Viral infection linked to juvenile diabetes

San Diego, Ca - Researchers from Italy have found a statistically significant association between enteroviral infection and diagnosis of type-1 diabetes in children. They report their findings today at the 110th General Meeting of the American Society for Microbiology in San Diego, California.

Type 1 diabetes, also called juvenile diabetes or insulin-dependent diabetes, is a disorder of the body's immune system. The patient's own immune system is somehow activated to slowly destroy insulin-producing beta cells in the pancreas until the patient's body cannot produce insulin anymore. People diagnosed with type-1 diabetes require lifelong insulin therapy. Approximately 13,000 young people are diagnosed in the United States each year. Type 1 diabetes develops in individuals who are genetically susceptible. An exposure to some yet unknown triggering environmental factor or factors may be required.

"We studied the possible association of enterovirus infections with type-1 diabetes at time of diagnosis," says Antonio Toniolo of the University of Insubria and Ospedale di Circolo in Verese, Italy, a researcher on the study. "Literature suggests that infection by different enteroviruses may be linked to the early stages of diabetes."

Toniolo and his colleagues tested the blood of 112 children at the time of time of diagnosis for the existence of enteroviral DNA. All the children, ranging in age from 2-16 years, were patients at the Pediatric Endocrinology Units of Varese and Pisa. Low-level enteroviral infectivity and genome fragments were detected in 83% of type-1 diabetes patients, compared to only 7% of healthy controls.

"These data do not provide a causal relationship between enterovirus infections and diabetes," warns Toniolo. "However, the high prevalence of enteroviral genome sequences in newly diagnosed type-1 diabetes cases indicate that different enterovirus types represent a significant biomarker of early stage juvenile diabetes."

If similar results could be obtained in patient populations in other geographic areas, early enterovirus detection could help lead researchers to identify other environmental factors that lead to type-1 diabetes development and maybe one day innovative methods for prevention or treatment, says Toniolo.

Can bacteria make you smarter?

Exposure to specific bacteria in the environment, already believed to have antidepressant qualities, could increase learning behavior according to research presented today at the 110th General Meeting of the American Society for Microbiology in San Diego.

"Mycobacterium vaccae is a natural soil bacterium which people likely ingest or breath in when they spend time in nature," says Dorothy Matthews of The Sage Colleges in Troy, New York, who conducted the research with her colleague Susan Jenks.

Previous research studies on M. vaccae showed that heat-killed bacteria injected into mice stimulated growth of some neurons in the brain that resulted in increased levels of serotonin and decreased anxiety. "Since serotonin plays a role in learning we wondered if live M. vaccae could improve learning in mice," says Matthews.

Matthews and Jenks fed live bacteria to mice and assessed their ability to navigate a maze compared to control mice that were not fed the bacteria. "We found that mice that were fed live M. vaccae navigated the maze twice as fast and with less demonstrated anxiety behaviors as control mice," says Matthews.

In a second experiment the bacteria were removed from the diet of the experimental mice and they were retested. While the mice ran the maze slower than they did when they were ingesting the bacteria, on average they were still faster than the controls.

A final test was given to the mice after three weeks' rest. While the experimental mice continued to navigate the maze faster than the controls, the results were no longer statistically significant, suggesting the effect is temporary.

"This research suggests that M. vaccae may play a role in anxiety and learning in mammals," says Matthews. "It is interesting to speculate that creating learning environments in schools that include time in the outdoors where M. vaccae is present may decrease anxiety and improve the ability to learn new tasks."

A live interview with Matthews and Jenks will be webcast Monday, May 24, 2010 at 12:45 p.m. PDT, over the ASM Live uStream channel (http://www.ustream.tv/channel/asm-live). Questions will be taken from the audience via chat room and Twitter.

Model demonstrates infectious cause of asthma

San Diego, Ca - Scientists from the University of Massachusetts have developed an animal model that shows how an early childhood lung infection can cause asthma later in life. They present their data today at the 110th General Meeting of the American Society for Microbiology in San Diego.

Asthma is the most common chronic respiratory disease affecting young children all over the world and the number of new pediatric asthma cases has dramatically increased over the last 20 years. Chlamydia infection of the respiratory tract has been identified as a risk factor in asthma development.

"Even with this knowledge, we currently do not understand how this pathogen causes asthma symptoms and if it really initiates the disease," says Katir Patel, one of the researchers on the study. "In our mouse model we are able to demonstrate that when mice are infected very early in life with respiratory chlamydia, asthma was induced."

The key appears to be an altered immune response in neonatal mice. Patel and colleagues began the study by inducing chlamydial lung infection in newborn neonatal as well as in adult mice and compared the immune response and outcomes. The immune response in the newborns was significantly different from adults and the newborns never cleared the infection, while the adults did.

"When allergic airway disease was induced in this mouse model, infected neonatal mice significantly increased their production of allergic type chemical messengers characteristic of asthma, compared to uninfected neonatal controls and infected adult groups," says Patel.

"Our data indicate that early-life infections with chlamydia may drive aberrant immune responses ultimately causing chronic infection and inducing asthma disease," says Patel. "Early life respiratory colonization with chlamydia elicits pathogen-specific IgE antibody production, which for the first time provides evidence of an infectious asthma phenotype."

9/11 attacks linked to loss of male babies

The stress caused by psychological shock from the 9/11 terrorist attacks, felt even by people with no direct link to the event, may have led to an increased number of male children being miscarried in the US. Researchers writing in the open access journal BMC Public Health found that the fetal death rate for boys spiked in September 2001, and that significantly fewer boys than expected were born in December of that year.

Tim Bruckner from the University of California at Irvine worked with researchers from the University of California at Berkeley to carry out the study. He said, "The theory of 'communal bereavement' holds that societies may react adversely to unsettling national events, despite having no direct connection to persons involved in these events. Our results appear to demonstrate this; as the shocks of 9/11 may have threatened the lives of male fetuses across the U.S."

Bruckner and his colleagues used data from the National Vital Statistics System, which compiles fetal death data from all fifty states of the US, from January 1996 to December 2002 to calculate how many male fetal losses would be expected in a 'normal' September. They found that in September 2001, this figure was significantly exceeded. Speaking about the reasons for this, Bruckner said, "Across many species, stressful times reportedly reduce the male birth rate. This is commonly thought to reflect some mechanism conserved by natural selection to improve the mother's overall reproductive success."

Notes to Editors

1. Male fetal loss in the U.S. following the terrorist attacks of September 11, 2001 Tim A Bruckner, Ralph Catalano and Jennifer Ahern BMC Public Health (in press)

Caltech-led team first to directly measure body temperatures of extinct vertebrates

Could help scientists track paleoclimate, determine whether dinosaurs and other species were warm- or cold-blooded

Pasadena, Calif.- Was Tyrannosaurus rex cold-blooded? Did birds regulate their body temperatures before or after they began to grow feathers? Why would evolution favor warm-bloodedness when it has such a high energy cost? Questions like these - about when, why, and how vertebrates stopped relying on external factors to regulate their body temperatures and began heating themselves internally - have long intrigued scientists.

Now, a team led by researchers at the California Institute of Technology (Caltech) has taken a critical step toward providing some answers.

Reporting online this week in the early edition of the Proceedings of the National Academy of Sciences (PNAS), they describe the first method for the direct measurement of the body temperatures of large extinct vertebrates - through the analysis of rare isotopes in the animals' bones, teeth, and eggshells.

"This is not quite like going back in time and sticking a thermometer up a creature's back end," says John Eiler, Robert P. Sharp Professor of Geology and professor of geochemistry at Caltech. "But it's close."

Studying the mechanisms of and changes in temperature regulation in long-extinct animals requires knowing what their body temperatures were in the first place. But the only way scientists have had to study temperature regulation in such creatures was to make inferences based on what is known about their anatomy, diet, or behavior. Until now.

The technique the team has developed to measure body temperature in extinct vertebrates looks at the concentrations of two rare isotopes - carbon-13 and oxygen-18. "These heavy isotopes like to bond, or clump together, and this clumping effect is dependent on temperature," says Caltech postdoctoral scholar Robert

Eagle, the paper's first author. "At very hot temperatures, you get a more random distribution of these isotopes, less clumping. At low temperatures, you find more clumping."

In living creatures, this clumping can be seen in the crystalline lattice that makes up bioapatite - the mineral from which bone, tooth enamel, eggshells, and other hard body parts are formed. "When the mineral precipitates out of the blood - when you create bone or tooth enamel - the isotopic composition is frozen in place and can be preserved for millions of years," he adds.

In addition, work in Eiler's lab has "defined the relationship between clumping and temperature," says Eagle, "allowing measurements of isotopes in the lab to be converted into body temperature." The method is accurate to within one or two degrees of difference. "A big part of this paper is an exploration of what sorts of materials preserve temperature information, and where," notes Eiler.

To do this, the team looked at bioapatite from animals whose form of body-temperature regulation is already known. "We know, for instance, that mammals are warm-blooded; all the bioapatite in their bodies was formed at or near 37 degrees centigrade," says Eagle. After showing proof of concept in living animals, the team looked at those no longer roaming the earth. For instance, the team was able to analyze mammoth teeth, finding body temperatures of between 37 and 38 degrees - exactly as expected.

Going back even further in time, they looked at 12-million-year-old fossils from a relative of the rhinoceros, as well as from a cold-blooded member of the alligator family tree. "We found we could measure the expected body temperature of the rhino-like mammal, and could see a temperature difference between that and the alligator relative, of about 6 degrees centigrade," Eagle says.

There are, however, limitations to this sort of temperature sleuthing. For one, the information that the technique provides is only a snapshot of a particular time and place, Eiler says, and not a lifelong record. "When we look at tooth enamel, for instance, what we get is a record of the head temperature of the animal when the tooth grew," he notes. "If you want to know what his big-toe temperature was two years later, too bad."

And, of course, the technique relies on the quality of the fossils available for testing. While teeth tend to withstand the rigors of burial and time, eggshells are "fragile and prone to recrystallization during burial," says Eiler. Finding good specimens can be difficult.

