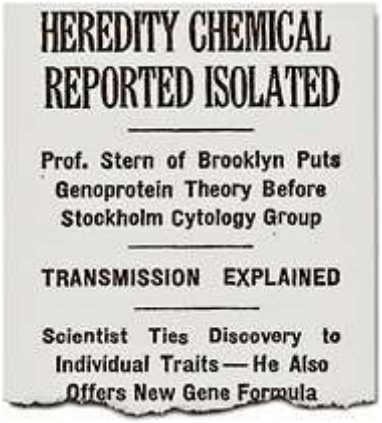
"This Jonah ossuary is most fascinating," Tabor remarked. "It seems to represent a pictorial story with the fish diving under the water on one end, the bars or gates of death, the bones inside, and the image of the great fish spitting out a man representing, based on the words of Jesus, the 'sign of Jonah' – the 'sign' that he would escape the bonds of death."

http://nyti.ms/zEN8aD

DNA, 1947

Scientists had known of DNA since 1869 (although not by that name), but The New York Times did not mention it until 78 years later.

By NICHOLAS BAKALAR


HEREDITY CHEMICAL REPORTED ISOLATED

Prof. Stern of Brooklyn Puts Genoprotein Theory Before Stockholm Cytology Group

TRANSMISSION EXPLAINED

Scientist Ties Discovery to Individual Traits — He Also Offers New Gene Formula

"The isolation from the nuclei of living cells of a chemical believed to be the substance transmitting heredity was reported today," an article published July 15, 1947, began. It went on to describe two different forms of the chemical, which it called "ribo-nucleic acid" and "desoxyribo-nucleic acid."

By Aug. 16, 1951, the abbreviation "DNA" was in common use, and The Times printed it for the first time in an article by William L. Laurence reporting on a scientific conference held at the Brookhaven National Laboratory. "One of the major substances identified with the chromosomes is known as desoxyribonucleic acid or DNA. The evidence has accumulated, as reported here today, that DNA is the vital component of all genes in all animals... although its chemical configuration remains a mystery."

But The Times resisted consistent use of the abbreviation for several more years. In a roundup of science news published on Nov. 2, 1952, "desoxyribonucleic acid" was described as "the major puzzle in nuclear structure; it is thought to be the basis of the gene, smallest known unit of heredity."

Then on June 13, 1953, the newspaper reported that rarest of events, a true scientific breakthrough: the structure of the molecule had finally been worked out by James Watson and Francis Crick, and the term "double helix" first entered the pages of The Times.

"Clue to Chemistry of Heredity Found" read the headline. The report began, "A scientific partnership between an American and a British biochemist at the Cavendish Laboratory in Cambridge has led to the unraveling of the structural pattern of a substance as important to biologists as uranium is to nuclear physicists. The substance is nucleic acid, the vital constituent of cells, the carrier of inherited characters in the fluid that links organic life with inorganic matter. The form of nucleic acid under investigation is called DNA (desoxyribonucleic acid)."

On Sept. 7, 1958, the newspaper reported that DNA had been synthesized, and a search of The Times database from that date forward yields thousands of references to "DNA," "double helix," "nucleic acid" and other terms associated with the chemical. In fact, DNA has become so familiar that it appears often in the newspaper as a metaphor in non-scientific contexts.

In recent years such phrases as "his artistic DNA," "the DNA of a young company," and the "DNA of the Democratic Party" have become common.

http://www.physorg.com/news/2012-02-lunar-scientists-moon-impact-history.html

Lunar scientists shed light on Moon's impact history

Researchers from have discovered that debris that caused a "lunar cataclysm" on the moon 4 billion years ago struck it at much higher speeds than those that made the most ancient craters.

PhysOrg.com - A team of researchers from the NASA Lunar Science Institute (NLSI) at NASA Ames Research Center, Moffett Field, Calif., have discovered that debris that caused a "lunar cataclysm" on the moon 4 billion years ago struck it at much higher speeds than those that made the most ancient craters. The scientists found evidence supporting this scenario by examining the history of crater formation on the moon.

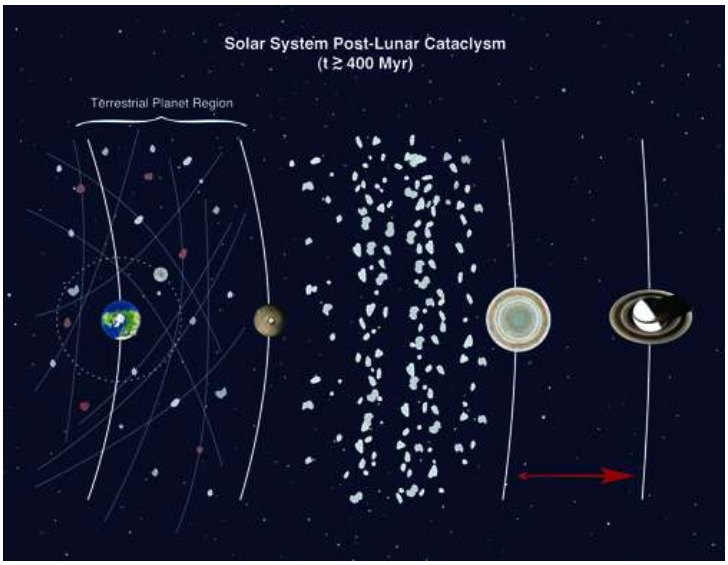
During Earth's earliest days, our planet and others in the inner solar system, including the moon, experienced repeated impacts from debris that formed the building blocks of the planets. Over time, as material was swept up and incorporated into the inner planets, the rate of impacts decreased. Then, roughly 4 billion years ago, a second wave of impacts appears to have taken place, with lunar projectiles hitting at much higher speeds. This increase could reflect the origin of the debris, where main belt asteroids were dislodged and sent into the inner solar system by shifts in the orbits of the giant planets.

The team is composed of Simone Marchi, an NLSI postdoctoral fellow, William Bottke, the NLSI Team Lead at Southwest Research Institute, Boulder, Colo., David Kring, the NLSI Team Lead at USRA's Lunar and Planetary Institute in Houston, and Alessandro Morbidelli from the Observatoire de la Cote d'Azur, France.

Their research paper, “On the Onset of the Lunar Cataclysm as Recorded in its Ancient Crater Populations,” was recently published in the journal Earth and Planetary Science Letters.

The scientists analyzed digital maps of the lunar surface to learn about its history. Their analysis shows that craters formed near the 860 km diameter Nectaris impact basin were created by projectiles hitting twice as fast as those found on more ancient terrains. This was represented by a subtle shift in crater sizes, with the crater themselves thirty to forty percent larger on average than those found in comparable populations with older craters. The scientists believe this can be best explained by an increase in the velocities of the projectiles that produced the younger craters.

The increase in velocities may indicate a change in the solar system when the craters were created. The analysis supports the "lunar cataclysm" hypothesis that the brief pulse of impacting objects 4 billion years ago was due to gravitational disturbances caused by the reorganization of the giant planets as their orbits changed. Nectaris, a crater close to the Apollo 16 landing site, appears to have recorded the spike in asteroid impacts during the "lunar cataclysm."



Post Lunar Cataclysm diagram of our Solar System. **Credit: LPI/Marchi/Bottke/Kring/Morbidelli.**

Determining the magnitude and duration of any impact cataclysm and testing that hypothesis is a top science priority for future exploration of the moon, according to a previously published report by the National Research Council.

When Apollo astronauts gathered rock samples from the moon, many samples had ages dating back 3.9 to 4 billion years ago, suggesting an enhanced pulse of bombardment. If a bombardment of asteroids hit the moon as theorized, there could be indicators left on the lunar surface that would help validate the theory. Detailed mapping by the United States Geological Survey has previously identified small regions of the lunar surface that might contain clues about the bombardment. The team re-studied those ancient surfaces and measured the sizes of the impact craters using new data obtained from the Lunar Orbiter Laser Altimeter, an instrument on NASA’s Lunar Reconnaissance Orbiter (LRO) currently orbiting around the moon.

“This is an exciting time for lunar research with LRO and other spacecraft providing so much new data,” said lead author Simone Marchi. “Collaborating with scientists of different disciplines allowed us to link these observational data to dynamical models to put new constraints on solar system history.”

The inferred increase in velocity seems to have occurred after the moon’s largest impact basin was produced, the 2,500-kilometer-diameter South Pole-Aitken Basin, but before the formation of the largest lava-filled impact basins on the lunar nearside, visible from backyards around the world.

“It is fascinating that the surface of our own moon records evidence of orbital changes in Jupiter and Saturn that took place so long ago,” said NLSI Director Yvonne Pendleton. ***More information***

http://bit.ly/wNXtSZ

Ötzi the ice mummy's secrets found in DNA

Ötzi the ice mummy may have met his death in the Alps some 5300 years ago, but his descendants live on – on the Mediterranean islands of Corsica and Sardinia

16:00 28 February 2012 by Andy Coghlan

The finding comes from an analysis of Ötzi's DNA, which also reveals he had brown eyes and hair, and was lactose intolerant. The ice mummy was found in 1991 on an Alpine glacier between Austria and Italy, where he met a violent end in the Neolithic. Albert Zink of the Institute for Mummies and the Iceman in Bolzano, Italy, and colleagues have now analysed DNA extracted from Ötzi's pelvis to find out more about his life.

Mutations to the iceman's MCM6 gene suggest he could not digest the lactose protein in milk – unlike most modern Europeans. "Maybe at that time most people were still lactose-intolerant," says Zink. "The change to farming livestock [in Europe] only began between about 5000 and 10,000 years ago and so digesting milk became an advantage."

Ötzi was more likely than most to develop heart disease. He carried one genetic mutation that in modern humans raises the risk of coronary heart disease by 40 per cent, and two others that made him prone to a build-up of fat in the linings of his arteries.

Zink says these findings fit with earlier investigations showing that Ötzi's major arteries, including his aorta, were all calcified – a sign they were clogged with fatty deposits.
The team also compared Ötzi's DNA with that of 1300 Europeans, 125 North Africans and 20 people from the Arab peninsula to establish that his closest living kin are found on Sardinia and Corsica. "His contemporaries have disappeared from the European mainland," says Zink. Although the analysed DNA was partially degraded, Zink says most of it was intact and free from contamination.
Journal reference: *Nature Communications, DOI: 10.1038/ncomms1701*

http://www.eurekalert.org/pub_releases/2012-02/uoc--tlf022812.php

3-strikes law fails to reduce crime

UC Riverside analysis finds that decreased alcohol consumption is responsible for significant drop in crime nationwide, not tougher sentencing policies

RIVERSIDE, Calif. - California's three-strikes law has not reduced violent crime, but has contributed significantly to the state's financial woes by substantially increasing the prison population, according to a University of California, Riverside researcher. Declining crime rates in California and nationwide reflect declines in alcohol consumption, not tough-on-crime policies such as three-strikes laws, says Robert Nash Parker, a sociologist and director of the Presley Center for Crime and Justice Studies at UCR.

Parker, who is known internationally for groundbreaking research on the relationship between alcohol policies and crime, details those findings in "Worse Policy After Bad: How and Why California's 'Three Strikes' is a Complete Failure as Crime and Economic Policy, and What to Do About Either," which will appear in the spring issue of California Journal of Politics and Policy.

Three-strikes legislation, which took effect in 1994, was intended to incarcerate so-called "career criminals" for 25 years to life upon a third conviction, even when the third offense was a nonviolent crime. California's crime rate has been cut in half in the last 20 years - a decline that began two years before the implementation of three-strikes legislation.

"Political leaders, activists, law enforcement personnel, and elected officials in California believe the state's three-strikes law is the cause of this magnificent decline in violence," Parker said. "That is not the case. Three-strikes has had nothing whatsoever to do with the drop in violent crime."

Analyzing national crime data, Parker found that crime in California has declined at rates similar to states with three-strikes policies and those without - including large states with no three-strikes laws such as Texas, New York and Illinois - and found little difference. "This suggests that whatever is driving the trend in violent crime over the last 46 years in these states it is not three-strikes policy," Parker concluded.

A National Institute of Justice review of three-strikes legislation found that California imprisoned roughly 300 times the number of inmates as did the state of Washington, which enacted a three-strikes law about the same time as California. California's population is about 5.5 times as large as that of Washington.

"Differences between California's three-strikes law and those of Washington and other states explains this difference," Parker said. "California increased its prison population significantly yet obtained roughly the same crime drop at the same time as states that had similar laws, but without their impact, as well as that obtained by states that did not pass any laws aimed at reducing violence through vast increase in the prison population."

In earlier research, Parker found that homicide rates nationally correlate with alcohol consumption and unemployment rates. Since the 1930s, an increase in alcohol consumption has occurred one to two years before an upturn in homicide rates, and has decreased one to two years before a downturn in homicide rates. Nationwide, alcohol consumption peaked in 1982 and has declined significantly and steadily since.

"There is no justification for continuing three-strikes from a violence-prevention point of view," Parker says. "My analysis suggests that alcohol policy designed to reduce overall consumption in California may be more effective at reducing violence than three-strikes or other criminal justice policy initiatives."

The economic impact on California has been devastating, Parker added. Although the state's financial troubles are complex, three-strikes has amplified those problems by consuming an ever-larger portion of the general fund budget each year.

For example, in 1985 spending on higher education consumed about 11 percent of the general fund, while prison funding accounted for about 4 percent. By 2010, spending on higher education accounted for less than 6 percent of total spending while prison costs consumed about 10 percent.

The state auditor estimates that future prison costs attributable to three-strikes sentencing range from $19 billion to $23 billion annually, perhaps more, depending on how the state responds to the 2011 U.S. Supreme Court order to release 40,000 inmates from overcrowded prisons. In response to that order, the Legislature plans to divert most of those inmates to county jails, with the state bearing some of the costs.

If inmates sentenced under three-strikes were released immediately, the state and counties would save about $1.3 billion immediately, and likely more in coming years, according to the auditor's report.
"If three strikes has resulted in all this incarceration and expense, yet has little to do with controlling crime, why not release these inmates?" Parker asked. "The state of California should give up its addiction to the all-you-can eat buffet of imprisonment, the result of which has been to undermine the financial health of the state, weaken the quality of education at all levels, and force California to make draconian cuts in programs that enhance and benefit the lives of its residents in exchange for a mistaken idea that public safety was the result. The bottom-line result of three-strikes has been an almost unbearable financial burden that looms in the future despite current efforts, and which will only be resolved when the pipeline of over-punishment is finally shut down."

http://www.eurekalert.org/pub_releases/2012-02/sfu-srt022812.php

SFU researchers test sugary solution to Alzheimer's

Slowing or preventing the development of Alzheimer's disease, a fatal brain condition expected to hit one in 85 people globally by 2050, may be as simple as ensuring a brain protein's sugar levels are maintained.

That's the conclusion seven researchers, including David Vocadlo, a Simon Fraser University chemistry professor and Canada Research Chair in Chemical Glycobiology, make in the latest issue of Nature Chemical Biology. The journal has published the researchers' latest paper Increasing O-GlcNAc slows neurodegeneration and stabilizes tau against aggregation.

Vocadlo and his colleagues describe how they've used an inhibitor they've chemically created - Thiamet-G - to stop O-GlcNAcase, a naturally occurring enzyme, from depleting the protein Tau of sugar molecules.