But the rewards are worth the effort. "The main reason to do this sort of work is because gigantic land animals are intrinsically fascinating," Eiler says. "We want to look at where warm-bloodedness emerged, and where it didn't emerge. And this technique will help us to reconstruct food webs. In the distant past, dinosaurs and other large animals were the crown of the food web; we'll be able to figure out how they went about their business."

Now that they've pinned down an accurate paleothermometer, the research team has gone further back in time, and has begun looking at the body temperatures of vertebrates about whom less is known. "Before mammals and birds," says Eagle, "we have no good idea what physiology these ancient creatures had."

First up? Dinosaurs, of course. "We're looking at eggshells and teeth to see whether the most conspicuous dinosaur species were warm- or cold-blooded," says Eiler.

In addition, he says, the researchers would like to apply their approach to better understand some key evolutionary transitions. "Take birds, for instance," Eiler says. "Were they warm-blooded before or after they started to fly? Before or after they developed feathers? We want to take small birds and track their body temperature through time to see what we can learn."

Finally, they hope to get a peek at the paleoclimate, through the body-temperature data derived from ancient cold-blooded animals. "With this method, we can track changes in body temperature as a proxy for changes in air or water temperature."

In addition to Eiler and Eagle, the other authors on the PNAS paper, "Body temperatures of modern and extinct vertebrates from 13C-18O bond abundances in bioapatite," are Edwin Schauble of the University of California, Los Angeles (UCLA); Thomas Tütken of the Universität Bonn in Germany; Richard Hulbert of the Florida Museum of Natural History; and Aradhna Tripati, who has appointments at Caltech, UCLA, and the University of Cambridge.

Their work was supported by grants from the National Science Foundation, and by a Caltech Chancellors Postdoctoral Scholarship.

Oldest Human Species Found: May Have Been Cannibal?

Potential new species H. gautengensis walked, swung, played with fire?

James Owen for National Geographic News

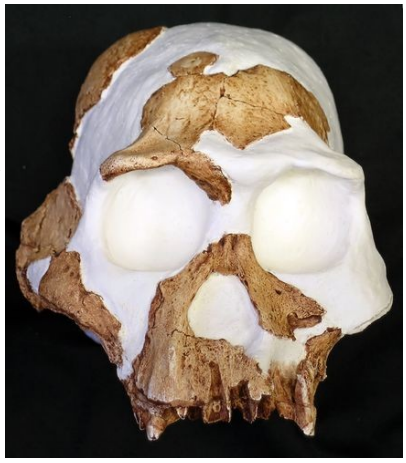
There's a good chance it was a tiny little cannibalistic tree swinger, but the newly identified ***Homo gautengensis*** is family, according to a new study. Thought to have used tools - and possibly fire - the creature is the oldest named species in the human genus, ***Homo,*** study author **Darren Curnoe** says.

The new-species designation is based on two-million- to 800,000-year-old fossil-skull pieces, jaws, teeth, and other bones found at the Sterkfontein caves complex in South Africa's Gauteng Province.

Though only fragmentary fossils from about six individuals have been found, upright-walking *H. gautengensis* is thought to have stood a squat three and a half feet (one meter) tall and weighed about 110 pounds (50 kilograms), according to Curnoe, an anthropologist at the University of New South Wales, Australia.

Compared with modern humans, the new species had proportionally long arms, a projecting face somewhat like a chimp's, larger teeth, and a smaller brain - though not too small for verbal communication.

"While it seems possible that *Homo gautengensis* had language," Curnoe said via email, "it would have been much more rudimentary than ours, lacking the complex tones and lacking a grammar, as all human languages have."



The "bizarre specimen" - called skull Stw 53 - that helped inspire the controversial new human-species designation. Photograph courtesy Darren Curnoe

Human But Not *Habilis?*

Though it's said to be the oldest named human species, *H. gautengensis*, or "Gauteng man," appears too late in the evolutionary time line to be our direct ancestor, Curnoe believes.

"Large-bodied hominins like *Homo erectus*, which are likely to be our ancestors, have been found dating to the same period as [some] *Homo gautengensis"* - which suggests *H. erectus'*s predecessor arose earlier than *H. gautengensis,* he said. Hominins, or hominids, are humans plus human ancestral species and their close evolutionary relatives. Furthermore, Curnoe noted, human fossils some 300,000 years older than *H. gautengensis* have been found in East Africa and have yet to be classified. (Explore a prehistoric time line.)

"I think, in all honesty," he said, "we don't yet know which species was our earliest direct ancestor in the human evolutionary line." Even though *H. gautengensis* isn't likely in our direct lineage, the potential new species had humanlike characteristics, according to Curnoe.

The anthropologist said he's detected 40 features that appear to separate the bipedal creature from the more apelike human ancestors called australopithecines. The traits include "a much smaller face, with narrow teeth, and much smaller chewing muscles and jaws, compared to the australopithecines," he said.

For decades scientists - including Curnoe - have assigned the fossils now marked *H. gautengensis* to *Homo habilis* ("handy man"). Believed to have arisen between 2 million and 1.5 million years ago, *H. habilis* is widely considered the oldest named human species.

But, he said, "after 14 years of work on the South African *Homo* record, I decided that there was a strong case for recognizing and naming a new species" - one separate from, and older than, *H. habilis.*

For one thing, *H. gautengensis* individuals have smaller brains - perhaps only a third the size of our own. The new species also has smaller teeth and jaws than *H. habilis*, which may indicate a different diet and lifestyle, Curnoe said.

***H. Gautengensis* a Sometime Swinger?**

While *H. gautengensis* likely lived mainly on the ground, there's evidence the human ancestor spent some time in the trees, Curnoe said. Fossil traces of "inner-ear organs of balance suggest that there may have been a mixture of lifestyles," with "some individuals engaging in regular arboreal behavior and others perhaps much more terrestrial," Curnoe said.

Today it isn't unusual for gorillas and forest baboons to show such behavior, with females typically climbing trees more than males, the anthropologist noted.

Tools ... and a Touch of Cannibalism?

The *H. gautengensis* fossils were found alongside basic stone tools and evidence of the use of fire. The most complete human ancestor skull from the sediments associated with *H. gautengensis* is a widely studied mid-1970s discovery labeled Stw 53.

The stone tools would have been used for "'de-fleshing' and cutting open bones to access marrow, and probably also for digging and [preparing] plant foods," he said. "They might also have been used for processing animal hides." Cut marks on the Stw 53 skull hint at darker practices - "that it was de-fleshed, either for ritual burial or cannibalistic consumption."

Along with the burned bones of a prehuman of the genus *Paranthropus* found in the same cave, the marks suggest that "hominin was certainly on the menu of *Homo gautengensis,"* Curnoe added.

But *H. gautengensis* wasn't exclusively carnivorous. The new species had teeth apparently adapted for eating plant material that looks to have required plenty of chewing, according to the study, soon to be published in the human-biology journal *HOMO*.

New "Missing Link" Broken Already?

The new species hails from a region called the Cradle of Humankind, which also produced the recently announced *Australopithecus sediba, said to be the "key transitional species"* between the apelike australopithecines and the first human species. But the new study casts doubt on those findings, Curnoe said. The newfound *Australopithecus* - with its tiny brain and long, apelike arms and wrists adapted to life in trees - *"*is much more primitive than *Homo gautengensis"* yet they both "lived at the same time and in the same place," he said.

Assuming *A. sediba* co-existed with the new early human species, then *A. sediba* is "less likely to be the ancestor of humans" than its proponents say it is - it's simply too late in the fossil record, Curnoe argued.

Unruly Evolutionary Tree

Paleontologist Fred Spoor of the Max Planck Institute for Evolutionary Anthropology in Germany agrees that *H. gautengensis* and *A. sediba* appear to contradict each other.

In fact, he noted, the *A. sediba* team had argued that Stw 53 is a more primitive skull than that of *A. sediba*. In other words, *H. gautengensis* may not be human at all but an apelike australopithecine.

Spoor, who wasn't involved in either study, said experts have puzzled over Stw 53 for years. For one thing, "there is not enough bone preserved to make an uncontroversial reconstruction" of the skull, Spoor said.

Furthermore, South African fossil hominins are much harder to date than those from East Africa, "where you have all these beautiful volcanic ash layers which you can date."

The "bizarre specimen" doesn't fit in with other known hominin skulls and may well signal a new species, he said - "a lot of people have suggested it." But whether that new species is human or australopithecine will continue to be debated.

Study author Curnoe, for his part, said, "The real significance of the new species is that it shows just how complicated, how bushy, our evolutionary tree was. "There were many different species living at the same time, and alongside our own species and ancestors, until really very recently."

As for the fate of *H. gautengensis,* he said, "It is up to my colleagues to decide whether they are convinced that a new species is warranted and whether they will use [the designation] in their research.

"Ultimately, history will decide."

The history of ice on Earth

* 16:39 24 May 2010 **by Michael Marshall**

Primitive humans, clad in animal skins, trekking across vast expanses of ice in a desperate search to find food. That's the image that comes to mind when most of us think about an ice age.

But in fact there have been many ice ages, most of them long before humans made their first appearance. And the familiar picture of an ice age is of a comparatively mild one: others were so severe that the entire Earth froze over, for tens or even hundreds of millions of years.

In fact, the planet seems to have three main settings: "greenhouse", when tropical temperatures extend to the poles and there are no ice sheets at all; "icehouse", when there is some permanent ice, although its extent varies greatly; and "snowball", in which the planet's entire surface is frozen over.

Why the ice periodically advances – and why it retreats again – is a mystery that glaciologists have only just started to unravel. Here's our recap of all the back and forth they're trying to explain.

Snowball Earth 2.4 to 2.1 billion years ago

The Huronian glaciation is the oldest ice age we know about. The Earth was just over 2 billion years old, and home only to unicellular life-forms.

The early stages of the Huronian, from 2.4 to 2.3 billion years ago, seem to have been particularly severe, with the entire planet frozen over in the first "snowball Earth". This may have been triggered by a 250-million-year lull in volcanic activity, which would have meant less carbon dioxide being pumped into the atmosphere, and a reduced greenhouse effect.

Deep freeze 850 to 630 million years ago

During the 200 million years of the Cryogenian period, the Earth was plunged into some of the deepest cold it has ever experienced – and the emergence of complex life may have caused it.