"The general thinking in science," says Vocadlo, "is that Tau stabilizes structures in the brain called microtubules. They are kind of like highways inside cells that allow cells to move things around."

Previous research has shown that the linkage of these sugar molecules to proteins, like Tau, in cells is essential. In fact, says Vocadlo, researchers have tried but failed to rear mice that don't have these sugar molecules attached to proteins. Vocadlo, an accomplished chess player in his spare time, is having great success checkmating troublesome enzymes with inhibitors he and his students are creating in the SFU chemistry department's Laboratory of Chemical Glycobiology.

Research prior to Vocadlo's has shown that clumps of Tau from an Alzheimer brain have almost none of this sugar attached to them, and O-GlcNAcase is the enzyme that is robbing them. Such clumping is an early event in the development of Alzheimer's and the number of clumps correlate with the disease's severity.

Scott Yuzwa and Xiaoyang Shan, grad students in Vocadlo's lab, found that Thiamet-G blocks O-GlcNAcase from removing sugars off Tau in mice that drank water with a daily dose of the inhibitor. Yuzwa and Shan are co-first authors on this paper. The research team found that mice given the inhibitor had fewer clumps of Tau and maintained healthier brains.

"This work shows targeting the enzyme O-GlcNAcase with inhibitors is a new potential approach to treating Alzheimer's," says Vocadlo. "This is vital since to date there are no treatments to slow its progression.

"A lot of effort is needed to tackle this disease and different approaches should be pursued to maximize the chance of successfully fighting it. In the short term, we need to develop better inhibitors of the enzyme and test them in mice. Once we have better inhibitors, they can be clinically tested.

http://www.sciencedaily.com/releases/2012/02/120228123941.htm

Cold Air Chills Heart's Oxygen Supply, Making Snow Shoveling Dangerous for Some People

People with heart disease may not be able to compensate for their bodies' higher demand for oxygen when inhaling cold air, according to Penn State researchers, making snow shoveling and other activities dangerous for some.

ScienceDaily - "This study can help us understand why cold air is such a trigger for coronary events," said Lawrence I. Sinoway, Distinguished Professor of Medicine and director of the Heart and Vascular Institute, Penn State College of Medicine.

Breathing cold air during exercise can cause uneven oxygen distribution throughout the heart. But a healthy body generally corrects for this problem and redistributes blood flow, making sure the heart continues to function properly. In people with heart problems - such as coronary artery disease - this may not be the case, said Sinoway.

"If you are doing some type of isometric work and you're breathing cold air, your heart is doing more work - it's consuming more oxygen," said Sinoway, also director of the Clinical and Translational Science Institute at Penn State.

Isometric work includes such activities as shoveling snow and carrying a briefcase or laptop bag. The heart works harder when exerted in cold temperatures and the number of deaths due to cardiac arrest peaks during the winter.

"There are two different things going on here -- demand and supply," said Matthew D. Muller, postdoctoral fellow at the Heart and Vascular Institute, Penn State College of Medicine. "We thought that oxygen demand in the heart would be higher with cold-air breathing and we also thought that oxygen supply would be a little bit impaired. And that's generally what we found."

Sinoway, Muller and colleagues reported their results in a recent issue of the Journal of Applied Physiology and in the current issue of the American Journal of Physiology, Heart and Circulatory Physiology.

The researchers first studied healthy young adults in their 20s and then studied a group of healthy older adults in their 60s so that they could learn how the heart functions in people without disease. Each subject was monitored for lung function and heart functions during the trials.

In order to measure heart function during exercise, the participants performed an isometric, or static, handgrip, which is a maneuver known to increase blood pressure. Subjects squeezed the handgrip device and held it still for two minutes, providing a consistent workload on the heart for the researchers to measure. Muller and Sinoway found that there was a supply-demand mismatch in the left ventricle - where the heart receives oxygenated blood - yet the heart was able to continue functioning appropriately.

These findings "suggest that healthy humans can adequately redistribute blood to the subendocardium (the blood vessels entering the heart) during the combined stimulus of cold-air inhalation and handgrip exercise," the researchers stated.

Also working on this research were Zhaohui Gao, instructor; Rachel C. Drew, postdoctoral fellow; Michael D. Herr, biomedical engineer; Urs A. Leuenberger, physician and professor of medicine; and Jessica L. Mast and Cheryl A. Blaha, clinical research nurses, all at the Heart and Vascular Institute, Penn State College of Medicine.

The National Institutes of Health and the Wilderness Medical Society both supported this research.

***Journal Reference:** M. D. Muller, Z. Gao, J. L. Mast, C. A. Blaha, R. C. Drew, U. A. Leuenberger, L. I. Sinoway. Aging attenuates the coronary blood flow response to cold air breathing and isometric handgrip in healthy humans. AJP: Heart and Circulatory Physiology, 2012; DOI: 10.1152/ajpheart.01195.2011*

http://news.discovery.com/animals/dolphins-greet-each-other-120228.html

Dolphins at Sea Greet Each Other

When groups of dolphins meet up in the open sea they thoughtfully introduce themselves.

By Jennifer Viegas

Bottlenose dolphins swap signature whistles with each other when they meet in the open sea, a new study reports, suggesting that these marine mammals engage in something akin to a human conversation.

Earlier research found that signature whistles are unique for each dolphin, with the marine mammals essentially naming themselves and communicating other basic information.

A signature dolphin whistle in human speak, might be comparable to, "Hi, I'm George, a large, three-year-old dolphin in good health who means you no harm."

The latest study, published in the Proceedings of the Royal Society B, is the first to show how free-ranging dolphins in the wild use these whistles at sea. The findings add to the growing body of evidence that dolphins possess one of the most sophisticated communication systems in the animal kingdom, perhaps even surpassing that of humans.

"In my mind, the term 'language' describes the human communication system; it is specific to us," co-author Vincent Janik of the University of St. Andrews Sea Mammal Research Unit, told Discovery News. "It is more fruitful to ask whether there are communication systems with similar complexity. I think the dolphin system is probably as complex as it gets among animals."

Janik and colleague Nicola Quick studied how bottlenose dolphins in St. Andrews Bay, off the coast of northeast Scotland, communicate with each other. While in a small, quiet boat, the researchers followed the wild dolphins and recorded their vocalizations. Analysis of the observations and recordings found that the dolphins usually swam together in a group moving slowly and relatively quietly.

"When another group approaches, usually one or more animals start to produce their signature whistles," Janik said. "We then hear dolphins from the other group calling back with their own signatures, and after or during this counter-calling the animals get together as one group and continue swimming together. Shortly after the union of the groups, they become much more quiet again."

Most animals have some sort of communication system that allows them to make similar introductions and meetings, but dolphins are unique in that they can invent and copy new sounds. This is "unlike non-human primates, who are stuck with their species-specific repertoire," he said.

The researchers also noticed that usually just one dolphin from each group would emit a signature whistle before the other group members would join the second group. This might mean that dolphins elect a "spokesman" to represent the entire group during meetings. Such an individual may be an older dolphin, Janik said, but he thinks the other dolphins are not fully silent, and may be using echolocation instead of whistles.

"We don't know whether echolocation works in this way, but it seems like a viable hypothesis," he said. "In that case, the whistle exchange is more of a greeting ceremony that communicates a friendly intention and is perhaps not needed to identify the group after the first introduction."

Dolphins at a distance may rely more upon sounds and echolocation for their communications than visual, scent and other signals. This is likely due to their marine environment and social structure. A dolphin can hear the whistle of another dolphin over a distance of about six miles and with lots of noise in the background. Heidi Harley, a bottlenose dolphin expert who is a professor of psychology at the New College of Florida, told Discovery News that she believes the findings are key to understanding how dolphins use signature whistles.

"Now we know that dolphins in groups use signature whistles before they join each other," Harley said. "This is an important piece in the puzzle that we've been constructing about signature whistles." She added, "I was surprised to learn that the exchanges appeared to be between only a single individual in each group."

http://www.physorg.com/news/2012-02-method-much-needed-medical-isotopes.html

New method to separate much-needed medical isotopes proposed

Individual atoms of a certain chemical element can be very stubborn when it comes to separation, mainly because techniques rely on a difference in chemical and physical properties - atoms are almost identical in both regards.

However, if you peer closely enough into the atoms, there are subtle differences that can have very big effects. These "different" atoms, called isotopes, are heavily relied on in areas of medicine and nuclear energy and now researchers have proposed a novel way of isolating them.

Reported today, Wednesday 29 February, in the New Journal of Physics, this new proposal combines a simple laser with a set of specifically aligned magnets to extract the desired atoms, and offers an alternative to the only general-purpose separator, called a Calutron, which is currently operating in Russia.

The Calutron, first invented by Ernest Lawrence in the 1930s, is still used to separate most elements in the periodic table; however, the US government has made it clear in its recommendations that the world is facing a supply crisis that the Russian Calutron cannot resolve.

Mark Raizen, lead author of the study and Professor of Physics at the University of Texas at Austin, said: "One thing is clear: isotopes are indispensable to the advancement of medicine. Calcium-48, for example, is used in the diagnosis of osteoporosis and bone development in children and nickel-64, which can be converted to copper-64, is a promising isotope for imaging and cancer therapy."

An atom's type is determined by its number of protons; an isotope is a variant of an atom because of its different number of neutrons - the neutral, subatomic particles that live in the nucleus at the centre of atoms.

For example, carbon-12, carbon-13 and carbon-14 are three isotopes that can be found in a regular sample of carbon and have six, seven and eight neutrons, respectively (every carbon atom also has six protons in its nucleus, making up the whole number that follows each isotope name).

The researchers, from the University of Texas at Austin, propose three simple steps in their new method. The starting point is to create a flow of atoms of a particular element. Simple, low-powered lasers will then be fired at this stream of atoms, in a process called optical pumping.

"Optical pumping involves atoms being pumped into a particular desired state by the absorption of photons from a laser with a particular polarization. This state could be one that is repelled by the magnetic field, or attracted to the magnetic field, depending on the polarization of the laser," continued Professor Raizen.

After the optical pumping, the stream of optically pumped atoms would pass through a set of magnetic barriers, aligned in a specific manner. In this part of the proposed apparatus, the isotopes that researchers do not require will become attracted to the magnets and the required isotopes will pass through freely, allowing them to be collected.

Computer simulations showed the researchers' method could obtain 99.96% of lithium-7 from a sample, suggesting it would be an ideal means of getting hold of this very important isotope - lithium-7 is used in cooling water in the nuclear industry.

The most recent method used to obtain lithium-7 required enormous levels of mercury, which is a very toxic metal, and was consequently terminated at Oak Ridge National Laboratory, Tennessee.

More information: *"Magnetically activated and guided isotope separation" Raizen M G and Klappauf B 2012 New J. Phys. 14 023059*

http://bit.ly/xv53ej

Facebook swaps 'Like' for 'Safe' during natural disasters

When natural disasters strike, most people's first instinct is to check whether their friends and family are safe, but more tech-savvy individuals might choose to update their social networking status.

Now you can do both, thanks to a new initiative being trialled by Facebook in Japan.

The social network's Disaster Message Board, which is currently only accessible in Japan, lets users mark themselves as "Safe", much as they can currently "Like" status updates. Users can also check their friends' current city, mark them as being safe and post comments with details of their whereabouts.

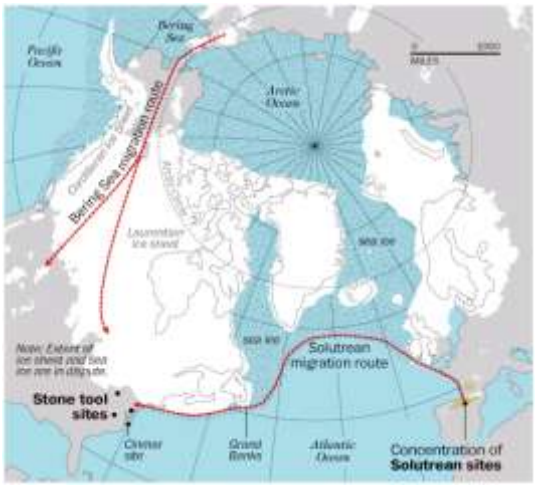
It is not the first time social networks have been put to good use following natural disasters. An app called Ushahidi lets aid workers check-in to share their location with others in the surrounding area, while last year crowdsourcing websites helped map radiation in the aftermath of the earthquake and tsunami that hit the Fukushima Daiichi nuclear plant.

http://www.physorg.com/news/2012-02-european-style-stone-tools-age.html

European style stone tools suggest Stone Age people actually discovered America

Archeologists and historians have long known that it wasn't really Christopher Columbus who discovered America.

PhysOrg.com - Native Americans had been living all over North, Central and South America long before he arrived. And Native Americans came from Asia across the frozen-over Bering Sea in the west. But now, it appears Europeans might have been first to arrive on the scene after all. Stone tools found recently in Delaware, Maryland and Virginia in the eastern United States, all appear to bear a striking resemblance to tools used by Stone Age peoples in early Europe, and have been dated to a time between 19,000 and 26,000 years ago, a period during which Stone Age people were making such tools, and long before the early Asians arrived.



It's not an implausible theory, suggests Dennis Stanford, of the Smithsonian Institution and Bruce Bradley of the University of Exeter, because Stone Age people could have come from Europe by traveling across the ice-bound North Atlantic during the Ice Age. The evidence is further bolstered by the recent discovery that an ancient knife found in Virginia in 1971 was made of flint that originated from France. They two have coauthored a book on the subject, Across Atlantic Ice.

Dennis Stanford and Bruce Bradley. The Washington Post.

Stanford and Bradley also point out the lack of evidence of any human activity in the north-east part of Siberia or in Alaska any earlier than 15,500 years ago. And the reason early Asians won out, evolving into the people now called Native Americans, was because their window of opportunity was much wider, 15,000 years versus just 4500 for the early Europeans. Thus the original Native Americans were either assimilated or killed by the large numbers of migrating Asians. Evidence that it was likely the former has been found in the DNA of skeletons of North American Native American people. Also, the language of several Native American tribes doesn't seem to have originated from Asia.

The two also say that it's conceivable that Stone Age people could have traveled such a long way over ice from Europe to America because there would have been more than enough food to be had from the ocean. It all adds up the two say, to a compelling case for Stone Age travelers being titled as the people who truly did discover America.

http://www.eurekalert.org/pub_releases/2012-02/acs-nh022912.php

New hybrid 'NOSH aspirin' as possible anti-cancer drug

Scientists have combined two new "designer" forms of aspirin into a hybrid substance that appears more effective than either of its forebears in controlling the growth of several forms of cancer in laboratory tests.

Their report on the new NOSH-aspirin, so named because it releases nitric oxide (NO) and hydrogen sulfide (H2S), appears in the journal ACS Medicinal Chemistry Letters.

Khosrow Kashfi, Ravinder Kodela and Mitali Chattopadhyay point out that NO and H2S are signaling substances produced in the body that relax blood vessels, reduce inflammation and have a variety of other

effects. Scientists previously developed designer aspirin that releases NO in an effort to reduce aspirin's potential adverse effects in causing bleeding in the gastrointestinal tract. Another designer aspirin that releases H_2S was developed which also has anti-inflammatory properties and appears safe to the stomach.

Since NO and H_2S are gases with physiological relevance, and Kashfi's group had previously shown beneficial effects with both NO- and $H_2$2S-aspirins, they postulated that a new hybrid that incorporated both of these entities might be even more potent and effective than either one alone. Their hypothesis has proved to be correct.

They found indications that the new hybrid inhibits the growth of breast, colon, pancreas, lung, prostate and some leukemia cancer cells in laboratory tests. Some of the NOSH-aspirins tested were more than 100,000 times more powerful against cancer cell growth than aspirin alone. Promisingly, the group reported that their hybrids did not damage normal cells.

The authors acknowledge funding from the National Cancer Institute.

http://www.eurekalert.org/pub_releases/2012-02/miot-rag022912.php

Reversing Alzheimer's gene 'blockade' can restore memory, other cognitive functions

Neuroscientists show that HDAC2 enzyme could be a good target for new drugs

Written by Anne Trafton, MIT News Office

CAMBRIDGE, Mass. - MIT neuroscientists have shown that an enzyme overproduced in the brains of Alzheimer's patients creates a blockade that shuts off genes necessary to form new memories. Furthermore, by inhibiting that enzyme in mice, the researchers were able to reverse Alzheimer's symptoms.

The finding suggests that drugs targeting the enzyme, known as HDAC2, could be a promising new approach to treating the disease, which affects 5.4 million Americans. The number of Alzheimer's victims worldwide is expected to double every 20 years, and President Barack Obama recently set a target date of 2025 to find an effective treatment.

Li-Huei Tsai, leader of the research team, says that HDAC2 inhibitors could help achieve that goal, though it would likely take at least 10 years to develop and test such drugs.

"I would really strongly advocate for an active program to develop agents that can contain HDAC2 activity," says Tsai, director of the Picower Institute for Learning and Memory at MIT. "The disease is so devastating and affects so many people, so I would encourage more people to think about this."

Tsai and her colleagues report the findings in the Feb. 29 online edition of Nature. Lead author of the paper is Johannes Gräff, a postdoc at the Picower Institute.

Genome modification

Histone deacetylases (HDACs) are a family of 11 enzymes that control gene regulation by modifying histones - proteins around which DNA is spooled, forming a structure called chromatin. When HDACs alter a histone through a process called deacetylation, chromatin becomes more tightly packaged, making genes in that region less likely to be expressed.

HDAC inhibitors can reverse this effect, opening up the DNA and allowing it to be transcribed.

In previous studies, Tsai had shown that HDAC2 is a key regulator of learning and memory. In the new study, her team discovered that inhibiting HDAC2 can reverse Alzheimer's symptoms in mice.

The researchers found that in mice with Alzheimer's symptoms, HDAC2 (but not other HDACs) is overly abundant in the hippocampus, where new memories are formed. HDAC2 was most commonly found clinging to genes involved in synaptic plasticity - the brain's ability to strengthen and weaken connections between neurons in response to new information, which is critical to forming memories. In the affected mice, those genes also had much lower levels of acetylation and expression.

"It's not just one or two genes, it's a group of genes that work in concert to control different phases of memory formation," Tsai says. "With such a blockade, the brain really loses the ability to quickly respond to stimulation. You can imagine that this creates a huge problem in terms of learning and memory functions, and perhaps other cognitive functions."

The researchers then shut off HDAC2 in the hippocampi of mice with Alzheimer's symptoms, using a molecule called short hairpin RNA, which can be designed to bind to messenger RNA - the molecule that carries genetic instructions from DNA to the rest of the cell.

With HDAC2 activity reduced, histone acetylation resumed, allowing genes required for synaptic plasticity and other learning and memory processes to be expressed. In treated mice, synaptic density was greatly increased and the mice regained normal cognitive function. "This result really advocates for the notion that if there is any agent that can selectively down-regulate HDAC2, it's going to be very beneficial," Tsai says.

The researchers also analyzed postmortem brains of Alzheimer's patients and found elevated levels of HDAC2 in the hippocampus and entorhinal cortex, which play important roles in memory storage.

Reversing the blockade

The findings may explain why drugs that clear beta-amyloid proteins from the brains of Alzheimer's patients have offered only modest, if any, improvements in clinical trials, Tsai says.

Beta-amyloid proteins are known to clump in the brains of Alzheimer's patients, interfering with a type of cell receptor needed for synaptic plasticity. The new study shows that beta amyloid also stimulates production of HDAC2, possibly initiating the blockade of learning and memory genes.

"We think that once this epigenetic blockade of gene expression is in place, clearing beta amyloid may not be sufficient to restore the active configuration of the chromatin," Tsai says.

The appeal of HDAC2 inhibitors, Tsai says, is that they could conceivably reverse symptoms even after the blockade is well-established. However, much more drug development has to take place before such a compound could enter clinical trials. "It's really hard to predict," Tsai says. "Clinical trials would probably be five years down the line. And if everything goes well, to become an approved drug would probably take at least 10 years."

Some general HDAC inhibitors, not specific to HDAC2, have been tested in clinical trials as cancer drugs. However, to treat Alzheimer's, a more selective approach is needed, Tsai says. "You want something as selective as possible, and as safe as possible," she says.

http://www.eurekalert.org/pub_releases/2012-02/bu-foo022912.php

Floor of oldest forest discovered in Schoharie County

Scientists from Binghamton University and Cardiff University, and New York State Museum researchers, and have reported the discovery of the floor of the world's oldest forest in a cover article in the March 1 issue of Nature, a leading international journal of science.

ALBANY, NY - "It was like discovering the botanical equivalent of dinosaur footprints," said William Stein, associate professor of biological sciences at Binghamton University, and one of the article's authors. "But the most exciting part was finding out just how many different types of footprints there were. The newly uncovered area was preserved in such a way that we were literally able to walk among the trees, noting what kind they were, where they had stood and how big they had grown."

Scientists are now piecing together a view of this ancient site, dating back about 385 million years ago, which could shed new light on the role of modern-day forests and their impact on climate change.

The recent discovery was made in the same area in Schoharie County where fossils of the Earth's oldest trees – the Gilboa stumps – were discovered in the 1850s, 1920 and again in 2010 and were brought to the State Museum. The Museum has the world's largest and best collection of Gilboa fossil tree stumps. For decades scientists did not know what the trees connected to the stumps looked like. That mystery was solved when Linda VanAller Hernick, the State Museum's Paleontology collections manager, and Frank Mannolini, Paleontology collections technician, found fossils of the tree's intact crown in a nearby location in 2004, and a 28-foot-long trunk portion in 2005. The discovery of the 385-million-year-old specimens was named one of the "100 top Science Stories of 2007" by Discover Magazine. Stein, Mannolini, Hernick, and Dr. Christopher M. Berry, a paleobotany lecturer at Cardiff University in Wales, co-authored a Nature article reporting that discovery, as well as the most recent one. Working in conjunction with Stein, Mannolini also developed a sketch of the ancient forest.

"This spectacular discovery and the resulting research provide more answers to the questions that have plagued scientists for more than a century since the first Gilboa stumps were uncovered and brought to the State Museum," said Hernick, whose passionate interest in the fossils date back to her childhood exposure to the Gilboa fossils.

In 2003 Hernick wrote "The Gilboa Fossils," a book published by the State Museum, about the history and significance of the fossils and their use in an iconic exhibition about the Earth's oldest forest that was in the

Museum's former location in the State Education Department building on Washington Avenue. One of the key planners of the exhibition, which influenced generations of paleontologists, was Winifred Goldring, the nation's first female state paleontologist who was based at the State Museum. She worked tirelessly to study and interpret the Gilboa fossils and named the trees Eospermatopteris, or "ancient seed fern." In 1924, her paper about the stumps, together with the Museum exhibition, brought the "Gilboa forest" to the attention of the world. One of the Gilboa stumps will be on display in the Museum lobby, beginning March 2.

Following the discovery of the tree's crown, a thorough investigation was conducted by Stein and Christopher M. Berry, a paleobotany lecturer at Cardiff University in Wales and the other co-author of both Nature articles. They were able to determine that these trees actually resembled modern-day cycads or tree ferns, but interestingly enough, were not related to either one. Many questions still remained about what the surrounding area looked like, whether other plant life co-existed with these trees and how.

In 2010, during ongoing repair of the Gilboa Dam, New York City Department of Environmental Protection (DEP) engineers excavated infill from a quarry in Schoharie County. They agreed to allow researchers to re-examine the site where the fossils had been found when the dam was built in the 1920s. What they found this time was a large, substantially intact portion of the ancient forest horizon, complete with root systems. As they had expected, Eospermatopteris root systems of different sizes were the most abundant. But what they didn't expect to find was the level of detail of the overall composition of the forest.

The first glimpse of the unexpected complexity of this ancient forest came when Stein, Berry, Hernick and Mannolini found the remains of large scrambling tree-sized plants, identified as aneurophytaleans. These plants were likely close ecological associates to the original trees, living among them on the forest floor like modern ferns, possibly scrambling into the forest canopy much as tropical vines do today. The aneurophytes are the first in the fossil record to show true "wood" and the oldest known group in the lineage that lead to modern seed plants.

Work on the new discoveries also pointed to the vital importance that the State Museum's collections have played in the paleontological research. "Discovery of scrambling aneurophytaleans at Gilboa was a complete surprise, but pointed to the likelihood that similar material had already been found at the site, but was unrecognized," said Hernick. "Sure enough in the State Museum collections a wonderful specimen, originally collected in the 1920s, provided additional key evidence."

The team also came across a tree belonging to the class Lycopsida, or club mosses, which predates an earlier discovery made in Naples, NY and an ecologically important group in the history of land plants. The lycopsids are an ancient group of non-seed plants represented today by low growing forms such as the "running pines" of the northern hardwood forests of New York. They also inhabited swamps and ended up being much of the Pennsylvanian coal we burn today.

Based on the new research, the team now believes that the area probably enjoyed a wetland environment in a tropical climate. It was filled with large Eospermatopteris trees that resembled weedy, hollow, bamboo-like plants, with roots spreading out in all directions, allowing other plants to gain a foothold. Scrambling among these roots on the forest floor were aneurophytaleans, acting much like ferns do today, and possibly climbing into the forest canopy as vines. The lycopsids, although seemingly rare, may also have been very important in certain places although perhaps not yet as specialized inhabitants of swamps.

But what the research team believes is most important about this particular site is what it was doing to impact the rest of the planet. At the time the Gilboa forest began to emerge -- during the Middle Devonian period, about 385 million years ago – Earth experienced a dramatic drop in global atmospheric carbon dioxide levels and the associated cooling led ultimately to a period of glaciation.

"Trees probably changed everything," said Stein. "Not only did these emerging forests likely cause important changes in global patterns of sedimentation, but they may have triggered a major extinction in fossil record."

For Stein, it all comes down to one thing – how much we don't know but need to understand about our ancient past. "The complexity of the Gilboa site can teach us a lot about the original assembly of our modern day ecosystems," said Stein. "As we continue to understand the role of forests in modern global systems, and face potential climate change and deforestation on a global scale, these clues from the past may offer valuable lessons for managing our planet's future."

Video available here: *http://youtu.be/mBp3obZkX4o*

http://www.sciencedaily.com/releases/2012/02/120229105135.htm

No Workout? No Worries: Scientists Prevent Muscle Loss in Mice, Despite Disease and Inactivity

If you want big muscles without working out, there's hope.

ScienceDaily - In the March 2012 print issue of the FASEB Journal, scientists from the University of Florida report that a family of protein transcription factors, called "Forkhead (Fox0)" plays a significant role in the regulation of skeletal muscle mass. Specifically, they found that interfering with the activity of these transcription factors prevents muscle wasting associated with cancer and sepsis, and even promotes muscle growth. This discovery is likely to be relevant to any disease, condition or lifestyle that leads to muscle wasting, including voluntary inactivity.

"The loss of muscle mass is a major contributor to disease-related deaths," said Andrew R. Judge, Ph.D., a researcher involved in the work from the Department of Physical Therapy at the University of Florida in Gainesville. "FoxO proteins may provide a target for therapies aimed at reducing muscle wasting and thus improving the quality of life and survival rates for patients with many different diseases."

To make this discovery, Judge and colleagues genetically inhibited the activity of "Forkhead boxO" proteins, or "FoxO," in the skeletal muscle of healthy control mice, septic mice, and mice with cancer. The loss of muscle mass in those with cancer and sepsis was significantly decreased by inhibition of FoxO activity. In healthy control animals inhibiting FoxO activity caused an increase in muscle cell size which occurred as a result of protein synthesis.

"No one can deny that the human body was meant to move, and to move often," said Gerald Weissmann, M.D., Editor-in-Chief of the FASEB Journal, "but the reality is that many of us don't move enough, whether because of disease, injury, or simply a busy schedule. This discovery is another important step towards the treatment of muscle wasting in cancer, severe infection or aging -- or to maintain our muscle mass to help face the slings and arrows of outrageous fortune."

http://bit.ly/x4S2sC

Neanderthals were ancient mariners

IT LOOKS like Neanderthals may have beaten modern humans to the seas.

29 February 2012 by Michael Marshall

Growing evidence suggests our extinct cousins criss-crossed the Mediterranean in boats from 100,000 years ago - though not everyone is convinced they weren't just good swimmers.

Neanderthals lived around the Mediterranean from 300,000 years ago. Their distinctive "Mousterian" stone tools are found on the Greek mainland and, intriguingly, have also been found on the Greek islands of Lefkada, Kefalonia and Zakynthos. That could be explained in two ways: either the islands weren't islands at the time, or our distant cousins crossed the water somehow.

Now, George Ferentinos of the University of Patras in Greece says we can rule out the former. The islands, he says, have been cut off from the mainland for as long as the tools have been on them.

Ferentinos compiled data that showed sea levels were 120 metres lower 100,000 years ago, because water was locked up in Earth's larger ice caps. But the seabed off Greece today drops down to around 300 metres, meaning that when Neanderthals were in the region, the sea would have been at least 180 metres deep (Journal of Archaeological Science, DOI: 10.1016/j.jas.2012.01.032).

Ferentinos thinks Neanderthals had a seafaring culture for tens of thousands of years. Modern humans are thought to have taken to the seas just 50,000 years ago, on crossing to Australia.

The journeys to the Greek islands from the mainland were quite short - 5 to 12 kilometres - but according to Thomas Strasser of Providence College in Rhode Island, the Neanderthals didn't stop there. In 2008 he found similar stone tools on Crete, which he says are at least 130,000 years old. Crete has been an island for some 5 million years and is 40 kilometres from its closest neighbour - suggesting far more ambitious journeys.

Strasser agrees Neanderthals were seafaring long before modern humans, in the Mediterranean at least. He thinks early hominins made much more use of the sea than anyone suspects, and may have used the seas as a highway, rather than seeing them as a barrier. But the details remain lost in history. Any craft were presumably made from wood, so rotted away long ago. The oldest known Mediterranean boat, a dugout canoe from Lake Bracciano in Italy, is just 7000 years old. Ferentinos speculates that Neanderthals may have made something similar.

There is a simpler explanation for how they reached the islands, says Paul Pettitt of the University of Sheffield, UK: maybe they just swam there. Pettitt also points out that the tools on the islands have not been chemically dated, so estimates of their age are based entirely on their design.