One theory is that the glaciation was triggered by the evolution of large cells, and possibly also multicellular organisms, that sank to the seabed after dying. This would have sucked CO2 out of the atmosphere, weakening the greenhouse effect and thus lowering global temperatures.

There seem to have been two distinct Cryogenian ice ages: the so-called Sturtian glaciation between 750 and 700 million years ago, followed by the Varanger (or Marinoan) glaciation, 660 to 635 million years ago. There's some evidence that Earth became a snowball at times during the big freezes, but researchers are still trying to work out exactly what happened.

Mass extinction 460 to 430 million years ago

Straddling the late Ordovician period and the early Silurian period, the Andean-Saharan ice age was marked by a mass extinction, the second most severe in Earth's history.

The die-off was surpassed only by the gargantuan Permian extinction 250 million years ago. But as the ecosystem recovered after the freeze, it expanded, with land plants becoming common over the course of the Silurian period. And those plants may have caused the next great ice age.

Plants invade the land 360 to 260 million years ago

Like the Cryogenian glaciation, the Karoo ice age featured two peaks in ice cover that may well have been distinct ice ages. They took place in the Mississipian period, 359 to 318 million years ago, and again in the Pennsylvanian 318 to 299 million years ago.

These ice ages may have been the result of the expansion of land plants that followed the Cryogenian. As plants spread over the planet, they absorbed CO2 from the atmosphere and released oxygen (PDF). As a result CO2 levels fell and the greenhouse effect weakened, triggering an ice age.

There is some evidence that the ice came and went in regular cycles, driven by changes in Earth's orbit. If true, this would mean that the Karoo ice age operated in much the same way as the current one.

Antarctica freezes over 14 million years ago

Antarctica wasn't always a frozen wasteland. It wasn't until around 34 million years ago that the first small glaciers formed on the tops of Antarctica's mountains. And it was 20 million years later, when world-wide temperatures dropped by 8 °C, that the glaciers' ice froze onto the rock, and the southern ice sheet was born.

This temperature drop was triggered by the rise of the Himalayas. As they grew higher they were exposed to increased weathering, which sucked CO2 out of the atmosphere and reduced the greenhouse effect.

The northern hemisphere remained relatively ice-free for longer, with Greenland and the Arctic becoming heavily glaciated only around 3.2 million years ago.

Latest advance of the ice 2.58 million years ago

The Quaternary glaciation started just a few million years ago – and is still going on. So its history is relatively recent, in geological terms, and can be studied in far more detail than the others'. It's evident that the ice sheets have gone through multiple stages of growth and retreat over the course of the Quaternary.

During "glacial" stages, the temperature was low and ice extended far away from the poles. During "interglacials", the temperature was somewhat warmer and the ice retreated. Brief, inconclusive periods of advancing ice – typically lasting less than 10,000 years – are called "stadials"; conversely, periods when the ice retreated, but only briefly, are called "interstadials".

The main trigger for the Quaternary glaciation was the continuing fall in the level of CO2 in the atmosphere due to the weathering of the Himalayas. However, the timing of the glacials and interglacials was driven by periodic changes in Earth's orbit that change the amount of sunshine reaching various parts of the planet. The effect of these small orbital changes was amplified by positive feedbacks, such as changes in greenhouse gas levels.

During the first two-thirds of the Quaternary, the ice advanced and retreated roughly every 41,000 years – the same tempo as the changes in the tilt of Earth's axis. About a million years ago, the ice switched to a 100,000-year cycle for reasons that were until recently a mystery. Now more detailed information about the timing of the ice's movements may have helped glaciologists find an answer.

To make matters more complicated still, the ice didn't advance and retreat simultaneously all around the world. Often it would begin advancing on one continent, with the others only being covered thousands of years later, and then linger on a few continents several millennia after it had disappeared from the others.

So there were actually many overlapping glaciations within the Quaternary, each separately named: the Bavelian and Cromerian complexes of glacials and interglacials; the Elsterian glacial; the Holsteinian interglacial and the Saalian glaciation, among others.

Between 130,000 and 114,000 years ago, the ice retreated during the Eemian interglacial – and then advanced again to create the glacial that most people know as "the ice age".

Our ice age 110,000 to 12,000 years ago

The cool temperatures of the Quaternary may have allowed our brains to become much larger than those of our of hominid ancestors. While that's still open to debate, it's plausible that the most recent glacial period left its mark on our species.

Neanderthals, with whom we shared the planet until just before the last glacial maximum, 20,000 years ago, may have struggled to survive as the rising and falling ice ate away at their habitat – although many other explanations for their extinction have been suggested. What is beyond doubt is that Homo sapiens survived and turned to farming soon after the ice retreated, setting the stage for the rise of modern civilisation.

As the glacial period drew to a close and temperatures began to rise, there were two final cold snaps. First, the chilly "Older Dryas" of 14,700 to 13,400 years ago transformed most of Europe from forest to tundra, like modern-day Siberia. After a brief respite, the Younger Dryas, between 12,800 to 11,500 years ago, froze Europe solid within a matter of months – probably as a result of meltwater from retreating glaciers shutting down the Atlantic Ocean's "conveyor-belt" current, although a cometary impact has also been blamed.

Twelve thousand years ago, the great ice sheets retreated at the beginning of the latest interglacial – the Flandrian – allowing humans to return to northern latitudes. This period has been relatively warm, and the climate relatively stable, although it has been slightly colder than the last interglacial, the Eemian, and sea levels are currently at least 3 metres lower – differences that are being closely scrutinised by researchers keen to understand how our climate will develop.

But this respite from the ice is likely to prove short-lived, at least in geological terms. Human effects on the climate notwithstanding, the cycle will continue to turn, the hothouse period will some day come to an end – and the ice sheets will descend again.

Male Antelopes Trick Females Into Extra Sex Opportunities

Columbus, Ohio – Scientists have caught male topi antelopes in the act of faking fear in front of females in heat as a way to improve their chances of having sex. The male antelopes, observed in southwest Kenya, send a false signal that a predator is nearby only when females in heat are in their territories. When the females react to the signal, they remain in the territory long enough for some males to fit in a quick mating opportunity.

The signal in this case, an alarm snort, is not a warning to other antelopes to beware, but instead tells a predator that it has been seen and lost its element of surprise, the researchers found.

So when the scientists observed the animals misusing the snort in the presence of sexually receptive females, they knew they were witnessing the practice of intentional deception – a trait typically attributed only to humans and a select few other animal species.

"There is very little evidence that animals use deception, and to make that link that the deception is intentional is very difficult," said Wiline Pangle, co-author of the study and a visiting scholar in evolution, ecology and organismal biology at Ohio State University. "It's almost amusing to us. The female hears the snort and thinks, 'oops, there is a lion.' She steps back, and the male comes around and mates. It's striking."

Pangle conducted the research with Jakob Bro-Jørgensen of the University of Liverpool. The paper appears online and is scheduled for print publication in the July issue of the journal The American Naturalist. Pangle and Bro-Jørgensen, a longtime expert in topi behavior, met while they were conducting separate field work in the Masai Mara National Reserve in Kenya, where Pangle studies the survival strategies of the antelopes' carnivorous predators. Over dinner, they discussed Bro-Jørgensen's observation that he had witnessed this sexual deception, and they teamed to conduct a rare controlled study of this type of animal behavior.

The two logged a total of 274 hours of observation of 73 female topi during mating seasons between 2005 and 2009. Females are in heat for one day per year sometime in February or March. During this time, they visit multiple male territories and mate repeatedly – on average, 11 times with four different males.

The males uttered their false alarms only when one of the females wandering their territory was in estrus – or in heat. The researchers noted that the males made these false alarms when females were trying to leave their territories – and the males even looked in the direction the females were going, suggesting that the predator was straight ahead.

Both sexes of topi emit alarm snorts when they detect stalking predators – typically lions, cheetahs, leopards, humans and hyenas. During the observation periods, the researchers recorded these snorts made by males. They then scanned the area for predators and coded the snorts as either "true" or "false" alarms.

It turns out that the males uttered their false alarms only when one of the females wandering their territory was in estrus – or in heat. The researchers noted that the males made these false alarms when females were trying to leave their territories – and the males even looked in the direction the females were going, suggesting that the predator was straight ahead.

To test whether these false alarms could be mistakes, the researchers observed male topi when they were alone, and saw that the males emitted these snorts only when a predator was stalking – a sign that the purpose of the snort is to tell the predator to go away rather than to warn fellow topi that a predator is in their midst.

"We did this to reject the hypothesis that topi use the snort to alert others around them. This snort is clearly an alert to a predator. The females snort, the males snort, they all snort when they see a predator," Pangle said. "That's why the male does it when a female is in estrus. Then she thinks it's just like the other snorts. And that is deception."

The scientists recorded three different sounds: true and false alarm snorts as well as a separate grunt sound. Acoustic analyses showed that the true and false snorts were identical in duration and frequency.

In a playback experiment, they broadcast the sounds 20 times each to a total of 60 randomly selected females and recorded their reactions. No matter which type of snort the animals heard, their response was the same – they walked away from the likely location of the predator.

By comparison, these females had very little reaction to the control sound – a miscellaneous grunt.

According to the recorded observations, the males achieved almost three additional mating opportunities per false snort – an obvious benefit in the animal world, where reproducing offspring is the principal sign of fitness.

And the females benefit, as well, Pangle noted. If they ignore the false snort, they could die – or so they believe. And they are not subject to the deception often enough to become jaded about their sexual partners.

"They don't hear this false alarm very often – only when they are in estrus, and not by all males. So for them to catch on would require a fairly high frequency of that behavior," Pangle said. "And second, even if they caught on, it's still better to be safe than sorry. The cost of missing that cue, if it is accurate, is so high."

This work was supported by Marie Curie, the Zoological Society of London and Research Councils UK fellowships.

Banned: doctor who linked MMR vaccine with autism

* 18:18 24 May 2010 **by Andy Coghlan**

The British doctor who controversially drew a link between autism and the triple vaccine against measles, mumps and rubella (MMR) should be banned from practising medicine. That's the ruling issued today (pdf) by a panel of the General Medical Council, which regulates the medical profession in the UK.