Even if Ferentinos is right, the Neanderthals were probably not the first hominin seafarers. One million-year-old stone tools have been found on the Indonesian island of Flores (Nature, DOI: 10.1038/nature 08844). Something, perhaps primitive Homo erectus, crossed the sea to Flores before Neanderthals even evolved.

http://bit.ly/wNv2e0

Giant fleas plagued feathered dinosaurs

It's amazing what you find when you scratch about in old rocks – the oldest and largest flea ever discovered, for instance, which has turned up in Jurassic rocks in China.

18:00 29 February 2012 by Colin Barras

Warm-blooded animals have been itching to get rid of the pests ever since.

At 20.6 millimetres long, the 165-million-year old fossils dwarf the largest living flea – a 12 mm species which plagues the mountain beaver of North America. The fossil beasts are so large they may have lived on feathered dinosaurs rather than the small mammals that scuttled across the Mesozoic landscape, according to André Nel at the National Museum of Natural History in Paris, France, a member of the team that made the find (Nature, DOI: 10.1038/nature10839).

"Small hosts – mice, shrews, small bats – never have any large [external] parasites, and certainly never anything the size of these wonderful, extinct fleas," says David Grimaldi at the American Museum of Natural History, New York, who was not involved in the find.

Mammals probably did not escape the blood suckers for long. The most primitive fleas alive today all live on mammals, which suggests their ancestors quickly hopped from feathered dinosaurs to our furry forerunners.

http://n.pr/x8W0PN

Six-Legged Giant Finds Secret Hideaway, Hides For 80 Years

by Robert Krulwich

No, this isn't a make-believe place. It's real.

Ball's Pyramid in the Tasman sea is located 19 kilometers from Lord Howe Island east of Australia.

John White

They call it "Ball's Pyramid." It's what's left of an old volcano that emerged from the sea about 7 million years ago. A British naval officer named Ball was the first European to see it in 1788. It sits off Australia, in the South Pacific. It is extremely narrow, 1,844 feet high, and it sits alone.

What's more, for years this place had a secret. At 225 feet above sea level, hanging on the rock surface, there is a small, spindly little bush, and under that bush, a few years ago, two climbers, working in the dark, found something totally improbable hiding in the soil below. How it got there, we still don't know.

Here's the story: About 13 miles from this spindle of rock, there's a bigger island, called Lord Howe Island.

On Lord Howe, there used to be an insect, famous for being big. It's a stick insect, a critter that masquerades as a piece of wood, and the Lord Howe Island version was so large - as big as a human hand - that the Europeans labeled it a "tree lobster" because of its size and hard, lobsterlike exoskeleton. It was 12 centimeters long and the heaviest flightless stick insect in the world. Local fishermen used to put them on fishing hooks and use them as bait.

Then one day in 1918, a supply ship, the S.S. Makambo from Britain, ran aground at Lord Howe Island and had to be evacuated. One passenger drowned. The rest were put ashore. It took nine days to repair the Makambo, and during that time, some black rats managed to get from the ship to the island, where they instantly discovered a delicious new rat food: giant stick insects. Two years later, the rats were everywhere and the tree lobsters were gone.

Totally gone. After 1920, there wasn't a single sighting. By 1960, the Lord Howe stick insect, Dryococelus australis, was presumed extinct. There was a rumor, though.

Some climbers scaling Ball's Pyramid in the 1960s said they'd seen a few stick insect corpses lying on the rocks that looked "recently dead." But the species is nocturnal, and nobody wanted to scale the spire hunting for bugs in the dark.

Climbing The Pyramid

Fast forward to 2001, when two Australian scientists, David Priddel and Nicholas Carlile, with two assistants, decided to take a closer look. From the water, they'd seen a few patches of vegetation that just might

support walking sticks. So, they boated over. ("Swimming would have been much easier," Carlile said, "but there are too many sharks.") They crawled up the vertical rock face to about 500 feet, where they found a few crickets, nothing special. But on their way down, on a precarious, unstable rock surface, they saw a single melaleuca bush peeping out of a crack and, underneath, what looked like fresh droppings of some large insect.

Where, they wondered, did that poop come from?

The only thing to do was to go back up after dark, with flashlights and cameras, to see if the pooper would be out taking a nighttime walk. Nick Carlile and a local ranger, Dean Hiscox, agreed to make the climb. And with flashlights, they scaled the wall till they reached the plant, and there, spread out on the bushy surface, were two enormous, shiny, black-looking bodies. And below those two, slithering into the muck, were more, and more ... 24 in all. All gathered near this one plant.

They were alive and, to Nick Carlile's eye, enormous. Looking at them, he said, "It felt like stepping back into the Jurassic age, when insects ruled the world."

They were Dryococelus australis. A search the next morning, and two years later, concluded these are the only ones on Ball's Pyramid, the last ones. They live there, and, as best we know, nowhere else.

How they got there is a mystery. Maybe they hitchhiked on birds, or traveled with fishermen, and how they survived for so long on just a single patch of plants, nobody knows either. The important thing, the scientists thought, was to get a few of these insects protected and into a breeding program.

That wasn't so easy. The Australian government didn't know if the animals on Ball's Pyramid could or should be moved. There were meetings, studies, two years passed, and finally officials agreed to allow four animals to be retrieved. Just four.

When the team went back to collect them, it turned out there had been a rock slide on the mountain, and at first they feared that the whole population had been wiped out. But when they got back up to the site, on Valentine's Day 2003, the animals were still there, sitting on and around their bush.

The plan was to take one pair and give it a man who was very familiar with mainland walking stick insects, a private breeder living in Sydney. He got his pair, but within two weeks, they died.

Rod Morris/www.rodmorris.co.nz

Adam And Eve And Patrick

That left the other two. They were named "Adam" and "Eve," taken to the Melbourne Zoo and placed with Patrick Honan, of the zoo's invertebrate conservation breeding group. At first, everything went well. Eve began laying little pea-shaped eggs, exactly as hoped. But then she got sick. According to biologist Jane Goodall, writing for Discover Magazine:

"Eve became very, very sick. Patrick ... worked every night for a month desperately trying to cure her. ... Eventually, based on gut instinct, Patrick concocted a mixture that included calcium and nectar and fed it to his patient, drop by drop, as she lay curled up in his hand."

Her recovery was almost instant. Patrick told the Australian Broadcasting Company, "She went from being on her back curled up in my hand, almost as good as dead, to being up and walking around within a couple of hours." Eve's eggs were harvested, incubated (though it turns out only the first 30 were fertile) and became the foundation of the zoo's new population of walking sticks.

When Jane Goodall visited in 2008, Patrick showed her rows and rows of incubating eggs: 11,376 at that time, with about 700 adults in the captive population. Lord Howe Island walking sticks seem to pair off - an unusual insect behavior - and Goodall says Patrick "showed me photos of how they sleep at night, in pairs, the male with three of his legs protectively over the female beside him."

Now comes the question that bedevils all such conservation rescue stories. Once a rare animal is safe at the zoo, when can we release it back to the wild?

On Lord Howe Island, their former habitat, the great-great-great-grandkids of those original black rats are still out and about, presumably hungry and still a problem. Step one, therefore, would be to mount an intensive (and expensive) rat annihilation program. Residents would, no doubt, be happy to go rat-free, but not every Lord Howe islander wants to make the neighborhood safe for gigantic, hard-shell crawling insects. So the

Melbourne Museum is mulling over a public relations campaign to make these insects more ... well, adorable, or noble, or whatever it takes.

They recently made a video, with strumming guitars, featuring a brand new baby emerging from its egg. The newborn is emerald green, squirmy and so long, it just keeps coming and coming from an impossibly small container. Will this soften the hearts of Lord Howe islanders? I dunno. It's so ... so ... big.

But, hey, why don't you look for yourself?

What happens next? The story is simple: A bunch of black rats almost wiped out a bunch of gigantic bugs on a little island far, far away from most of us. A few dedicated scientists, passionate about biological diversity, risked their lives to keep the bugs going. For the bugs to get their homes and their future back doesn't depend on scientists anymore. They've done their job. Now it's up to the folks on Lord Howe Island.

Will ordinary Janes and Joes, going about their days, agree to spend a little extra effort and money to preserve an animal that isn't what most of us would call beautiful? Its main attraction is that it has lived on the planet for a long time, and we have the power to keep it around. I don't know if it will work, but in the end, that's the walking stick's best argument:

I'm still here. Don't let me go.

http://www.eurekalert.org/pub_releases/2012-03/eu-dcb030112.php

Depression could be evolutionary byproduct of immune system

Depression is common enough – afflicting one in ten adults in the United States – that it seems the possibility of depression must be "hard-wired" into our brains.

Writer: Quinn Eastman

This has led biologists to propose several theories to account for how depression, or behaviors linked to it, can somehow offer an evolutionary advantage. Some previous proposals for the role of depression in evolution have focused on how it affects behavior in a social context. A pair of psychiatrists addresses this puzzle in a different way, tying together depression and resistance to infection. They propose that genetic variations that promote depression arose during evolution because they helped our ancestors fight infection.

An outline of their proposal appears online in the journal Molecular Psychiatry. The co-authors are Andrew Miller, MD, William P. Timmie professor of psychiatry and behavioral sciences at Emory and director of psychiatric oncology at Winship Cancer Institute, and Charles Raison, MD, previously at Emory and now at the University of Arizona.

"Most of the genetic variations that have been linked to depression turn out to affect the function of the immune system," Miller says. "This led us to rethink why depression seems to stay embedded in the genome."

For decades, researchers have seen links between depression and inflammation, or over-activation of the immune system. People with depression tend to have higher levels of inflammation, even if they're not fighting an infection. Still, high levels of inflammatory markers are not an inevitable consequence of depression.

"The basic idea is that depression and the genes that promote it were very adaptive for helping people – especially young children – not die of infection in the ancestral environment, even if those same behaviors are not helpful in our relationships with other people," Raison says.

Infection was the major cause of death in humans' early history, so surviving infection was a key determinant in whether someone was able to pass on his or her genes. The authors propose that evolution and genetics have bound together depressive symptoms and physiological responses that were selected on the basis of reducing mortality from infection. Fever, fatigue/inactivity, social avoidance and anorexia can all be seen as adaptive behaviors in light of the need to contain infection, they write.

The theory provides a new explanation for why stress is a risk factor for depression. The link between stress and depression can be seen as the byproduct of a process that preactivates the immune system in anticipation of a wound, they write. Similarly, a disruption of sleep patterns can be seen in both mood disorders and when the immune system is activated. This may come from our ancestors' need to stay on alert to fend off predators after injury, Miller says. Their theory could also guide future genetic, physiological and clinical research on depression. In particular, the presence of biomarkers for inflammation may be able to predict whether someone will respond to various treatments for depression.

Miller and Raison are involved in ongoing research on whether certain medications, which are normally used to treat auto-immune diseases, can be effective with treatment-resistant depression.

Reference: *The evolutionary significance of depression in Pathogen Host Defense (PATHOS-D).*
C.L. Raison and A.H. Miller. Mol Psychiatry. 2012 Jan 31. doi: 10.1038/mp.2012.2. [Epub ahead of print]

http://nyti.ms/xHHoaQ

Parkinson's Drug May Help With Brain Injuries, Report Finds

Daily doses of a drug used to treat Parkinson's disease significantly improved function in severely brain-injured people thought to be beyond the reach of treatment

By BENEDICT CAREY

Daily doses of a drug used to treat Parkinson's disease significantly improved function in severely brain-injured people thought to be beyond the reach of treatment, scientists reported on Wednesday, providing the first rigorous evidence to date that any therapy reliably helps such patients.

The improvements were modest, experts said, and hardly amounted to a cure, or a quick means of "waking up" someone who has long been unresponsive. But the progress was meaningful, experts said, and, if replicated, would give rehabilitation doctors something they have never had: a standard treatment for injuries that are not at all standard or predictable in the ways they affect the brain.

Some 50,000 to 100,000 Americans live in states of partial consciousness, and perhaps 15,000 in an unresponsive "vegetative" condition. According to the Department of Defense, more than 6,000 veterans have had severe brain injuries since 2000 and would potentially benefit from this therapy. The new report, appearing in The New England Journal of Medicine, gives doctors a solid basis to address such injuries, if not yet a predictable outcome.

"This study puts the traumatic brain injury field on the first step of the ladder to developing scientific treatments. We've been trying to get there for a long time," said Dr. Ramon Diaz-Arrastia, director of clinical research at the Center for Neuroscience and Regenerative Medicine at the Uniformed Services University of the Health Sciences in Rockville, Md., who was not involved in the research. "And there's no reason to doubt that this therapy would also be effective in people with less severe brain injuries" than in the study.

"Hope is critical and false hope is cruel for families dealing with this," said Susan Connors, president and chief executive of the Brain Injury Association of America, in Vienna, Va. The new findings, she added, are "a little piece of hope, the real kind."

Doctors have long experimented with the Parkinson's drug - amantadine hydrochloride - as well as many others to treat severe brain injuries, with mixed and uncertain results. Previous studies of amantadine suggested some benefit, but the numbers were small and experts were unsure of the findings. The new experiment put those doubts to rest, by testing the drug against a placebo in two large groups of patients.

A consortium of researchers from 11 clinics enrolled 184 patients who recently had a traumatic brain injury from a car accident or from blows to the head. Some were in a vegetative state, breathing, their eyes open when awake, but unresponsive to commands or prompts. Others were in what is known as a minimally conscious state, able to track objects and follow commands once in a while, but not predictably.

The research team, led by Joseph T. Giacino of the J. F. K. Johnson Rehabilitation Institute in Edison, N.J., and Dr. John Whyte of the Moss Rehabilitation Research Institute, in Elkins Park, Pa., divided the patients into two groups, carefully matched for the severity of their injuries. Members of one group got two doses of amantadine a day, given through their feeding tubes. Members of the other group received placebo pills.

The study was "blinded," meaning that the therapists providing the usual daily care - moving limbs, stimulating the senses and giving medical support - did not know who was on the drug and who was not.

After four weeks, the researchers analyzed the patients' progress, using a standard scale that rates abilities in such areas as coordination and communication. The scale ranges from zero, for no disability, to 29, for a state of total unresponsiveness, and is scored regularly at bedside.

Almost all of the patients improved somewhat during the four weeks. This was expected; their injuries were recent, and in the first year after a traumatic brain injury most people recover some function, even if they do not always regain full awareness later on, scientists say.

But the group receiving amantadine showed more improvement, by two points on the disability scale. Two points is not a dramatic difference, but it occurred in just a month, a short period of time in terms of recovery.

"The main finding is that on every single behavioral domain measured, we had a higher incidence of recovery in the amantadine group than in the placebo group," said Dr. Giacino, who is now at Harvard's Spaulding Rehabilitation Hospital.

When doctors took patients off the drug, the rate of recovery slowed down. "In the next two weeks, the placebo group caught up," said Dr. Whyte. "So we know that the drug accelerates recovery, but we can't say whether it alters the trajectory entirely." The patients on the drug showed no adverse effects, Dr. Whyte said.