Andrew Wakefield, who worked at the Royal Free Hospital, London, in 1998 when his controversial paper on MMR and autism was published, has said that he will appeal against the verdict.

Wakefield has told the BBC in a radio interview that he "categorically denies the charges" and will appeal against the verdict. If he doesn't, he will automatically be struck off the UK medical register in 28 days.

The GMC panel also ruled that John Walker-Smith (pdf), a former colleague of Wakefield's at the Royal Free Hospital, should be struck off. It cleared a third colleague, Simon Murch (pdf), of any wrongdoing.

Litany of failings

The panel found Wakefield guilty of a litany of transgressions in the late 1990s, when he and his colleagues conducted their research on 12 children, leading to publication of the controversial findings in The Lancet in 1998. The findings, retracted by The Lancet in February this year (pdf), linked the vaccine shots with the development of autism and bowel disorders. Panicked parents failed to have their children vaccinated, and the uptake rate for MMR, which had peaked at 92 per cent, fell to a low of 81 per cent in 2004.

The transgressions listed by the panel include dishonesty about the paper itself, undeclared conflicts of interest and ethical irregularities in how the children were recruited and managed during course of the research.

The panel points out that Wakefield's patent on an alternative to MMR called Transfer Factor meant he stood to gain financially by discrediting the triple vaccine. He was also appearing as an expert witness in a court action against the vaccine. He failed to mention any of this either to the hospital's research and ethics committee or to The Lancet, the panel says.

Unethical party

The panel also concluded that Wakefield subjected the children to painful and invasive procedures that were not clinically necessary. Three children had spinal fluid taken through lumbar punctures, for example, and others underwent colonoscopies. Not all the children had a history of being treated for gastrointestinal problems, contrary to what was stated in the paper in The Lancet, and nine underwent procedures for which Wakefield had not sought ethical approval.

The panel also condemned Wakefield's failure to state in The Lancet the true purpose of the research, which was to investigate a proposed new syndrome following vaccination. On another occasion, in 1999, he took blood from children at a party then paid them £5 for agreeing to it.

Protecting patients

"Accordingly, the panel has determined that Dr Wakefield's name should be erased from the medical register," it said in its ruling, citing the need to protect patients and to maintain public trust and confidence in the medical profession.

The panel also recommended striking off John Walker-Smith for subjecting children to painful but unnecessary procedures, including colonoscopies, barium meals and lumbar punctures. The panel determined that, like Wakefield, Walker-Smith, an author on The Lancet paper, ought to have known of the widespread implications of the paper, and failed in his duty to ensure that the information in it was accurate.

Simon Murch was cleared of any wrongdoing and is free to continue practising as a doctor. The panel accepted that in carrying out colonoscopies for Walker-Smith, Murch was quite reasonably deferring to the clinical judgements and authority of his senior colleague.

The investigation is the longest in the GMC's history, having lasted more than three years. Earlier this year, the GMC issued its preliminary findings on whether the three should face censure.

Shortly after this, Wakefield left the Thoughtful House Center for Children, which he founded in 2005 in Austin, Texas, to treat autism and related disorders. Wakefield has no licence to practise in the US, and the GMC says it will circulate its verdict on him to similar bodies throughout the world.

Do we clamp the umbilical cord too soon?

USF researchers: Early clamping may interrupt humankind's first 'natural stem cell transplant'

Tampa, Fla. – The timing of umbilical cord clamping at birth should be delayed just a few minutes longer, suggest researchers at the University of South Florida's Center of Excellence for Aging and Brain Repair.

Delaying clamping the umbilical cord for a slightly longer period of time allows more umbilical cord blood volume to transfer from mother to infant and, with that critical period extended, many good physiological "gifts" are transferred through 'nature's first stem cell transplant' occurring at birth.

The USF review is published in a recent issue of the Journal of Cellular and Molecular Medicine (14:3).

"Several clinical studies have shown that delaying clamping the umbilical cord not only allows more blood to be transferred but helps prevent anemia as well," said the paper's lead author Dr. Paul Sanberg, director of the Center. "Cord blood also contains many valuable stem cells, making this transfer of stem cells a process that might be considered 'the original stem cell transplant'."

At birth, the placenta and umbilical cord start contracting and pumping blood toward the newborn. After the blood equilibrates, the cord's pulse ceases and blood flow from mother to newborn stops. In recent Western medical practice, early clamping - from 30 seconds to one minute after birth - remains the most common practice among obstetricians and midwives, perhaps because the benefits of delaying clamping have not been clear. However, waiting for more than a minute, or until the cord stops pulsating, may be beneficial, the authors said.

Birthing methods have also changed over the last century. Throughout human history and currently in cultures and areas where delivering mothers squat to deliver, gravity helps speed the stem cell transfer. Today, the cord may be clamped early for a number of reasons, including the medical resuscitation and stabilizing of infants or the notion that delaying clamping might lead to adverse effects or, more recently, to quickly facilitate umbilical cord banking.

According to study co-author Dr. Dong-Hyuk Park, the relationship between cord clamping time and the transfer of stem cells needs to be understood through the early weeks of the perinatal period and the process of 'hematopoiesis,' the formation of blood cells that begins as early as two weeks into pregnancy. A transfer of pluripotent stems cells continues throughout pregnancy, however, and for a time through the umbilical cord following delivery.

"Several randomized, controlled trials, systematic reviews and meta-analyses have compared the effects of late versus early cord clamping," said Dr. Park. "In pre-term infants, delaying clamping the cord for at least 30 seconds reduced incidences of intraventricular hemorrhage, late on-set sepsis, anemia, and decreased the need for blood transfusions." Another potential benefit of delayed cord clamping is to ensure that the baby can receive the complete retinue of clotting factors.

Yet, there is debate and disagreement on early versus later clamping. The side favoring delayed clamping, the authors noted, cite the value of the infant's receiving umbilical cord blood (UCB)-derived stem cells, known to be pluripotent. "The virtue of the unique and immature features of cord blood, including their ability to differentiate, are well known," added Dr. Sanberg.

The researchers concluded that many common disorders in newborns related to the immaturity of organ systems may receive benefits from delayed clamping. These may include: respiratory distress; anemia; sepsis; intraventricular haemorrhage; and periventricular leukomalacia. They also speculate that other health problems, such as chronic lung disease, prematurity apneas and retinopathy of prematurity, may also be affected by a delay in cord blood clamping.

"There remains no consensus among scientists and clinicians on cord clamping and proper cord blood collection," concluded co-author and obstetrician Dr. Stephen Klasko, senior vice president of USF Health and dean of the USF College of Medicine. "The most important thing is to avoid losing valuable stems cells during and just after delivery."

The authors agreed that delaying cord clamping should appropriately be delayed for pre-term babies and babies born where there is no effort to bank umbilical cords, and for babies born where there is limited access to health care and where nutrition may be poor.

Regimens: Eat Your Vegetables, but Not Too Many

By RONI CARYN RABIN

They say you can never be too rich or too thin. But is it possible to eat too many leafy green vegetables?

Last year, an 88-year-old woman was admitted to NYU Langone Medical Center in a nearly comatose state, unable to walk or swallow and barely able to breathe. Though she had no history of thyroid disease, she was given a diagnosis of myxedema coma, a life-threatening condition caused by extreme hypothyroidism, or low thyroid function.

The culprit, it turned out, was raw bok choy. The patient had been eating two to three pounds of it every day for several months, in the belief it would help control her diabetes. Instead, the vegetables may have suppressed her thyroid, according to NYU physicians who described the case in a letter in the May 20 issue of The New England Journal of Medicine.

Bok choy contains compounds called glucosinolates that have been found to inhibit thyroid function in animals.

“I don’t want to say people shouldn’t be eating raw vegetables, but everything in moderation - even things that are good for us,” said Dr. Michael Chu, an NYU resident physician who was one of the letter’s authors. “This probably wouldn’t have happened if the vegetables were cooked.”

'Nature's batteries' may have helped power early lifeforms

Researchers at the University of Leeds have uncovered new clues to the origins of life on Earth. The team found that a compound known as pyrophosphite may have been an important energy source for primitive lifeforms. There are several conflicting theories of how life on Earth emerged from inanimate matter billions of years ago – a process known as abiogenesis.

"It's a chicken and egg question," said Dr Terry Kee of the University of Leeds, who led the research. "Scientists are in disagreement over what came first – replication, or metabolism. But there is a third part to the equation – and that is energy."

All living things require a continual supply of energy in order to function. This energy is carried around our bodies within certain molecules, one of the best known being ATP*, which converts heat from the sun into a useable form for animals and plants.

At any one time, the human body contains just 250g of ATP – this provides roughly the same amount of energy as a single AA battery. This ATP store is being constantly used and regenerated in cells via a process known as respiration, which is driven by natural catalysts called enzymes.

"You need enzymes to make ATP and you need ATP to make enzymes," explained Dr Kee. "The question is: where did energy come from before either of these two things existed? We think that the answer may lie in simple molecules such as pyrophosphite which is chemically very similar to ATP, but has the potential to transfer energy without enzymes."

The key to the battery-like properties of both ATP and pyrophosphite is an element called phosphorus, which is essential for all living things. Not only is phosphorus the active component of ATP, it also forms the backbone of DNA and is important in the structure of cell walls.

But despite its importance to life, it is not fully understood how phosphorus first appeared in our atmosphere. One theory is that it was contained within the many meteorites that collided with the Earth billions of years ago.

"Phosphorus is present within several meteoritic minerals and it is possible that this reacted to form pyrophosphite under the acidic, volcanic conditions of early Earth," added Dr Kee.

The findings, published in the journal Chemical Communications, are the first to suggest that pyrophosphite may have been relevant in the shift from basic chemistry to complex biology when life on earth began. Since completing this research, Dr Kee and his team have found even further evidence for the importance of this molecule and now hope to team up with collaborators from NASA to investigate its role in abiogenesis.

***Adenosine triphosphate**

The findings, entitled: 'On the prebiotic potential of reduced oxidation state phosphorus: the H-phosphinate–pyruvate system', are published in Chemical Communications DOI: 10.1039/c002689a.

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

* 25 May 2010 **by Nora Schultz**

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

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

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

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

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

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

New Way Bacterium Spreads in Hospital

By NICHOLAS BAKALAR

Health care workers and patients have yet another source of hospital-acquired infection to worry about, British researchers are reporting.

Clostridium difficile, a germ that causes deadly intestinal infections in hospital patients, has long been thought to be spread only by contact with contaminated surfaces. But a new study finds that it can also travel through the air. The researchers emphasized that there is no evidence that C. difficile can be contracted by inhaling the germs. Rather, they float on the air, landing in places where more people can touch them.

The bug is commonly spread by contact with infected feces, and the British scientists said the new study made it even more urgent to isolate hospital patients with diarrhea as soon as possible - even before tests confirm a C. difficile infection.

“We don’t want people to wait for the confirmation,” said the study’s senior author, Dr. Mark H. Wilcox, a professor of medical microbiology at the University of Leeds. “By then, the cat’s out of the bag.”

Outbreaks of C. difficile, a bacterium resistant to many antibiotics, have been increasing in the United States since 2001, along with the evolution of more virulent strains. People in good health are rarely infected. But broad-spectrum antibiotics can wipe out the bacteria that normally live in the intestines, allowing C. difficile to flourish. Hospitalized people on antibiotics and the elderly, even when not taking medicine, are at high risk. Health care workers who touch contaminated feces can spread the disease by direct contact with other people or just by touching objects. The spores are resistant to disinfectants and can survive in open areas for months.

The bacterium produces toxins that can cause fever, nausea, abdominal pain, severe diarrhea - and sometimes colitis, a serious inflammation of the large intestine. Treatment involves replacing the broad-spectrum antibiotics with other antibiotics, usually vancomycin or metronidazole.

The British researchers began with a six-month investigation of 50 patients, symptomatic and not, with confirmed infection. The air near 12 percent of them was found to be contaminated with C. difficile. The more active their diarrheal symptoms, the more likely they were to have spores in the air around them.

Then the scientists repeatedly tested 10 patients with symptomatic illness over a 10-hour period, and the air near 7 was positive for c. difficile, usually during visiting hours or when there was activity in patient rooms like food delivery, ward rounds or bedding changes. Surfaces around 9 of the 10 patients were also contaminated.

The scientists believe that the movement of people and the opening and closing of doors stir up spores on contaminated surfaces, helping them disperse and increasing the possibility of them spreading.

The finding is unlikely to change current preventive practice, said Dr. L. Clifford McDonald, an epidemiologist at the Centers for Disease Control and Prevention. He said that the study supported putting patients in a single room, “which is the norm here in the U.S.”

“There is a little bit of dispersion,” he added, “but the heavier contamination is still from direct contact.”

Dr. Wilcox agreed. “It’s important,” he said, “not to interpret the results as a justification for methods aimed at removing bacteria from the air, techniques that may be appropriate for highly immunocompromised patients, but not for those at risk for C. diff infection.”

The amounts of C. difficile found in the air were generally modest. There were no clouds of germs circulating in patients’ rooms. This may suggest a genuinely low level of airborne contamination, the researchers write, or it may be a result of methodological problems in collecting air samples: the initial location of the sampling devices, their design, or their movement to accommodate patient care or the arrival of visitors.

Dr. Wilcox said patients should protect themselves from C. difficile by the conscientious application of two substances that do not require a prescription: soap and water.

“For everyone in a hospital, staff or patients,” he said, “the chief thing is optimal hand hygiene.”

Medicine's secret archives

How patients are harmed by the concealment of knowledge

No one knows how many mothers' and babies' lives have been saved by the obstetrical forceps. This device has been part of the standard equipment of every maternity room for about 250 years. However, a shadow lies over the success story: after the Chamberlen brothers developed the device at the beginning of the 17th century, the brothers and their descendants used it for 3 generations, but kept it a secret from other obstetricians. While thanks to the forceps the Chamberlen family became rich and famous, at the same time women and babies were still dying elsewhere because the device was not available.

The story of the obstetrical forceps is one of the oldest documented examples showing what consequences secrecy in medicine can have. In an article published in the journal Trials, researchers at the German Institute for Quality and Efficiency in Health Care (IQWiG) compiled over 60 examples illustrating how the dissemination of medical knowledge has been impeded. For this purpose, they assessed hundreds of articles from journals and other sources, which covered areas including treatment for psychiatric disorders, pain, heart and circulatory disease, skin disease, cancer, and infectious diseases. A wide range of interventions was affected: from drugs and vaccines to medical devices such as ultrasound or devices for wound care. The collection reads like the script for a crime series.

Concealment is common

In science the phenomenon is called "publication bias", i.e. bias through selective publication. This occurs on two levels: On the first level complete studies remain unpublished. For example, an analysis of 90 drugs that had been newly approved in the US showed that they had been tested in a total of 900 trials. However, even 5 years after approval, 60% of these studies were unpublished. On the second level only selected outcomes from studies are published. Nowadays researchers have to specify in a study protocol which outcomes they want to measure and how they are going to analyse them. Comparisons of protocols and journal articles of studies showed that in 40% to 60% of studies, results had either been completely omitted or analyses changed. "In this way study results are often presented in a more positive way than is actually the case," says Beate Wieseler, Deputy Head of IQWiG's Drug Assessment Department.

This does not only affect studies sponsored by the pharmaceutical industry. In their paper, the IQWiG authors also cite an analysis in which 2000 studies on cancer topics were analysed according to sponsorship. The proportion of published studies was extremely low: of the industry-sponsored studies, 94% were unpublished; however, even 86% of university-sponsored studies were also unpublished. "Due to legal regulations, regulatory authorities are also sometimes obliged to withhold data," says Thomas Kaiser, Head of the Drug Assessment Department.

Patients are harmed

The concealment of knowledge often has consequences for patients. On the one hand, it can result in delays to the implementation and dissemination of beneficial interventions (as was the case with the obstetrical forceps). However, it is more common that bad news and reports of failure remain unpublished. "As a result, physicians and patients use treatments that are actually futile or even harmful," says Beate Wieseler. For example, researchers estimate that drugs prescribed in the 1980s to prevent irregular heart beat cost tens of thousands of lives, because early signs of dangerous adverse effects were not published.

Appeals are insufficient

IQWiG's search for documented examples of publication bias was triggered by the Institute's own experience in its daily work, as was recently the case, for example, in the assessment of reboxetine, a drug used to treat depression: the pharmaceutical company Pfizer only provided previously concealed studies to IQWiG after subjection to public pressure. In the previously unpublished studies, the results for reboxetine were considerably worse than appeared to be the case in published studies. "For many years, not only patients but also physicians have been deceived," says Beate Wieseler.

The collection of examples published in Trials shows that the tendency to conceal unfavourable results or results that do not fulfil one's own expectations is so widespread that appeals and proposals for voluntary solutions will not be able to solve the problem effectively. "The increasing registration of studies in public registries is an important first step," says Thomas Kaiser. "However, in order to protect patients, we need legal regulations, so that results of all clinical trials are published swiftly and completely."

Throat Exercises Can Relieve Sleep Apnea

By ANAHAD O'CONNOR

THE FACTS For people suffering from sleep apnea, specialized breathing machines are the standard treatment. The machines use a method called continuous positive airway pressure, or CPAP, which keeps the airway open and relieves potentially dangerous pauses in breathing during the night. But the machines are expensive, and some people complain that the mask and headgear cause uncomfortable side effects, like congestion.

One free and fairly simple alternative may be exercises that strengthen the throat. While they aren't as established or as well studied as breathing machines, some research suggests they may reduce the severity of sleep apnea by building up muscles around the airway, making them less likely to collapse at night.

In a study published last year in The American Journal of Respiratory and Critical Care Medicine, scientists recruited a group of people with obstructive sleep apnea and split them into two groups. One was trained to do breathing exercises daily, while the other did 30 minutes of throat exercises, including swallowing and chewing motions, placing the tip of the tongue against the front of the palate and sliding it back, and pronouncing certain vowels quickly and continuously.

After three months, subjects who did the throat exercises snored less, slept better and reduced the severity of their condition by 39 percent. They also showed reductions in neck circumference, a known risk factor for apnea. The control group showed almost no improvement.

Other randomized studies have found similar effects. One even showed that playing instruments that strengthen the airways, like the didgeridoo, can ease sleep apnea.

THE BOTTOM LINE For people with sleep apnea, throat exercises may be a cheap and useful therapy.

From Trees and Grass, Bacteria That Cause Snow and Rain

By JIM ROBBINS

Bozeman, Mont. - Walking across the campus of Montana State University here, David Sands, a plant pathologist, says the blanket of snow draped over the mountains around town contains a surprise.

The cause of most of it, he said, is a living organism, a bacterium, called pseudomonas syringae. In the last few years, Dr. Sands and other researchers have accumulated evidence that the well-known group of bacteria, long known to live on agricultural crops, are far more widespread and may be part of a little-studied weather ecosystem. The principle is well accepted, but how widespread the phenomenon is remains a matter of debate.

The accepted precipitation model is that soot, dust and other inert things form the nuclei for raindrops and snowflakes. Scientists have found these bacteria in abundance on the leaves of a wide range of wild and domestic plants, including trees and grasses, everywhere they have looked, including Montana, Morocco, France, the Yukon and in the long buried ice of Antarctica. The bacteria have been found in clouds and in streams and irrigation ditches. In one study of several mountaintops here, 70 percent of the snow crystals examined had formed around a bacterial nucleus.

Some of the bacteria promote freezing as a means of attacking plants. They make proteins that will trigger freezing at higher temperatures than usual and the resulting water ice damages the plant, giving the bacteria access to the nutrients they need.

This ability to promote freezing of water at higher-than-normal freezing temperatures has led Dr. Sands and other scientists to believe the bacteria are part of an unstudied system. After the bacteria infect plants and multiply, he says, they may be swept as aerosols into the sky, where it seems they prompt the formation of ice crystals (which melt as they fall to earth, causing rain) at higher temperatures than do dust or mineral particles that also function as the nuclei of ice crystals.