Among other effects, amantadine increases the activity of dopamine, a chemical messenger that is highly active in the frontal areas of the brain behind the forehead. Those areas control attention and help plan and

execute deliberate actions and responses, and are at least partly damaged or offline in people with severe brain injuries.

Some experts said that the study, financed by the National Institute on Disability and Rehabilitation Research, could be a turning point in the understanding and treatment of people with severe traumatic brain injuries. The centers that conducted the study were located around the world, in Germany, Canada and Denmark, as well as Indianapolis and Jackson, Miss. The collaboration produced a positive result.

Having a standard therapy may give family members, doctors and policymakers leverage to get treatment covered by insurers. Many thousands of people with such severe injuries lie trapped in partial states of consciousness, in nursing homes and living rooms, with no access to rehabilitation.

"I see this as a tipping point for the entire field," said Dr. Nicholas Schiff, a neuroscientist at Weill Cornell Medical College in New York, who was not involved in the study. "If this drug works, then other things will too, in various combinations, and we can begin to develop a medical model for treatment."

http://www.eurekalert.org/pub_releases/2012-03/bmj-bbj022912.php

Babies born just 2 or 3 weeks early at higher risk of poor health

Research: Population-based cohort study of the effects of gestational age at birth on health outcomes at 3 and 5 years of age

A research paper which demonstrates that babies born even just a few weeks early have worse health outcomes than full term babies has been published today on bmj.com.

The authors, from the Universities of Leicester, Liverpool, Oxford, Warwick and the National Perinatal Epidemiology Unit studied over 18,000 British babies born between September 2000 and August 2001. Health outcomes were studied when the infants reached nine months, three years and five years.

Health outcomes assessed included height, weight and BMI, whilst parents also reported on number of hospital visits, long-standing illness, disability or infirmity, wheezing, use of prescribed medication and overall rating of child's health.

The authors report that both moderate / late preterm (32-36 weeks) and early term (37-38 weeks) babies required re-admission to hospital in the first few months more often than full term babies (39-41 weeks). Those born between 33 and 36 weeks had an increased risk of asthma and wheezing compared to full term babies.

A strong correlation was found between decreasing gestation and increasing risk of poor health outcomes. The greatest contribution to disease at the age of both three and five was being born moderate / late preterm or early term.

The study discovered that mothers of children born at less than 37 weeks were more likely to be single, less likely to have educational qualifications or work in managerial positions. Mothers of very preterm babies were more likely to smoke and less likely to breast feed for four or more months than those delivered at or beyond 37 weeks.

The authors conclude that it is inappropriate simply to group babies as preterm or term as the study demonstrates a "continuum of increasing risk of adverse outcome with increasing prematurity, even approaching full term gestation". They argue for further explanation of factors that influence health outcomes for babies born between 32-38 weeks gestation to inform the provision of obstetric services and planning and delivery of healthcare services for children in early life.

http://www.eurekalert.org/pub_releases/2012-03/uob-cro022912.php

Current rates of ocean acidification are unparalleled in Earth's history

Oceans are currently absorbing about a quarter of the CO2 released into the atmosphere, lowering the pH of the surface ocean

The study, based on an expert workshop led by Columbia University's Lamont-Doherty Earth Observatory and the University of Bristol, assessed in detail a number of climate change events in the planet's history, including the asteroid impact that made the dinosaurs go extinct and the Permian mass-extinction which wiped out around 95 per cent of all life on Earth. The findings are reported this week in Science.

Oceans are currently absorbing about a quarter of the CO2 released into the atmosphere, lowering the pH of the surface ocean. As atmospheric CO2 increases, so does the rate at which it will dissolve in seawater, forcing surface ocean pH lower and lower – a process called ocean acidification.

Laboratory experiments suggest that if the pH continues to fall, we may start to see impacts on marine organisms such as slower growth, fewer offspring, muscle wastage, dwarfism, reduced activity and the dissolution of their carbonate shells – with knock-on effects throughout the marine ecosystem. However, as a large number of processes are involved, it is hard to predict what ecosystems in the oceans will look like in future and to what extent humans will be able to continue to benefit from the resources oceans provide.

In order to learn about the future, the researchers looked to the past, reviewing climate events over the past 300 million years that showed evidence of elevated atmospheric CO2, global warming and ocean acidification.

Dr Daniela Schmidt, a Royal Society Research Fellow in Bristol University's School of Earth Sciences, was one of the organizers of the workshop which gathered all the experts and compiled the evidence. She said: "Laboratory experiments can tell us about how individual marine organisms react, but the geological record is a real time experiment involving the entire ocean."

Professor Andy Ridgwell added: "The geological record suggests that the current acidification is potentially unparalleled in at least the last 300 million years of Earth history, and raises the possibility that we are entering an unknown territory of marine ecosystem change.

"Although similarities exist, nothing in the last 300 million years parallels rates of future projections in terms of the disrupting of ocean carbonate chemistry – a consequence of the unprecedented rapidity of CO2 release currently taking place."

Notes to editors

*'**The Geological Record of Ocean Acidification**' by Bärbel Hönisch, Andy Ridgwell, Daniela N. Schmidt et al. in Science*

This work was based on a workshop on Paleocean Acidification and Carbon Cycle Perturbation Events funded by the National Science Foundation (NSF) and PAGES (Past Global Changes).

Professor Ridgwell and Dr Schmidt are funded by the Royal Society in the form of University Research Fellowships

http://www.eurekalert.org/pub_releases/2012-03/sjcr-smo030112.php

Solving mystery of how sulfa drugs kill bacteria yields 21st century drug development target

St. Jude Children's Research Hospital scientists discover key enzyme structure in bacteria, a finding that lays the foundation for a new generation of antibiotics that are safer and less prone to drug resistance

MEMPHIS, Tenn. - More than 70 years after the first sulfa drugs helped to revolutionize medical care and save millions of lives, St. Jude Children's Research Hospital scientists have determined at an atomic level the mechanism these medications use to kill bacteria. The discovery provides the basis for a new generation of antibiotics that would likely be harder for bacteria to resist and cause fewer side effects.

The work focused on sulfa drugs and their target enzyme, dihydropteroate synthase (DHPS). Most disease-causing microorganisms need DHPS to help make the molecule folate, which is required for the production of DNA and some amino acids. Working with enzymes from gram-negative and gram-positive bacteria, researchers used a variety of techniques to determine for the first time the key intermediate structure DHPS forms during the chemical reaction to advance folate production. The structure also explains at a molecular level how sulfa drugs function and how resistance causing mutations help bacteria withstand them.

The findings mark a major advance in both microbial biochemistry and anti-microbial drug discovery. The study is published in the March 2 issue of the journal Science.

"The structure we found was totally unexpected and really opens the door for us and others to design a new class of inhibitors targeting DHPS that will help us avoid side effects and other problems associated with sulfa drugs," said Stephen White, Ph.D., chair of the St. Jude Department of Structural Biology and the paper's corresponding author.

Co-author Richard Lee, Ph.D., a member of the St. Jude Department of Chemical Biology and Therapeutics, added: "Now we want to leverage this information to develop drugs against the opportunistic infections that threaten so many St. Jude patients."

Sulfa drugs were discovered in the 1930s and became the first antibiotic in widespread use. Although the drugs were early victims of antibiotic resistance, they are still widely used against emerging infectious diseases and to prevent infections in patients with weakened immune systems, including St. Jude patients undergoing cancer chemotherapy. The growing problem of antibiotic resistance has prompted renewed interest in sulfa drugs as a possible source of new therapeutic targets, Lee said.

Previous work had shown that sulfa drugs target DHPS and work by mimicking a molecule called pABA. DHPS advances folate production by accelerating the fusion of pABA and another molecule called dihydropteridine pyrophosphate (DHPP). Until now, however, scientists did not know exactly how the DHPS reaction occurred or how sulfa drugs disrupted the process.

Working on enzymes from gram-positive Bacillus anthracis and gram-negative Yersinia pestis, the bacteria that cause anthrax and plague, researchers first used computational methods to predict the enzyme's activity. Next they used a technique called X-ray crystallography to capture the unfolding chemical reaction and confirm

the prediction. X-ray crystallography involves bombarding proteins trapped in crystals with X-rays to determine the protein structure.

Researchers showed that DHPP binds to a specific pocket in DHPS. Aided by magnesium, the binding promotes the break-up of DHPP and release of pyrophosphate. Two long flexible loops then create an intermediate structure that sets the stage for pABA to enter and bind in a second short-lived pocket, allowing pABA to fuse with the cleaved DHPP. Investigators captured all four actors in the drama in a single crystal structure, including the intermediate cleaved DHPP molecule whose existence was previously unknown.

The results showed that the mechanism involves a chemical reaction known as an Sn1 reaction rather than the anticipated Sn2 reaction. "This is a key finding for drug discovery because it reveals chemical features of the DHPS enzyme's active site that we can exploit in developing new drugs," said study co-author Donald Bashford, Ph.D., an associate member of the St. Jude Department of Structural Biology.

The study also provided insights into sulfa drug resistance. Investigators showed that the binding sites of pABA and the sulfa drugs overlap, but that sulfa drugs extend beyond the pocket in which pABA binds. Mutations associated with drug resistance cluster around this extended region of the pABA pocket, which explains how mutations can prevent the drugs from binding without seriously affecting the binding of pABA. The work also highlights the transitory structure made by the two DHPS loops as a target for a new class of drugs that would be difficult for bacteria to develop resistance against.

"When we set out on this project eight years ago, a goal was to truly understand the catalytic mechanism of the DHPS protein and how the inhibitors targeting it work. I am ecstatic we've succeeded," Lee said. The success grew out of an interdisciplinary effort and some luck, White said. The plague enzyme turned out to be well suited to this project. Unlike the DHPS enzymes from other bacteria, the two extended loops are free to form the short-lived structure and the pABA pocket when the enzyme is immobilized in the crystal.

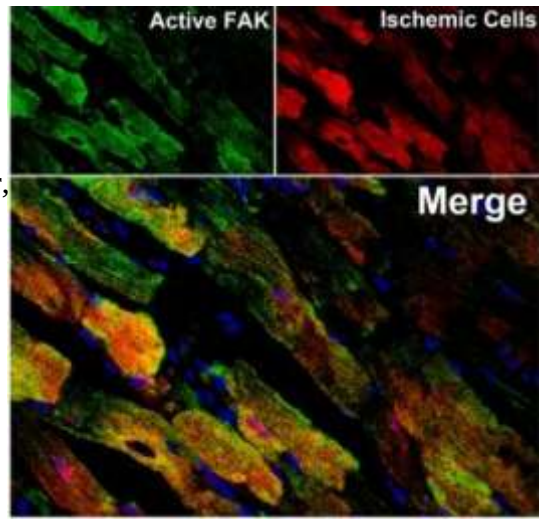
The study's first authors are Mi-Kyung Yun of St. Jude and Yinan Wu, a University of Tennessee Health Sciences Center graduate student working in White's laboratory. The other authors are Zhenmei Li, Ying Zhao, M. Brett Waddell and Antonio Ferreira, all of St. Jude. The research was supported in part by the National Institutes of Health and ALSAC.

http://www.eurekalert.org/pub_releases/2012-03/uonc-asp030112.php

A supercharged protein reduces damage from heart attack

Researchers from the University of North Carolina at Chapel Hill reduced damage from a heart attack by 50 percent by enhancing a protective protein found in mice and humans.

CHAPEL HILL, N.C. - The study, in which mice were bred to make a supercharged version of the protein focal adhesion kinase, or FAK, appeared March 1 in the online edition of the journal Arteriosclerosis, Thrombosis and Vascular Biology.



"This study shows that we can enhance existing cell survival pathways to protect heart cells during a heart attack," said Joan Taylor, PhD, associate professor in UNC's department of pathology and laboratory medicine. Taylor added that the findings could lead to new treatment approaches for heart attacks and may have broad implications for scientists seeking to manipulate the body's natural defensive systems.

During a heart attack, oxygen-deprived heart cells emit signals that activate the usually inert protein FAK, like the cry of a damsel in distress awakening her sleeping knight. If the gallant FAK arrives in time, it can save the cell and reduce permanent damage to the heart.

Following heart attack, heart cells are stressed due to lack of oxygen. When SuperFAK (in green) is expressed in the heart, it is further activated and protects heart cells from oxidative stress (in red). **Credit: Joan Taylor, Ph.D**

Taylor and her colleagues were intrigued by FAK's protective abilities. "We thought if we could activate FAK to a greater extent, then we could better protect those heart cells," said Taylor. Based on their previous studies that defined the signals induced by FAK in heart cells, they reasoned that expression of FAK set to an "always-on" position would eventually suffer uncontrolled inflammation and heart failure. "Simply having more of a good thing isn't always better," said Taylor. "The dynamics of the protein's activities are important to appropriately transmitting those survival signals."

The researchers then adjusted their formula to create a new protein they called "SuperFAK." To enhance its protective abilities without the harmful side effects, SuperFAK was primed for activation - ready to rush to the

scene at the slightest provocation from stressed heart cells - but remained under the control of the mice's natural feedback systems that would shut it off when the crisis passed.

Mice with SuperFAK showed a much stronger FAK response during a heart attack than mice with the natural protein, and three days later had about 50 percent less heart damage. Critically, SuperFAK deactivated at the appropriate time, so the eight-week follow-up revealed no detrimental effects.

The findings offer evidence that, rather than simply activating or de-activating key proteins, researchers can benefit from a more nuanced approach that taps into the body's natural feedback loops. "I think folks could use this idea to exploit mutations in other molecules - by thinking about how to modify the protein so that it can be under natural controls," said Taylor. "Negative feedback loops are important because they 'reset' the system."

The findings also may help researchers augment FAK in patients undergoing chemotherapy. Some chemotherapy drugs are known to break down FAK, leaving patients' hearts more vulnerable to damage.

Co-authors included Zhaokang Cheng, Laura A. DiMichele, Zeenat S. Hakim, Mauricio Rojas and Christopher P. Mack. The research was supported by grants from the National Institutes of Health and the American Heart Association.

http://www.eurekalert.org/pub_releases/2012-03/mgh-srh030112.php

Study reveals how anesthetic isoflurane induces Alzheimer's-like changes in mammalian brains

MGH researchers find desflurane may be safer anesthetic option for patients with Alzheimer's disease

The association of the inhaled anesthetic isoflurane with Alzheimer's-disease-like changes in mammalian brains may by caused by the drug's effects on mitochondria, the structures in which most cellular energy is produced.

In a study that will appear in Annals of Neurology and has received early online release, Massachusetts General Hospital (MGH) researchers report that administration of isoflurane impaired the performance of mice on a standard test of learning and memory – a result not seen when another anesthetic, desflurane, was administered. They also found evidence that the two drugs have significantly different effects on mitochondrial function.

"These are the first results indicating that isoflurane, but not desflurane, may induce neuronal cell death and impair learning and memory by damaging mitochondria," says Yiying (Laura) Zhang, MD, a research fellow in the MGH Department of Anesthesia, Critical Care and Pain Medicine and the study's lead author. "This work needs to be confirmed in human studies, but it's looking like desflurane may be a better anesthetic to use for patients susceptible to cognitive dysfunction, such as Alzheimer's patients."

Previous studies have suggested that undergoing surgery and general anesthesia may increase the risk of Alzheimer's, and it is well known that a small but significant number of surgical patients experience a transient form of cognitive dysfunction in the postoperative period.