"The rain is a mechanism that helps these things move," said Cindy Morris, a plant pathologist with the French National Institute for Agricultural Research, who is studying the bacteria.

The ability of the protein in the bacteria to make snow is well known. Ski areas use a cannon to shoot it into the air with water for snow making, and it is used in cloud seeding efforts to create rain. A single bacterium, far too small to be seen with the naked eye, might make enough protein molecules for a thousand snow crystals.

The researchers believe that there are other bacteria and fungi out there that do the same thing.

Roy Rasmussen, a cloud physicist at the National Center for Atmospheric Research, says the research, mostly by plant pathologists, has renewed the study of bacteria as a cause of rainfall by atmospheric physicists. Some big questions remain, though. "It's a sound theory," Dr. Rasmussen said. "The question is, do these guys get into the atmosphere in large enough concentrations to have an effect? My gut feeling is this may be important for specific places and specific times, but it's not global. It's not something we missed."

Russ Schnell, an atmospheric scientist with the National Oceanic and Atmospheric Administration, first proposed the importance of bacteria in forming ice crystals in clouds, along with a colleague, Gabor Vali, in a

paper in Nature in 1970. “But we didn’t have the techniques to do more,” Dr. Schnell said. “The tools now are unbelievably better than when we were doing this stuff. It’s a neat thing to see.”

Interest in the bacteria has grown because of recent publications, and two international meetings on the subject. Ms. Morris estimated that some 30 scientists around the world are researching the role of bacteria in precipitation.

If Dr. Sands is correct about the importance of bacteria, there would be implications for destruction of vegetation through overgrazing or logging, which might decrease the presence of bacteria and contribute to droughts. On the other hand, because the bacteria flourish on some plants and are sparse on others, planting the right vegetation could enhance rain. “Wheat or barley might differ a thousandfold” in the number of bacteria, Dr. Sands said, “depending on the variety.”

The research continues. In England, scientists are flying into clouds to take samples of cloud water, and analyzing the DNA of microbes in it. Researchers at Virginia Tech have sequenced the DNA of 126 strains of the bacteria to create a database that could allow scientists to trace the bacteria to their geographic origin.

“It’s a complicated system,” said Brent C. Christner, an assistant professor at Louisiana State University, who studies microbial ecology in glacial ice and has found the bacteria in Antarctica. “You can’t bring them into the lab to enumerate them and study them.”

The research could have implications for climate change. Dr. Sands said the bacteria do not grow in temperatures over 82 degrees. If temperatures stayed too warm for too long, he said, they could die. “There’s more work to do,” Dr. Sands said. “It’s a great big complicated picture.”

Tracking the Ancestry of Corn Back 9,000 Years

By SEAN B. CARROLL

It is now growing season across the Corn Belt of the United States. Seeds that have just been sown will, with the right mixture of sunshine and rain, be knee-high plants by the Fourth of July and tall stalks with ears ripe for picking by late August. Corn is much more than great summer picnic food, however. Civilization owes much to this plant, and to the early people who first cultivated it.

For most of human history, our ancestors relied entirely on hunting animals and gathering seeds, fruits, nuts, tubers and other plant parts from the wild for food. It was only about 10,000 years ago that humans in many parts of the world began raising livestock and growing food through deliberate planting. These advances provided more reliable sources of food and allowed for larger, more permanent settlements. Native Americans alone domesticated nine of the most important food crops in the world, including corn, more properly called maize (Zea mays), which now provides about 21 percent of human nutrition across the globe.

But despite its abundance and importance, the biological origin of maize has been a long-running mystery. The bright yellow, mouth-watering treat we know so well does not grow in the wild anywhere on the planet, so its ancestry was not at all obvious. Recently, however, the combined detective work of botanists, geneticists and archeologists has been able to identify the wild ancestor of maize, to pinpoint where the plant originated, and to determine when early people were cultivating it and using it in their diets.

The greatest surprise, and the source of much past controversy in corn archeology, was the identification of the ancestor of maize. Many botanists did not see any connection between maize and other living plants. Some concluded that the crop plant arose through the domestication by early agriculturalists of a wild maize that was now extinct, or at least undiscovered.

However, a few scientists working during the first part of the 20th century uncovered evidence that they believed linked maize to what, at first glance, would seem to be a very unlikely parent, a Mexican grass called teosinte. Looking at the skinny ears of teosinte, with just a dozen kernels wrapped inside a stone-hard casing, it is hard to see how they could be the forerunners of corn cobs with their many rows of juicy, naked kernels. Indeed, teosinte was at first classified as a closer relative of rice than of maize.

But George W. Beadle, while a graduate student at Cornell University in the early 1930s, found that maize and teosinte had very similar chromosomes. Moreover, he made fertile hybrids between maize and teosinte that looked like intermediates between the two plants. He even reported that he could get teosinte kernels to pop. Dr. Beadle concluded that the two plants were members of the same species, with maize being the domesticated form of teosinte. Dr. Beadle went on to make other, more fundamental discoveries in genetics for which he shared the Nobel Prize in 1958. He later became chancellor and president of the University of Chicago.

Despite Dr. Beadle’s illustrious reputation, his theory still remained in doubt three decades after he proposed it. The differences between the two plants appeared to many scientists to be too great to have evolved in just a

few thousand years of domestication. So, after he formally retired, Dr. Beadle returned to the issue and sought ways to gather more evidence. As a great geneticist, he knew that one way to examine the parentage of two individuals was to cross them and then to cross their offspring and see how often the parental forms appeared. He crossed maize and teosinte, then crossed the hybrids, and grew 50,000 plants. He obtained plants that resembled teosinte and maize at a frequency that indicated that just four or five genes controlled the major differences between the two plants.

Dr. Beadle's results showed that maize and teosinte were without any doubt remarkably and closely related. But to pinpoint the geographic origins of maize, more definitive forensic techniques were needed. This was DNA typing, exactly the same technology used by the courts to determine paternity.

In order to trace maize's paternity, botanists led by my colleague John Doebley of the University of Wisconsin rounded up more than 60 samples of teosinte from across its entire geographic range in the Western Hemisphere and compared their DNA profile with all varieties of maize. They discovered that all maize was genetically most similar to a teosinte type from the tropical Central Balsas River Valley of southern Mexico, suggesting that this region was the "cradle" of maize evolution. Furthermore, by calculating the genetic distance between modern maize and Balsas teosinte, they estimated that domestication occurred about 9,000 years ago.

These genetic discoveries inspired recent archeological excavations of the Balsas region that sought evidence of maize use and to better understand the lifestyles of the people who were planting and harvesting it. Researchers led by Anthony Ranere of Temple University and Dolores Piperno of the Smithsonian National Museum of Natural History excavated caves and rock shelters in the region, searching for tools used by their inhabitants, maize starch grains and other microscopic evidence of maize.

In the Xihuatoxtla shelter, they discovered an array of stone milling tools with maize residue on them. The oldest tools were found in a layer of deposits that were 8,700 years old. This is the earliest physical evidence of maize use obtained to date, and it coincides very nicely with the time frame of maize domestication estimated from DNA analysis.

The most impressive aspect of the maize story is what it tells us about the capabilities of agriculturalists 9,000 years ago. These people were living in small groups and shifting their settlements seasonally. Yet they were able to transform a grass with many inconvenient, unwanted features into a high-yielding, easily harvested food crop. The domestication process must have occurred in many stages over a considerable length of time as many different, independent characteristics of the plant were modified.

The most crucial step was freeing the teosinte kernels from their stony cases. Another step was developing plants where the kernels remained intact on the cobs, unlike the teosinte ears, which shatter into individual kernels. Early cultivators had to notice among their stands of plants variants in which the nutritious kernels were at least partially exposed, or whose ears held together better, or that had more rows of kernels, and they had to selectively breed them. It is estimated that the initial domestication process that produced the basic maize form required at least several hundred to perhaps a few thousand years.

Every August, I thank these pioneer geneticists for their skill and patience.

From Big Leagues, Hints at Sibling Behavior

By ALAN SCHWARZ

When B. J. Upton hit a home run last Thursday night to help the Tampa Bay Rays defeat the New York Yankees, it was not the first time that day that Upton had gone deep. Just a few hours earlier, chatting in front of his locker, he had helped confirm the results of a recent study of sibling risk-taking behavior.

***POWER COUPLE** The Yankees slugger Joe DiMaggio, right, and his brother Dom of the Boston Red Sox, two years his junior, at the 1949 All-Star Game.* **Ray Howard/Associated Press**

In the current issue of Personality and Social Psychology Review, Frank J. Sulloway and Richard L. Zweigenhaft went digging for evidence of siblings behaving differently in the vast database of baseball statistics. Given how younger siblings have been shown to take more risks than their older counterparts - perhaps originally to fight for food, now for parental attention - Drs. Sulloway and Zweigenhaft examined whether the phenomenon might persist to the point that baseball-playing brothers would try to steal bases at significantly different rates.

In fact they did: For more than 90 percent of sibling pairs who had played in the major leagues throughout baseball's long recorded history, including Joe and Dom DiMaggio and Cal and Billy Ripken, the younger brother (regardless of overall talent) tried to steal more often than his older brother.

B. J. and his younger brother, Justin, a slugger for the Arizona Diamondbacks, are actually among the 1 in 10 exceptions (B. J., who at 25 is 3 years older than Justin, has been more of a speedy leadoff hitter, a position in the batting order often associated with base stealing). Yet B. J. nodded thoughtfully when told that scientists have found younger brothers tend to take more risks.

"He was always the one who would push things to the limit," B. J. said of Justin. "When Mama told him, 'Don't ride your bike there,' he would ride it. When Mama said, 'Don't stand on the bleachers,' he'd stand up on the bleachers and fall and bust his head open."

The finding by Drs. Sulloway and Zweigenhaft won't revolutionize behavioral science, but it is an intriguing example of how the personalities of siblings may differ according to birth order. A visiting scholar at the Institute of Personality and Social Research at the University of California, Berkeley, Dr. Sulloway has published extensively on the effect of familial birth order on siblings' relative rebelliousness, intelligence and even political activism.

Speaking by telephone from a research trip to the Galápagos Islands, Dr. Sulloway said that he did not expect the study to have any practical application for baseball managers, who base their rosters and lineups on players' skills, not bloodlines. Nonetheless, he said, the study contributes to the understanding of sibling psychology because it offers evidence of how differences developed in childhood could continue well past puberty.

"We tend not to exhibit birth-order differences all the time in adulthood - we employ them in situations with siblings, because that's where the behavior comes from," Dr. Sulloway said. "But we found that here, and that's significant."

Scientists including Stephen Jay Gould and Edward M. Purcell, who won the 1952 Nobel Prize in Physics for work on magnetism in atomic nuclei, have dabbled in baseball statistics mostly as a diversion from more substantive matters. Dr. Sulloway said that baseball's volumes of records since the 19th century present a unique opportunity for research. "We had 700 players and 300,000 athletic acts to look at," he said. "As a behavioral scientist, that's a data set you dream of."

Baseball aficionados will surely second-guess the study. The authors examined how many times each player attempted to steal per time on base, measured by singles, doubles, triples, walks and times hit by pitch. Of course few runners steal home or even third base; it is also hard to steal second if a runner is already there, records of which are scant at best. Even if both brothers encountered that equally, baseball abhors such inexactitude.

The data was further converted logarithmically, and several other factors were considered, like age differences, body size and even the order in which the players were promoted to the majors - leaving the numbers relatively unrecognizable to morning box score scanners. And there remains the plausible issue of whether younger brothers learned baseball strategy more fully simply by watching their older brothers growing up, which Dr. Zweigenhaft, a professor of psychology at Guilford College in Greensboro, N.C., said could very well be a contributing factor.

Nonetheless, he said, "I loved working on this study, going over statistical patterns of so many famous names. It was like being at a ballgame, really."

Study: Benchmarks and 'leapfrogs' drive up CEO pay

Why have CEO salaries skyrocketed over the past 20 years? Much of the blame lies in the practice of compensation benchmarking, say the authors of a study to be published next week in the American Journal of Sociology.

Benchmarking is a standard practice in American corporations. When setting pay, compensation committees use peer groups of executives at comparable firms to establish a "fair" market wage their CEOs. But according to the study, led by sociologist Thomas DiPrete from Columbia University, a few CEOs each year "leapfrog" their peers by getting huge raises that have little to do with the performance of their companies. Other companies then use the oversized pay of leapfroggers in subsequent benchmarks. Over time, this ratchets up pay for everyone through a "contagion effect."

"We show that rising CEO pay is not simply a function of what individual companies do, but is influenced by the behavior of leapfroggers at other firms," DiPrete said.

DiPrete and his colleagues (including a former CEO) used procedures laid out in compensation handbooks to reconstruct likely peer groups for CEOs listed in Standard and Poor's annual compensation surveys. They could then look for evidence of leapfrogging in those likely peer groups over time. Their simulation shows that leapfrogging explains about half of the overall increase in CEO pay from 1992 to 2006.

The researchers say that the finding broadens the debate about what is driving CEO salaries upward. Opinions on the subject have generally fallen into two camps: those who think CEOs are overpaid because of

failures in corporate governance at individual firms, and those who think CEOs are paid what they deserve based on the profits they deliver to shareholders and a "superstar" labor market. However, this study shows that ill-gotten raises for a few CEOs can lead to "legitimate" pay increases for others. "[T]he linkages among firms produced by the benchmarking process guarantee that firm-level governance failure becomes a factor in the environment of other firms," the researchers write.

Following the Enron and WorldCom scandals of the early 2000s, the Securities and Exchange Commission changed its rules to require firms to disclose benchmarking information. The research team is now using the new data mandated by the SEC to better understand how the network structure of peer groups affects executive pay setting in American corporations.

"Whether the SEC regulatory change reduces the ratcheting effect of leapfrogging on CEO pay -- creating more transparency about who is in the peer group and at what level the company is benchmarking -- is an important question for future research" says DiPrete.

Thomas A. DiPrete, Greg Eirich and Matthew Pittinsky, "Compensation Benchmarking, Leapfrogs, and the Surge in Executive Pay." American Journal of Sociology (May 2010).

Dangerous lung worms found in people who eat raw crayfish

If you're headed to a freshwater stream this summer and a friend dares you to eat a raw crayfish – don't do it. You could end up in the hospital with a severe parasitic infection.

Physicians at Washington University School of Medicine in St. Louis have diagnosed a rare parasitic infection in six people who had consumed raw crayfish from streams and rivers in Missouri. The cases occurred over the past three years, but three have been diagnosed since last September; the latest in April. Before these six, only seven such cases had ever been reported in North America, where the parasite, Paragonimus kellicotti, is common in crayfish.

"The infection, called paragonimiasis, is very rare, so it's extremely unusual to see this many cases in one medical center in a relatively short period of time," says Washington University infectious diseases specialist Gary Weil, MD, professor of medicine and of molecular microbiology, who treated some of the patients. "We are almost certain there are other people out there with the infection who haven't been diagnosed. That's why we want to get the word out."

Paragonimiasis causes fever, cough, chest pain, shortness of breath and extreme fatigue. The infection is generally not fatal, and it is easily treated if properly diagnosed. But the illness is so unusual that most doctors are not aware of it. Most of the patients had received multiple treatments for pneumonia and undergone invasive procedures before they were referred to Barnes-Jewish Hospital or St. Louis Children's Hospital at Washington University Medical Center.

The half-inch, oval-shaped parasitic worms at the root of the infection primarily travel from the intestine to the lungs. They also can migrate to the brain, causing severe headaches or vision problems, or under the skin, appearing as small, moving nodules.

Some of the patients had been in and out of the hospital for months as physicians tried to diagnose their mysterious illness and treat their symptoms, which also included a buildup of fluid around the lungs and around the heart. One patient even had his gallbladder removed, to no avail.

"Some of these invasive procedures could have been avoided if the patients had received a prompt diagnosis," says Michael Lane, MD, an infectious diseases fellow at the School of Medicine who treated some of the patients. "We hope more doctors will now have this infection on their radar screens for patients with an unexplained lingering fever, cough and fatigue."

Once the diagnosis is made, paragonimiasis is easily treated with an oral drug, praziquantel, taken three times a day for only two days. Symptoms begin to improve within a few days and are typically gone within seven to 10 days. All the patients have completely recovered, even one patient who temporarily lost his vision when parasites invaded the brain.

The recent infections, which occurred in patients ages 10-32, have prompted the Missouri Department of Health & Senior Services to issue a health advisory alerting doctors across the state. The department also printed posters warning people not to eat raw crayfish and placed them in campgrounds and canoe rental businesses near popular Missouri streams. Thoroughly cooking crayfish kills the parasite and does not pose a health risk.

Paragonimiasis is far more common in East Asia, where many thousands of cases are diagnosed annually in people who consume raw or undercooked crab that contain Paragonimus westermani, a cousin to the parasite in North American crayfish.

While the U.S. Centers for Disease Control and Prevention has an antibody test to identify Paragonimus westermani infection, the test is not sensitive for patients with P. kellicotti parasite, and this makes diagnosis a real challenge. Diagnostic clues include elevated levels of white blood cells called eosinophils. These cells

typically are elevated in patients with worm parasites, but they can also occur in more common illnesses, including cancer, autoimmune disease and allergy. X-rays also show excess fluid around the lungs and sometimes the heart.

"You have to be a bit of a detective and be open to all the clues," says Washington University infectious diseases specialist Thomas Bailey, MD, professor of medicine, who diagnosed and treated the first case at the School of Medicine.

As a case in point, the first patient who sought treatment at Washington University had had a fever and cough for several weeks. His chest X-ray showed fluid around the lungs, and blood tests showed elevated levels of eosinophils.

The "aha moment" for Bailey occurred when the patient's wife mentioned that his symptoms developed about a week after he ate raw crayfish from a Missouri river, and Bailey recalled that in Asia eating raw or undercooked crabs can lead to a paragonimus infection. With a quick search of the medical literature, Bailey learned that rare cases of North American paragonimiasis had been described in patients eating raw crayfish. The scenario fit perfectly with his patient.

"That's the interesting thing about being an infectious diseases doctor," Bailey says. "Every time you see a new patient you have to be open to the possibility that the diagnosis could be something highly unusual."

Crayfish are common throughout North America, where hundreds of species live in rivers, streams, lakes and ponds. The parasite P. kellicotti has a complex life cycle. It lives in snails and crayfish but only causes a dangerous infection if it ingested by mammals, including dogs, cats and humans, who eat it raw.

No one knows why more cases of paragonimiasis are being diagnosed now, but doctors and researchers at Washington University are studying the parasite and hope to develop a better diagnostic test for the infection. For now, the message for physicians is to consider paragonimiasis in patients with cough, fever and eosinophilia. The simple message for the public is: "Do not eat raw crayfish," Weil says.

Physicians at Washington University School of Medicine published a review article last year that includes information about the first three cases of paragonimiasis they diagnosed: Lane MA, Barsanti MC, Santos CA, Yeung M, Lubner SJ and Weil GJ. Review Article: Human Paragonimiasis in North America following Ingestion of Raw Crayfish. Clinical Infectious Diseases. Sept. 15, 2009.

New pathway to cheap insulin

Researchers from Helmholtz Centre in Braunschweig, Germany, publish new and more efficient method to manufacture insulin

More than eight million diabetics live in Germany. Diabetes is not restricted to our prosperous society and the highest growth rates often occur in countries with aspiring economies such as in Asia. Worldwide, more than 285 million people suffer from this illness; with 50 million diabetics, India is the country with the most people affected by this disease. In Europe, Germany shows the highest prevalence in the population with twelve percent. In a German-Indo collaboration, researchers from the Helmholtz-Centre for Infection Research (HZI) in Braunschweig, Germany have now developed a new method to cheaply produce insulin for the treatment of diabetes. The group's results have now been published in the open access online research magazine Microbial Cell Factories. With this, all information is freely accessible for everyone and is not subject to patent law.

"As we did last year with an alternative protocol for the development of a hepatitis B vaccine, we again decided to use this way and make our knowledge available for everybody," says Ursula Rinas from the HZI, who chairs the German side of the project. Thus, people can access "insider-information" that makes it possible to cheaply produce medicine which in return can be affordable to people in developing countries.