In 2008, members of the same MGH research team showed that isoflurane induced Alzheimer's-like changes – increasing activation of enzymes involved with cell death and generation of the A-beta plaques characteristic of the disease – in the brains of mice. The current study was designed to explore the underlying mechanism and behavioral consequences of isoflurane-induced brain cell death and to compare isoflurane's effects with those of desflurane, another common anesthetic that has not been associated with neuronal damage.

In a series of experiments, the investigators found that the application of isoflurane to cultured cells and mouse neurons increased the permeability of mitochondrial membranes; interfered with the balance of ions on either side of the mitochondrial membrane; reduced levels of ATP, the enzyme produced by mitochondria that powers most cellular processes; and increased levels of the cell-death enzyme caspase.

The results also suggested that the first step toward isoflurane-induced cell death was increased generation of reactive oxygen species – unstable oxygen-containing molecules that can damage cellular components. The performance of mice on a standard behavioral test of learning and memory declined significantly two to seven days after administration of isoflurane, compared with the results of a control group. None of the cellular or behavioral effects of isoflurane were seen when the administered agent was desflurane.

In another study by members of the same research team – appearing in the February issue of Anesthesia and Analgesia and published online in November – about a quarter of surgical patients receiving isoflurane showed some level of cognitive dysfunction a week after surgery, while patients receiving desflurane or spinal anesthesia had no decline in cognitive performance. That study, conducted in collaboration with investigators from Beijing Friendship Hospital in China, enrolled only 45 patients – 15 in each treatment group – so its results need to be confirmed in significantly larger groups.

"Approximately 8.5 million Alzheimer's disease patients worldwide will need anesthesia and surgical care every year," notes Zhongcong Xie, MD, PhD, corresponding author of both studies and director of the Geriatric Anesthesia Research Unit in the MGH Department of Anesthesia, Critical Care and Pain Medicine.

Developing guidelines for safer anesthesia care for these patients will require collaboration between specialists in anesthesia, neurology, geriatric medicine and other specialties. As the first step, we need to identify anesthetics that are less likely to contribute to Alzheimer's disease neuropathogenesis and cognitive dysfunction." Xie is an associate professor of Anesthesia at Harvard Medical School (HMS)

Additional co-authors of the Annals of Neurology study are Zhipeng Xu, MD, PhD, Hui Wang, MD, and Yuanlin Dong, MD, MGH Anesthesia; Rudolph Tanzi, PhD, MGH Neurology; Hai Ning Shi, DVM, PhD, MGH Pediatrics; Deborah Culley, MD, and Greg Crosby, MD, Brigham and Women's Hospital; and Edward Marcantonia, MD, MS, Beth Israel Deaconess Medical Center. The study was supported by grants from the National Institutes of Health, the American Geriatrics Society, the Alzheimer's Association and the Cure Alzheimer's Fund.

http://nyti.ms/xHHoaQ

Parkinson's Drug May Help With Brain Injuries, Report Finds

Daily doses of a drug used to treat Parkinson's disease significantly improved function in severely brain-injured people thought to be beyond the reach of treatment

By BENEDICT CAREY

Daily doses of a drug used to treat Parkinson's disease significantly improved function in severely brain-injured people thought to be beyond the reach of treatment, scientists reported on Wednesday, providing the first rigorous evidence to date that any therapy reliably helps such patients.

The improvements were modest, experts said, and hardly amounted to a cure, or a quick means of "waking up" someone who has long been unresponsive. But the progress was meaningful, experts said, and, if replicated, would give rehabilitation doctors something they have never had: a standard treatment for injuries that are not at all standard or predictable in the ways they affect the brain.

Some 50,000 to 100,000 Americans live in states of partial consciousness, and perhaps 15,000 in an unresponsive "vegetative" condition. According to the Department of Defense, more than 6,000 veterans have had severe brain injuries since 2000 and would potentially benefit from this therapy. The new report, appearing in The New England Journal of Medicine, gives doctors a solid basis to address such injuries, if not yet a predictable outcome.

"This study puts the traumatic brain injury field on the first step of the ladder to developing scientific treatments. We've been trying to get there for a long time," said Dr. Ramon Diaz-Arrastia, director of clinical research at the Center for Neuroscience and Regenerative Medicine at the Uniformed Services University of the Health Sciences in Rockville, Md., who was not involved in the research. "And there's no reason to doubt that this therapy would also be effective in people with less severe brain injuries" than in the study.

"Hope is critical and false hope is cruel for families dealing with this," said Susan Connors, president and chief executive of the Brain Injury Association of America, in Vienna, Va. The new findings, she added, are "a little piece of hope, the real kind."

Doctors have long experimented with the Parkinson's drug - amantadine hydrochloride - as well as many others to treat severe brain injuries, with mixed and uncertain results. Previous studies of amantadine suggested some benefit, but the numbers were small and experts were unsure of the findings. The new experiment put those doubts to rest, by testing the drug against a placebo in two large groups of patients.

A consortium of researchers from 11 clinics enrolled 184 patients who recently had a traumatic brain injury from a car accident or from blows to the head. Some were in a vegetative state, breathing, their eyes open when awake, but unresponsive to commands or prompts. Others were in what is known as a minimally conscious state, able to track objects and follow commands once in a while, but not predictably.

The research team, led by Joseph T. Giacino of the J. F. K. Johnson Rehabilitation Institute in Edison, N.J., and Dr. John Whyte of the Moss Rehabilitation Research Institute, in Elkins Park, Pa., divided the patients into two groups, carefully matched for the severity of their injuries. Members of one group got two doses of amantadine a day, given through their feeding tubes. Members of the other group received placebo pills.

The study was "blinded," meaning that the therapists providing the usual daily care - moving limbs, stimulating the senses and giving medical support - did not know who was on the drug and who was not.

After four weeks, the researchers analyzed the patients' progress, using a standard scale that rates abilities in such areas as coordination and communication. The scale ranges from zero, for no disability, to 29, for a state of total unresponsiveness, and is scored regularly at bedside.

Almost all of the patients improved somewhat during the four weeks. This was expected; their injuries were recent, and in the first year after a traumatic brain injury most people recover some function, even if they do not always regain full awareness later on, scientists say.

But the group receiving amantadine showed more improvement, by two points on the disability scale. Two points is not a dramatic difference, but it occurred in just a month, a short period of time in terms of recovery.

"The main finding is that on every single behavioral domain measured, we had a higher incidence of recovery in the amantadine group than in the placebo group," said Dr. Giacino, who is now at Harvard's Spaulding Rehabilitation Hospital.

When doctors took patients off the drug, the rate of recovery slowed down. "In the next two weeks, the placebo group caught up," said Dr. Whyte. "So we know that the drug accelerates recovery, but we can't say whether it alters the trajectory entirely." The patients on the drug showed no adverse effects, Dr. Whyte said.

Among other effects, amantadine increases the activity of dopamine, a chemical messenger that is highly active in the frontal areas of the brain behind the forehead. Those areas control attention and help plan and execute deliberate actions and responses, and are at least partly damaged or offline in people with severe brain injuries.

Some experts said that the study, financed by the National Institute on Disability and Rehabilitation Research, could be a turning point in the understanding and treatment of people with severe traumatic brain injuries. The centers that conducted the study were located around the world, in Germany, Canada and Denmark, as well as Indianapolis and Jackson, Miss. The collaboration produced a positive result.

Having a standard therapy may give family members, doctors and policymakers leverage to get treatment covered by insurers. Many thousands of people with such severe injuries lie trapped in partial states of consciousness, in nursing homes and living rooms, with no access to rehabilitation.

"I see this as a tipping point for the entire field," said Dr. Nicholas Schiff, a neuroscientist at Weill Cornell Medical College in New York, who was not involved in the study. "If this drug works, then other things will too, in various combinations, and we can begin to develop a medical model for treatment."

http://www.wired.com/wiredscience/2012/03/are-emotions-prophetic/

Are Emotions Prophetic?

For thousands of years, human beings have looked down on their emotions.

By Jonah Lehrer

We've seen them as primitive passions, the unfortunate legacy of our animal past. When we do stupid things – say, eating too much cake, or sleeping with the wrong person, or taking out a subprime mortgage – we usually blame our short-sighted feelings. People commit crimes of passion. There are no crimes of rationality.

This bias against feeling has led people to assume that reason is always best. When faced with a difficult dilemma, most of us believe that it's best to carefully assess our options and spend a few moments consciously deliberating the information. Then, we should choose the alternative that best fits our preferences. This is how we maximize utility; rationality is our Promethean gift. But what if this is all backwards? What if our emotions know more than we know? What if our feelings are smarter than us?

While there is an extensive literature on the potential wisdom of human emotion – David Hume was a prescient guy – it's only in the last few years that researchers have demonstrated that the emotional system (aka Type 1 thinking) might excel at complex decisions, or those involving lots of variables. If true, this would suggest that the unconscious is better suited for difficult cognitive tasks than the conscious brain, that the very thought process we've long disregarded as irrational and impulsive might actually be more intelligent, at least in some conditions.

The latest demonstration of this effect comes from the lab of Michael Pham at Columbia Business School. The study involved asking undergraduates to make predictions about eight different outcomes, from the Democratic presidential primary of 2008 to the finalists of American Idol. They forecast the Dow Jones and picked the winner of the BCS championship game. They even made predictions about the weather.

Here's the strange part: although these predictions concerned a vast range of events, the results were consistent across every trial: people who were more likely to trust their feelings were also more likely to accurately predict the outcome. Pham's catchy name for this phenomenon is the emotional oracle effect.

Consider the results from the American Idol quiz: while high-trust-in-feelings subjects correctly predicted the winner 41 percent of the time, those who distrusted their emotions were only right 24 percent of the time. The same lesson applied to the stock market, that classic example of a random walk: those emotional souls made predictions that were 25 percent more accurate than those who aspired to Spock-like cognition.

What explains these paradoxical results? The answer involves processing power. In recent years, it's become clear that the unconscious brain is able to process vast amounts of information in parallel, thus allowing it to analyze large data sets without getting overwhelmed. (Human reason, in contrast, has a very strict bottleneck and can only process about four bits of data at any given moment.) But this raises the obvious question: how do we gain access to all this analysis, which by definition is taking place outside of conscious awareness?

Here's where emotions come in handy. Every feeling is like a summary of data, a quick encapsulation of all the information processing that we don't have access to. (As Pham puts it, emotions are like a "privileged window" into the subterranean mind.) When it comes to making predictions about complex events, this extra information is often essential. It represents the difference between an informed guess and random chance.

How might this work in everyday life? Let's say, for example, that you're given lots of information about how twenty different stocks have performed over a period of time. (The various share prices are displayed on a ticker tape at the bottom of a television screen, just as they appear on CNBC.) You'll soon discover that you have difficulty remembering all the financial data. If somebody asks you which stocks performed the best, you'll probably be unable to give a good answer. You can't process all the information. However, if you're asked which stocks trigger the best feelings – your emotions are now being quizzed – you will suddenly be able to identify the best stocks. According to Tilmann Betsch, the psychologist who performed this clever little experiment, your feelings will "reveal a remarkable degree of sensitivity" to the actual performance of all of the different securities. The investments that rose in value will be associated with the most positive emotions, while the shares that went down in value will trigger a vague sense of unease.

But this doesn't mean we can simply rely on every fleeting whim. The subjects had to absorb all that ticker-tape data, just as Pham's volunteers seemed to only benefit from the emotional oracle effect when they had some knowledge of the subject. If they weren't following college football, then their feelings weren't helpful predictors of the BCS championship game. The larger lesson, then, is that our emotions are neither stupid nor omniscient. They are imperfect oracles. Nevertheless, a strong emotion is a reminder that, even when we think we know nothing, our brain knows something. That's what the feeling is trying to tell us.

http://www.eurekalert.org/pub_releases/2012-03/uoc--cme030212.php

Cocoa may enhance skeletal muscle function

Improvements seen in patients with heart failure and Type 2 diabetes in initial study

A small clinical trial led by researchers at UC San Diego School of Medicine and VA San Diego Healthcare System (VASDHS) found that patients with advanced heart failure and type 2 diabetes showed improved mitochondrial structure after three months of treatment with epicatechin-enriched cocoa. Epicatechin is a flavonoid found in dark chocolate.

The results of this initial study has led to the implementation of larger, placebo-controlled clinical trial at UC San Diego School of Medicine and VASDHS to assess if patients with heart failure and diabetes show improvement in their exercise capacity when treated with epicatechin-rich cocoa.

The study published this week by the journal Clinical and Translational Science looked at five profoundly ill patients with major damage to skeletal muscle mitochondria. Mitochondria are structures responsible for most of the energy produced in cells. These "fuel cells" are dysfunctional as a result of both type 2 diabetes and heart failure, leading to abnormalities in skeletal muscle. In patients with heart failure and diabetes abnormalities in both the heart and skeletal muscle result in impaired functional capacity. These patients often complain of shortness of breath, lack of energy and have difficulty walking even short distances.

The trial participants consumed dark chocolate bars and a beverage with a total epicatechin content of approximately 100 mg per day for three months. Biopsies of skeletal muscle were conducted before and after treatment. After the three-month treatment, the researchers looked at changes in mitochondria volume and the abundance of cristae, which are internal compartments of mitochondria that are necessary for efficient function of the mitochondria, and measurable by electron microscopy.

"The cristae had been severely damaged and decreased in quantity in these patients," said one of the senior investigators, Francisco J. Villarreal, MD, PhD of UC San Diego's Department of Medicine's Division of Cardiology. "After three months, we saw recovery – cristae numbers back toward normal levels, and increases in several molecular indicators involved in new mitochondria production."

The results, which mimicked earlier studies showing improvement in skeletal and heart muscle function in animal models after treatment with epicatechin, were promising enough to prompt the larger study.

The principal investigator of this trial was Pam R. Taub, MD, assistant professor of medicine at UC San Diego and the VA San Diego Healthcare System. Taub will be leading the new clinical trial at UC San Diego

that will enroll normal sedentary subjects as well as patients with heart failure/diabetes who will be treated with placebo, or epicatechin-rich chocolate.

Patients who would like more information about the clinical trial can call 858-552-8585, extension 3866.

Additional contributors to the published study include Israel Ramirez-Sanchez, PhD, Theodore P. Ciaraldi, PhD, Alan S. Maisel, MD, and Robert R. Henry, MD, UC San Diego School of Medicine and VA San Diego Health System; Guy Perkins, PhD, Anne N. Murphy, PhD, Robert Naviaux, MD, PhD and Michael Hogan, PhD, UC San Diego School of Medicine; and Guillermo Ceballos, MD, PhD, Escuela Superior de Medicina del Instituto Politécnico Nacional, Mexico City.

The study was supported in part by grants from the National Institutes of Health, American College of Cardiology and The Hershey Company.

http://www.eurekalert.org/pub_releases/2012-03/uol-drf030212.php

Diabetes risk from sitting around

Women could be more at risk than men -- new University of Leicester study

A new study has found that women who stay seated for long periods of time every day are more prone to developing type 2 diabetes, but that a similar link wasn't found in men. Researchers from the University of Leicester Departments of Health Sciences and Cardiovascular Sciences revealed that women who are sedentary for most of the day were at a greater risk from exhibiting the early metabolic defects that act as a precursor to developing type 2 diabetes than people who tend to sit less.

The team assessed over 500 men and women of the age of 40 or more about the amount of time spent sitting over the course of a week, helped out by tests on the level of specific chemicals in their bloodstream that are linked to diabetes and metabolic dysfunction. It was found that the women who spent the longest time sitting had higher levels of insulin, as well as higher amounts of C-reactive protein and chemicals released by fatty tissue in the abdomen, leptin, and interleukin6, and which indicate problematic inflammation.

The study, published in the American Journal of Preventive Medicine, revealed that the link between sitting time and diabetes risk was much stronger in women than men, but could not pinpoint why there was a gender difference, although it was suggested that women might snack more often than men during sedentary behaviour, or because men tend to take part in more robust activity when they do get up and about.

Dr Thomas Yates who led the study said: "This study provides important new evidence that higher levels of sitting time have a deleterious impact on insulin resistance and chronic low-grade inflammation in women but not men and that this effect is seen regardless of how much exercise is undertaken. This suggests that women who meet the national recommendations of 30 minutes of exercise a day may still be compromising their health if they are seated for the rest of the day.

'It therefore suggests that enabling women to spend less time sitting may be an important factor in preventing chronic disease.' The paper calls for further experimental research investigating the effect of reduced sitting time on human volunteers

Dr Yates added: "If these results are replicated, they have implications for lifestyle recommendations, public health policy, and health behaviour change interventions, as they suggest that enabling women to spend less time sitting is an important factor in preventing chronic disease."

The study was supported by the National Institute for Health Research Collaboration in Applied Health Research and Care for Leicestershire, Northamptonshire, and Rutland. The researchers are: Thomas Yates, PhD, Kamlesh Khunti, PhD, MD, Emma G. Wilmot, MBChB, Emer Brady, PhD, David Webb, MBChB, Bala Srinivasan, MBBS, Joe Henson, MSc, Duncan Talbot, BSc, Melanie J. Davies, MD.

http://the-scientist.com/2012/02/29/skin-deep-immunity/

Skin-Deep Immunity

Immune cells in skin provide powerful protection against infection, suggesting new routes for vaccination.

By Megan Scudellari | February 29, 2012

The smallpox vaccine was the first, and arguably most successful, vaccine ever put into practice, and it was scratched into the skin of individuals. With the invention of syringes and hypodermic needles, vaccination shifted toward administration directly into the muscle, under the assumption that it is better to get a vaccine straight into the body. But it turns out scientists may have had it right the first time.

A paper published this week in Nature suggests that the most important part of the human immune system actually resides in peripheral tissues, and that vaccination through those tissues may be more effective than traditional vaccination into the muscle.

The finding is “quite remarkable,” said Onur Boyman, an immunologist at the University of Zurich, who was not involved in the current study. The researchers showed that a population of immune cells called resident memory T cells, which are present in parts of the body that are in contact with the environment, such as the skin,

gut, and lungs, mediate an immune response far stronger than circulating, or central, memory T cells in the blood stream.

"In the past, people have conducted in vivo experiments that suggest resident memory and circulating memory cells confer comparable protection," said Boyman, who identified some of the first resident memory T cells in the skin in 2004. "This paper provides a nice step forward in showing that these resident memory cells are indeed more effective against a skin infection as compared to central memory cells."

In 2006, Rachael Clark and Thomas Kupper of Brigham and Women's Hospital in Boston demonstrated that there is a large pool of resident memory T cells in normal skin that initiates and maintains immune reactions in the absence of T cells from the blood. Last year they showed that similar T cells exist in the lungs. The presence of these cells in our peripheral organs makes sense, said Kupper, because these tissues are the first line of defense against infection. The cells are "ready to fight invaders as soon as the barriers are breached," he said. **In** the current study, Kupper, Clark, and their team pitted resident memory T cells against circulating memory T cells in a heads-up match to determine which type of immune cell provides stronger protection against viral re-infection. The researchers infected mice with vaccinia virus, the core component of the smallpox vaccine, to create three different groups: mice with both circulating memory cells and skin resident memory cells, and mice with either one or the other. Each type of mouse was then challenged again with the virus.

"The resident memory cells won hands down," said Kupper. "It wasn't even a contest. They're much more effective." The mice with active resident memory T cells cleared the infection in 6 days, whether or not circulating memory T cells were present. The mice with only circulating memory T cells took 20 days to clear the infection, only slightly better than the 25 days it took mice that had never been exposed to the virus.

The team also showed that resident memory T cells reside not only at the site of infection, but spread throughout the entire skin and remain present for at least 6 months. Repeated infections in the skin resulted in higher concentrations of resident memory T cells each time. "We're injured and infected through the skin many times during our lives, and we think this leads to the accumulation of populations of T cells that [spread] throughout our skin and stay there for long periods of time," said Kupper.

If the finding holds up, it means that vaccine trials are targeting the wrong cells in the body, said Kupper. Vaccination through peripheral organs, like the skin, lungs, or GI tract, could be more effective than injecting a vaccine into muscle. "It's a wakeup call that we need to think about these T cells when we're making vaccines, he said.

The results could also mean that researchers are looking at the wrong cell population when measuring the vaccine's effectiveness. Traditional vaccine trials measure either antibodies in the bloodstream, produced by B cells, or circulating memory T cells. "We're missing the population of cells we're trying to make when we vaccinate," said Kupper, who last year co-founded a vaccine biotech exploring the delivery of vaccine through the upper layers of the skin.

Using the finding to attempt new routes of vaccination "might be plausible," said Boyman, but first it will be important to find out how the T cells are retained in the skin and how long they stick around. "Would one need to boost the vaccines, and if so, how frequently?" he asked. The study also has implications for understanding organ-specific immune diseases like psoriasis, asthma, and multiple sclerosis, which may involve renegade resident memory T cells, said Kupper. "The scientific implications are broad."

X. Jiang et al., "Skin infection generates non-migratory memory CD81 TRM cells providing global skin immunity," Nature, doi:10.1038/nature10851, 2012.

http://www.physorg.com/news/2012-03-magnets.html

The origin of organic magnets

Electrical engineers are starting to consider materials made from organic molecules

Electrical engineers are starting to consider materials made from organic molecules - including those made from carbon atoms - as an intriguing alternative to the silicon and metals used currently in electronic devices, since they are easier and cheaper to produce. A RIKEN-led research team has now demonstrated the origin of magnetism in organic molecules, a property that is rarely found in this class of material, but is vital if a full range of organic electronic devices is to be created.

The permanent magnetic properties of materials such as iron stem from an intrinsic mechanism called ferromagnetism.

Ferromagnetism in organic materials is rare because their atomic structure is fundamentally different from metals. One of the few examples identified to date is called TDAE-C60: a compound comprising spherical carbon cages attached to an organic molecule known as tetrakis-dimethylamino-ethylene (Fig. 1). Since its identification in 1991, many theoretical and experimental studies have provided some insight into the

mechanism driving this unexpected ferromagnetism, but the explanation was not definitive. A full understanding would help materials scientists to develop more advanced magnetic materials in the future. "A precise model for organic magnetism could aid the design of high-density recording materials for use in next-generation memories," says team member Hitoshi Yamaoka from the RIKEN SPring-8 Center, Harima.

Materials scientists are particularly interested in understanding the electronic structure of TDAE-C60 and how this relates to its ferromagnetic properties. To this end, Yamaoka and his colleagues from research institutes across Japan studied this material using a powerful technique known as photoelectron spectroscopy (PES). They fired x-rays at a single crystal of TDAE-C60, and this radiation excited electrons in the crystal, which then escaped from the surface. The researchers measured the number and the kinetic energy of these electrons from which they could infer information about the electronic structure.

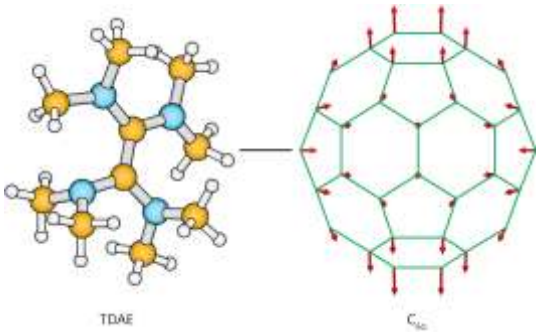


Figure 1: A compound comprising C60 (right), a spherical molecule of carbon atoms, and TDAE (left), tetrakis-dimethylamino-ethylene, is unusual because it can display magnetic behavior at low temperatures. **2012 Tohru Sato**

"From these experiments on a single crystal we could establish an exact theoretical model for organic magnetism," explains Yamaoka. "We propose that the transfer of one electron from the TDAE to the C60 causes the magnetic properties of TDAE-C60." The existence of the resulting positively charge TDAE state was also supported by the team's theoretical calculations.

With this thorough understanding of organic magnetism, the next step will be to apply the material to practical applications. "The problem with the TDAE-C60 organic magnet, however, is that the magnetism only appears at temperatures below 16 kelvin," says Yamaoka. "The next step will be to raise this transition point."

More information: *Yamaoka, H., et al. Electronic state of an organic molecular magnet: Soft x-ray spectroscopy study of α-TDAE-C60 single crystal. Physical Review B 84, 161404 (2011). Provided by RIKEN*

http://www.scientificamerican.com/article.cfm?id=international-groups-move-criminalize-fake-drugs

International Groups Move to Criminalize Fake Drugs

Regulations aim to shift medicine counterfeiting from patient infringement to crime

By Katherine Rowland of Nature magazine

When police officers, scientists and doctors launched an investigation into the scourge of counterfeit medicines in South East Asia, they were shocked to find that nearly half of the anti-malarials that they seized were fakes. Even more alarming was the discovery that many of the blister packs presumed to contain life-saving tablets were tainted with safrole, a carcinogenic compound used to make the illicit party drug ecstasy.

The presence of safrole underscored the link between bogus pharmaceuticals and criminal syndicates, which flourish in a legal grey zone that rewards counterfeiters with high profits at low risk.

"For a criminal interested in making money, it's less dangerous to traffic in counterfeits than to traffic in illegal drugs," says Susanne Keitel, director of the European Directorate for the Quality of Medicines and HealthCare (EDQM) in Strasbourg, France. That is because, although counterfeits endanger patients, diminish public faith in essential care and hamper economic growth, their deliberate manufacture is classified not as criminal activity, but as patent infringement. That may now change, as cross-border collaborations try to criminalize counterfeit drugs and coordinate global enforcement. Public-health authorities welcome the development, but say that years of inattention have turned the problem into a crisis.

Fatal consequences

In a week-long raid last year, the international police agency INTERPOL, based in Lyons, France, confiscated 2.4 million pills in dozens of countries. However, seized contraband provides only a crude indicator of the trade's true scope. The global counterfeit drug economy has been valued at US$75 billion a year, and is projected to grow by up to 13% annually.

Danny Lee-Frost, head of operations at the Medicines and Healthcare Products Regulatory Agency in London, says that in developed countries, border agencies intercept most illicit trade before it reaches markets. But poorer nations lack equivalent protection. The World Health Organization (WHO) reports that in developing economies, nearly one-third of drugs are either fakes or substandard.

Paul Newton, a doctor of infectious disease at the Wellcome Trust in Vientiane, Laos, says that regulating drug quality "requires political will, scientific expertise and solid data" - all of which are scarce in countries ravaged by poverty and infectious diseases.

But the most formidable barrier has been the lack of consensus on how to classify counterfeits. Efforts to establish a universal definition are caught in a tug of war between safeguarding public health and protecting intellectual property. Bryan Liang, a physician and lawyer at the California Western School of Law in San Diego and vice-president of the Partnership for Safe Medicines, argues that prevailing definitions "prioritize private interests at the expense of health" by treating fake drugs mainly as an intellectual-property issue.

The medical community insists that counterfeit medicines should not be placed in the same penal class as other imitation goods. "The main people affected are patients and their families, not pharmaceutical companies and their traders," says Newton. "Fake antimalarials cause more harm than fake Rolexes. They should be treated differently."

Criminalizing counterfeits

Last October, the Council of Europe invited countries to become signatories of the MEDICRIME Convention, the first international treaty to establish counterfeit medicines as a criminal threat. So far, 15 countries have signed on. Although none has yet ratified the document, Keitel is "absolutely confident" that it will become law in the signatory countries. The legal department of the EDQM, which oversees the convention, anticipates that the treaty will be fully ratified by the end of 2013.

In late 2011, US policy-makers made a similar move, introducing the Counterfeit Drug Penalty Enhancement Act, which distinguishes fake drugs from other sham goods and increases the prison sentences and fines associated with prosecution for their manufacture and trade. The act is now under deliberation in Congress.

Furthermore, the WHO is set to propose a mechanism for harmonizing global enforcement in May, at the World Health Assembly in Geneva, Switzerland. The scheme will exclude trade and intellectual-property considerations and focus solely on counterfeits as a humanitarian crime. But even with new definitions in place, limited resources and inadequate infrastructure may continue to impede quality assurance. "Most emerging-market countries don't have the capacity to regulate drug quality," says Liang.

Detection and enforcement

To improve enforcement, researchers are developing new ways to detect fakes. For example, the pharmaceutical company Merck, based in Darmstadt, Germany, has sponsored the Global Pharma Health Fund Minilab, which can assess the quality of 57 different compounds. According to Merck, nearly 500 kits have been distributed in 80 countries. However, independent assessments suggest that although the kit provides quick and relatively cheap results, it detects a fake only if the product is grossly substandard.

Harparkash Kaur, a chemist at the London School of Hygiene & Tropical Medicine, and her colleagues at the US Centers for Disease Control and Prevention in Atlanta, Georgia, are developing an assay to gauge the level of the active ingredient artemisinin in antimalarial medicines. They plan soon to make it available as a field kit simple enough for a lay person to use and interpret.

But poverty and profit remain at the heart of the problem. Newton says that as long as money can be made off vulnerable people, counterfeiters will persist. "Part of the solution is to make drugs more affordable and more accessible," he says. Increasing drug availability, adds Newton, will reduce counterfeiters' profit margins and protect global health.

http://www.scientificamerican.com/article.cfm?id=earth-formed-from-diverse-meteorite-mix

Earth Formed from Diverse Meteorite Mix

A match of silicon isotopes in terrestrial and lunar rock samples is revealing more about how both bodies really formed

By Clara Moskowitz and SPACE.com | Friday, March 2, 2012 | 9

Earth's building blocks were more eclectic than once thought, according to a new study suggesting our planet formed from collisions of many different types of meteorites.

Our planet is thought to have formed around 4.5 billion years ago from a disk of dust grains left over from the cloud of material that built our sun. These grains slowly clumped together, drawn by gravity into pebbles, then boulders, then planetary embryos. Eventually, enough mass coalesced to form the planet Earth.

Scientists had thought that most of the bodies that merged to make Earth formed from a narrow zone in space and were similar to each other, belonging to a subclass of meteorites called enstatite chondrites. This idea was based on measurements of numerous striking similarities between different types of atoms (called isotopes) of elements such as oxygen, nickel and chromium, between the Earth and enstatite chondrites.

But a new study of the silicon isotope signature of Earth rock samples and meteorites suggests that Earth is made of a more diverse mix of meteorites. [The Solar System To Scale (Infographic)]

Geochemists Caroline Fitoussi and Bernard Bourdon of the Ecole Normale Supérieure de Lyon in France analyzed the silicon isotopes in terrestrial rock samples collected from diverse types of mantle rocks. They also

analyzed lunar rock samples collected by NASA astronauts on moon missions. They compared these to meteorite samples, particularly enstatite chondrites and another type called enstatite achondrites. The measurements were done at the Swiss Federal Institute of Technology of Zurich in Switzerland.

Using computer models of Earth's formation, the researchers calculated that a mix of three types of meteorite ingredients could have produced the right blend of oxygen, nickel, and chromium isotopes previously measured in Earth samples, as well as their new findings about silicon isotopes in terrestrial and meteorite samples. The results suggest that a mixture of chondrites, rather than enstatite chondrites alone, probably combined to create the Earth.

"This is the first time that a different composition in isotopes is observed for a major element between the enstatite chondrites and the Earth," Fitoussi told SPACE.com. "So that's quite different from what has been observed before." The fact that the silicon isotope compositions measured were similar in both the Earth and moon rock samples suggests that the material that formed the moon must have mixed with the Earth's mantle before the moon formed so that both bodies hold the same signature.

"That should tell us something about how the moon really formed and what are the constraints," Caroline Fitoussi said.

The moon is thought to have resulted when a giant asteroid slammed into the Earth not long after our own planet's birth. But the precise details of the process are still not well understood.

The new findings were published in the March 2 issue of the journal Science.

http://www.sciencedaily.com/releases/2012/03/120302101413.htm

Dark Matter Core, Left Behind from Wreck Between Massive Clusters of Galaxies, Defies Explanation

Astronomers using data from NASA's Hubble Telescope have observed what appears to be a clump of dark matter left behind from a wreck between massive clusters of galaxies.

ScienceDaily - The result could challenge current theories about dark matter that predict galaxies should be anchored to the invisible substance even during the shock of a collision.

Abell 520 is a gigantic merger of galaxy clusters located 2.4 billion light-years away. Dark matter is not visible, although its presence and distribution is found indirectly through its effects. Dark matter can act like a magnifying glass, bending and distorting light from galaxies and clusters behind it. Astronomers can use this effect, called gravitational lensing, to infer the presence of dark matter in massive galaxy clusters.

This composite image shows the distribution of dark matter, galaxies, and hot gas in the core of the merging galaxy cluster Abell 520, formed from a violent collision of massive galaxy clusters. Superimposed on the image are "false-colored" maps showing the concentration of starlight, hot gas, and dark matter in the cluster. Starlight from galaxies, derived from observations by the Canada-France-Hawaii Telescope, is colored orange. The green-tinted regions show hot gas, as detected by NASA's Chandra X-ray Observatory. The gas is evidence that a collision took place. The blue-colored areas pinpoint the location of most of the mass in the cluster, which is dominated by dark matter. Dark matter is an invisible substance that makes up most of the universe's mass. The dark-matter map was derived from the Hubble Wide Field Planetary Camera 2 observations by detecting how light from distant objects is distorted by the cluster of galaxies, an effect called gravitational lensing. The blend of blue and green in the center of the image reveals that a clump of dark matter resides near most of the hot gas, where very few galaxies are found. **(Credit: NASA, ESA, CFHT, CXO, M.J. Jee (University of California, Davis), and A. Mahdavi (San Francisco State University))**

This technique revealed the dark matter in Abell 520 had collected into a "dark core," containing far fewer galaxies than would be expected if the dark matter and galaxies were anchored together. Most of the galaxies apparently have sailed far away from the collision. "This result is a puzzle," said astronomer James Jee of the University of California in Davis, lead author of paper about the results available online in The Astrophysical Journal. "Dark matter is not behaving as predicted, and it's not obviously clear what is going on. It is difficult to explain this Hubble observation with the current theories of galaxy formation and dark matter."

Initial detections of dark matter in the cluster, made in 2007, were so unusual that astronomers shrugged them off as unreal, because of poor data. New results from NASA's Hubble Space Telescope confirm that dark matter and galaxies separated in Abell 520.

One way to study the overall properties of dark matter is by analyzing collisions between galaxy clusters, the largest structures in the universe. When galaxy clusters crash, astronomers expect galaxies to tag along with the dark matter, like a dog on a leash. Clouds of hot, X-ray emitting intergalactic gas, however, plow into one another, slow down, and lag behind the impact. That theory was supported by visible-light and X-ray observations of a colossal collision between two galaxy clusters called the Bullet Cluster. The galactic grouping has become an example of how dark matter should behave.

Studies of Abell 520 showed that dark matter's behavior may not be so simple. Using the original observations, astronomers found the system's core was rich in dark matter and hot gas, but contained no luminous galaxies, which normally would be seen in the same location as the dark matter. NASA's Chandra X-ray Observatory was used to detect the hot gas. Astronomers used the Canada-France-Hawaii Telescope and Subaru Telescope atop Mauna Kea to infer the location of dark matter by measuring the gravitationally lensed light from more distant background galaxies. The astronomers then turned to the Hubble's Wide Field Planetary Camera 2, which can detect subtle distortions in the images of background galaxies and use this information to map dark matter. To astronomers' surprise, the Hubble observations helped confirm the 2007 findings.

"We know of maybe six examples of high-speed galaxy cluster collisions where the dark matter has been mapped," Jee said. "But the Bullet Cluster and Abell 520 are the two that show the clearest evidence of recent mergers, and they are inconsistent with each other. No single theory explains the different behavior of dark matter in those two collisions. We need more examples."

The team proposed numerous explanations for the findings, but each is unsettling for astronomers. In one scenario, which would have staggering implications, some dark matter may be what astronomers call "sticky." Like two snowballs smashing together, normal matter slams together during a collision and slows down. However, dark matter blobs are thought to pass through each other during an encounter without slowing down. This scenario proposes that some dark matter interacts with itself and stays behind during an encounter.

Another possible explanation for the discrepancy is that Abell 520 has resulted from more complicated interaction than the Bullet Cluster encounter. Abell 520 may have formed from a collision between three galaxy clusters, instead of just two colliding systems in the case of the Bullet Cluster.

A third possibility is that the core contained many galaxies, but they were too dim to be seen, even by Hubble. Those galaxies would have to have formed dramatically fewer stars than other normal galaxies. Armed with the Hubble data, the group will try to create a computer simulation to reconstruct the collision and see if it yields some answers to dark matter's weird behavior.

The Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency. NASA's Goddard Space Flight Center in Greenbelt, Md., manages the telescope. The Space Telescope Science Institute (STScI) in Baltimore, Md., conducts Hubble science operations. STScI is operated by the Association of Universities for Research in Astronomy, Inc., in Washington, D.C.

http://slate.me/wVPeky

Long-Lost Medicine

Broccoli, spider webs, and other health remedies from ancient times.

As scientific director of the Institute for the Preservation of Medical Traditions at the Smithsonian, Alain Touwaide is compiling a database of medicinal plants of antiquity. Proficient in 12 languages, he has a PhD in classics from the Catholic University of Louvain (UCL) in Belgium. New Scientist asked him about his mission to unearth lost medicinal knowledge from ancient manuscripts.

What would the ancient Greek physician Hippocrates have used to treat, say, a bad headache?

A cataplasm—or poultice—made of iris mixed with vinegar and rose perfume. And for a chronic headache, squirting cucumber.

What if he had a stomach ailment?

Dates, a hen's broth and cultivated lettuce.

What is the most memorable remedy you've come across?

Spiders' webs. Amazingly, I found spiders' webs and many other materia medica mentioned in the ancient literature when my wife and I visited the shop of a traditional healer in the Turkish city of Konya. We felt as if we had traveled back in time 2,000 years.

How do you find out about these remedies?

I search for them in ancient manuscripts from libraries all over the world—the British Library in London, the Vatican Library or in the many collections housed in the monasteries on the Athos peninsula in Greece. It's what I call my fieldwork. But many manuscripts are also in smaller libraries scattered all through Europe. I also follow the antiquarian book market.

I specialize in the ancient medico-pharmaceutical literature based on Mediterranean flora, and I study the texts in their original language—Greek, Latin, Arabic.

In the hunt for new plant-based medicines, broccoli is a popular target. Has it been used as a medicine in the past?

We have discovered a wealth of data on broccoli in the ancient literature. Originally it was mainly used to treat gynecological disorders. Then from the 3rd century B.C. it was also used for digestive troubles, tetanus and possibly dropsy. In the 1st century A.D., skin infections were the most important illnesses treated with broccoli, followed by troubles of the digestive system.

The ancient Roman Cato felt all Roman citizens should grow broccoli in their orchard to use as a sort of all-purpose medicine, and the Greek physician Galen prescribed broccoli to treat a medical condition that was most probably colon cancer.

Are there other plants mentioned in classical texts that have potential as new medicines?

Walnut, and the herbs black horehound and white horehound. These plants are credited with a disinfectant and anti-inflammatory action in the ancient literature. They appear to be active against the bacterium Staphylococcus aureus, even drug-resistant strains. And red raspberry (Rubus idaeus) is recommended for treating inflammation in ancient literature. In modern-day tests it appears to be active against superficial skin inflammation.

Have any new medicines come out from studying ancient ones?

The best example is artemisin—the malaria treatment derived from the Artemisia plant. Malaria plagued the ancient world, and we have found more than 70 agents to treat it in the Greek medical literature of the classical period, from the 5th century B.C. to 3rd century A.D.—including Artemisia. It was identified quite recently by Chinese pharmacologists on the basis of their ancient literature.

Currently, we have quite a range of plants on our databases that should be tested for the treatment of malaria.

Have you managed to get hold of some of these ancient medicines, rather than just written accounts of them?

Ships often traded natural substances across the Mediterranean, including medicinal plants, so shipwrecks and their cargo are a precious reservoir of material for us. As early as 2002, I suspected that shipwrecks could be a source of information not available anywhere else. Shortly afterwards we heard about what seemed to be medicines, recovered from the wreck of a ship called Relitto del Pozzino, dating from 140 to 120 B.C. We've been lucky enough to receive fragments of these archaeological remains. With DNA analysis we identified the plant components of these medicines: carrot, parsley, onion and sunflower.

We have recently received material from the famous Casa del chirurgo or House of the surgeon in Rimini, Italy, but we haven't analysed this yet.

What have you learned about the way ancient cultures used medicinal plants?

Their medicines were based on a core of 45 plants, which were cultivated in the orchard close to the homes of the patients to be treated.

What is striking from the writings attributed to Hippocrates is that the plants mentioned are very common: hellebore, garlic, mercurialis, celery, leek, flax, anise, beet and cabbage among others. This list is significant because it shows that food and medicines are just two faces of the same coin, and that the best medicine is preventive medicine. Myrrh was also used as an antiseptic, antibiotic agent. If you have a disinfectant and a good range of basic substances with which to treat a broad range of illnesses, you have quite a good therapeutic arsenal at your disposal.

Does your work shed any light on the diseases that were prevalent many years ago?

From the literature we've found that the most important group of diseases were skin infections, followed by those of the digestive system, the urinary tract and gynecological ailments. We don't have explicit data about the epidemiology of the populations we're working on, but we can reconstruct it hypothetically on the basis of texts and human remains.

Do any of the ancient texts contain the sort of case studies we find in modern medical literature?

Yes. We can even consider some of the ancient texts as a series of reports put together like a clinical folder. I remember a description of heart failure in a 12th-century treatise, which is the Greek translation of a work originally written in Arabic. Since the ancient physicians didn't have an overarching notion of heart failure, they fragmented the description into a series of symptoms, each of which was considered as an independent entity, for example, acute pain in the thorax and the back, a feeling of radiating heat. Reading ancient texts requires you to be in a high state of alert because few things indicate clearly what condition is being described. It's up to

the reader to be able to translate the description, starting from one key sign and then deciphering further from the rest of the description.

Your work focuses on the Mediterranean regions. Have you looked into the ancient Chinese medical literature?

No. I don't work on Chinese medicine—this is another universe. However, we've started a new research programme on the diffusion of Greek medicine into China, through the Arabic world and India, and, conversely, the trade of medicinal plants from China to the west as far as the Mediterranean. Going with this trade, there was also knowledge.

Have you been tempted to try any of the ancient remedies that you study?

No. I wouldn't practice self-medication! Studying these ancient remedies is a scientific activity for me, not a lifestyle "quest." ***This article originally appeared in New Scientist.***

http://ind.pn/Ap6IJ2

Scientists shocked to find antibiotics alleviate symptoms of schizophrenia

Chance discovery of link between acne drug and psychosis may unlock secrets of mental illness

Jeremy Laurance

A cheap antibiotic normally prescribed to teenagers for acne is to be tested as a treatment to alleviate the symptoms of psychosis in patients with schizophrenia, in a trial that could advance scientific understanding of the causes of mental illness. The National Institute for Health Research is funding a £1.9m trial of minocycline, which will begin recruiting patients in the UK next month. The research follows case reports from Japan in which the drug was prescribed to patients with schizophrenia who had infections and led to dramatic improvements in their psychotic symptoms.

The chance observation caused researchers to test the drug in patients with schizophrenia around the world. Trials in Israel, Pakistan and Brazil have shown significant improvement in patients treated with the drug.

Scientists believe that schizophrenia and other mental illnesses including depression and Alzheimer's disease may result from inflammatory processes in the brain. Minocycline has anti-inflammatory and neuroprotective effects which they believe could account for the positive findings.

Details of the trial were presented to the independent Schizophrenia Commission by Bill Deakin, professor of psychiatry at the University of Manchester, who is the lead investigator. The 12-member commission, set up by the mental health charity Rethink, is looking into the treatment and care of people with schizophrenia, and is due to report in the summer.

The first account of minocycline's effects appeared in 2007 when a 23-year-old Japanese man was admitted to hospital suffering from persecutory delusions and paranoid ideas. He had no previous psychiatric history but became agitated and suffered auditory hallucinations, anxiety and insomnia.

Blood tests and brain scans showed no abnormality and he was started on the powerful anti-psychotic drug halperidol. The treatment had no effect and he was still suffering from psychotic symptoms a week later when he developed severe pneumonia.

He was prescribed minocycline to treat the pneumonia and within two weeks the infection was cleared and the psychosis resolved. Minocycline was stopped and his psychiatric symptoms worsened. Treatment with the drug was resumed and within three days he was better again. Halperidol was reduced but he remained on minocycline. Two years after his psychotic episode, he was still well.

The UK trial aims to recruit 175 patients recently diagnosed with schizophrenia, half of whom will be randomly allocated to take minocycline with their standard anti-psychotic treatment while the remainder take a placebo. Brain scans will be carried out at the start and end of the 12 month trial to compare loss of grey matter – an effect of schizophrenia – in the two groups. Tests will also measure inflammatory markers in the blood.

Professor Sir Robin Murray, chair of the Schizophrenia Commission said: "Infection or inflammation might be involved in a minority of people with acute psychosis and minocycline might counter this. In depression inflammatory markers go up and in Alzheimer's too."

Jeremy Laurance is a member of the Schizophrenia Commission