The researchers wanted to develop a new procedure to increase the yield of an insulin precursor from which the actual insulin can be obtained, and in this way reduce costs. They found the yeast Pichia pastoris and modified the cells so that they produce the building block for insulin while growing on a special medium. The results were highly gratifying: "With our procedure, Pichia pastoris delivers high yields – twice as much as known before", says Ursula Rinas. "Already with few cells it is possible to produce a lot of the insulin precursor."

In the early 1980s, insulin was the first recombinant product approved by the FDA for human application. Today, human insulin is produced as recombinant protein, using two major routes. One route involves the production of the insulin precursor using the bacterium Escherichia coli as expression host with complex subsequent isolation, solubilization and refolding procedures. The other route involves the well-known baker's yeast Saccharomyces cerevisiae. The advantage of the latter route lies in the secretion of a soluble insulin precursor into the culture supernatant, making it easier for isolation and chemical modification. The newly described method from Ursula Rinas and her group also uses this route. The isolation of the precursor from the culture supernatant is only followed by enzymatic finishing. Insulin produced with this new method can be used

normally and is identical to human insulin. Currently, the researchers are working on a method to produce a vaccine against dengue fever using the same system as described here.
For most people in developing countries medicine is too expensive. The purchasing of insulin in those countries is often cost prohibitive. Another problem is patent law that makes it impossible to recreate medicine and sell it at low prices. Once a patent has expired, as is the case with insulin, the so called generic drugs can be produced cheaply. Unfortunately, emerging nations very often lack the insider knowledge to produce those generics.
Original article: Application of simple fed-batch technique to high-level secretory production of insulin precursor using Pichia pastoris with subsequent purification and conversion to human insulin. Gurramkonda C, Polez S, Skoko N, Adnan A, Gabel T, Chugh D, Swaminathan S, Khanna N, Tisminetzky S, Rinas U. Microb Cell Fact. 2010 May 12;9(1):31. [Epub ahead of print]

Vaccine hope for skin cancer sufferers

Nottingham scientists have been given the green light to test a vaccine which they hope could reverse, and even cure malignant melanoma, the most deadly type of skin cancer.

Scancell Holdings plc, led by Professor Lindy Durrant of the University's Division of Clinical Oncology within the School of Molecular Medical Sciences, believes the new vaccine, which targets tumour cells without damaging healthy tissue, could be successful in treating patients with malignant melanoma.

Incidences of malignant melanoma have more than quadrupled over the past 30 years and in the last 25 years rates of malignant melanoma have risen faster than for any other cancer. It is now the most common cancer in younger adults aged 15 to 34, which may be linked to risky associated behaviour such as exposure to the sun on foreign beach holidays and the use of tanning booths. Every year, most of the 2,000 skin cancer deaths result from malignant melanoma.

Professor Durrant said: “Up until now, early diagnosis has been a crucial factor in the successful treatment of this disease. In the early stages it can be cured by completely removing the skin melanoma by surgery. However, in cases where it has not been picked up until further down the line, we have found that chemotherapy and radiotherapy simply do not work, although new compounds are being tested.

“It is still at a very early stage and impossible to predict the outcome of the clinical trial but if our results from the lab are replicated in patients I think we have a good chance of dramatically improving the chances of successful treatment - we are hoping that the vaccine will cure between 10 and 20 per cent of patients with malignant melanoma.”

Testing for the new SCIB1 vaccine has been given approval by the Gene Therapy Advisory Committee and the Medicines and Healthcare products Regulatory Agency and clinical trials are due to start shortly at Nottingham City Hospital and centres in Manchester and Newcastle.

It will initially be given to patients who are suffering from advanced malignant melanoma which has spread to other parts of the body.

The new vaccine works by activating the body’s own natural defence systems - it contains DNA and genetic material from tumours meaning it ‘switches’ on the specific immune cells that target melanoma. This means that it targets only the cancer and not the surrounding healthy tissue.

The team of scientists believe that, in principle, new vaccines based upon the same principle could also be used to target other types of cancer tumours, such as breast and prostate.

Slow-release NSAIDs pose greater risk of GI bleeding

Risk of GI bleeding varies by drug and dose

A study conducted at the Spanish Centre for Pharmacoepidemiological Research revealed that the risk of gastrointestinal complications due to nonsteroidal anti-inflammatory drug (NSAID) use varies by specific NSAID administered and by dosage. The study further determined that NSAIDs with a long half-life or slow-release formulation are associated with a greater risk of GI bleeding or perforation. Study findings are published in the June issue of Arthritis & Rheumatism, a journal of the American College of Rheumatology.

NSAIDs such as Advil, Motrin and Aleve, are drugs that treat pain and inflammation by blocking the action of two cyclooxygenase (COX) enzymes. COX-2 promotes inflammation, but COX-1 protects the lining of the stomach. If an NSAID inhibits both COX-1 and COX-2, GI bleeding and ulcers can result.

According to the American College of Gastroenterology, it has long been recognized that persons using NSAIDs are at a significantly increased risk of gastrointestinal complications, for instance, injury to the intestinal lining that can result in ulcers and/or gastrointestinal bleeding. With millions taking NSAID pain medications every day, it is estimated that more than 100,000 Americans are hospitalized each year and between 15,000 and 20,000 Americans die each year from ulcers and gastrointestinal bleeding linked to NSAID use.

To reduce the morbidity associated with NSAIDs, specific estimates for individual drugs and individual groups of patients with different risk profiles are needed. This study assessed the risk of upper GI bleeding and

perforation among individual NSAIDs and analyzed the correlation between this risk and the degree of inhibition of whole blood COX-1 and COX-2 in vitro.

The research team conducted a systematic review of nine observational studies on NSAIDs and upper GI bleeding/perforation published between 2000 and 2008. The article criteria was 1) report case–control or cohort studies evaluating traditional NSAID or coxib use and upper GI bleeding/perforation in the general population, and 2) provide either an estimate or enough data to estimate a relative risk comparing NSAID users with nonusers. The pooled relative risk (RR) estimates of upper GI bleeding/perforation for individual NSAIDs was calculated, as well as whether the degree of inhibition of whole blood COX-1 and COX-2 in vitro by average circulating concentrations predicted the RR of upper GI bleeding/perforation.

The analysis suggests that NSAID-associated upper GI toxicity is the result of two pharmacologic features: drug exposure and sparing of COX-1 activity. These findings support the notion that there are multifactorial determinants in the risk of upper GI bleeding/perforation among NSAID users, including clinical background, use of concomitant medications, or a possible genetic susceptibility.

Study leader Luis A. García Rodríguez, M.D. states, "We showed that persistent exposure to the drug is an important independent determinant; in fact, drugs with a long half-life or slow-release formulation were associated overall with a greater risk than NSAIDs with a short half-life. We observed the lowest GI toxicity with coxibs, i.e., celecoxib and rofecoxib, which supports the notion that sparing of COX-1 in the GI tract and possibly in platelets translates clinically to a lower upper GI risk."

Article: "Variability Among Nonsteroidal Antiinflammatory Drugs in Risk of Upper Gastrointestinal Bleeding." Elvira L. Massó González, Paola Patrignani, Stefania Tacconelli, and Luis A. García Rodríguez, Arthritis & Rheumatism; Published Online: February 22, 2010 (DOI: 10.1002/art.27412); Print Issue Date: June 2010.
http://www3.interscience.wiley.com/journal/123299889/abstract

Giving credit to the right Dr. Wong: Seeking a unique ID for scientists

Which D. K. Wong gets credit for the next miracle cure? Is it Daniel Keith Wong, Danny Karl Wong, or Danellia Kay Wong? Scientists and publishers are trying to develop a new identity system - similar to a social security number - that would eliminate the alphabet soup of uncertainty that exists among authors of scientific papers with easily-confused names. That's the topic of an article in Chemical & Engineering News (C&EN), ACS' weekly newsmagazine.

C&EN Senior Editor Sophie Rovner notes that scientists rightly want credit for their research discoveries without being confused with individuals with the same name or initials. However, there's no universal system for attributing research discoveries to the correct scientist among many with the same name. As a result, researchers, publishers, and scientific and government organizations are seeking a "unique author identifier."

One possible approach to such unique identifiers involves setting up a central registry where every scientist could obtain an ID upon publication of their first paper and use it throughout a lifetime of publishing papers, applying for grants, and conducting other scientific business. The article describes a number of such projects currently being developed.

Article For Immediate Release "A Question of Identity"
This story is available at http://pubs.acs.org/cen/science/88/8821sci2.html

Artificial sweeteners, without the aftertaste: Scientists find bitter-blocking ingredient

Researchers have discovered a chemical that specifically blocks people's ability to detect the bitter aftertaste that comes with artificial sweeteners such as saccharin. The key is a molecule known only as GIV3727 that specifically targets and inhibits a handful of human bitter taste receptors, according to a report published online on May 27th in Current Biology, a Cell Press publication.

The finding of what the researchers say is the first commercially relevant small-molecule bitter taste inhibitor also opens the door to further discovery of compounds for other taste-enhancement purposes, such as hiding the yucky taste of medicines or other commonly encountered bitter flavors.

"To our knowledge, this is the first published example of a bitter receptor inhibitor with taste activity in humans," said Jay Slack of Givaudan Flavors Corp. in Cincinnati. "We applied high-throughput screening and medicinal chemistry approaches to develop specific inhibitors for human bitter taste receptors. While these methods are commonly used in the development of new drug candidates, ours is the first successful application of this technology for bitter taste modulation. This flavoring substance could be broadly used to improve the palatability of foods and beverages containing acesulfame K and saccharin."

Acesulfame K is a calorie-free sweetener sold as Sunett and Sweet One. Saccharin is often found in little pink packets at restaurants under the trade name Sweet'N Low.

In addition to its commercial potential in packaged foods and beverages, GIV3727 could also lead to important new insights in the scientific arena, the researchers said.

"Recent evidence indicates that some bitter receptors are also expressed in other nongustatory tissues with proposed roles in the detection of noxious airborne chemicals or regulation of glucose homeostasis via the gastrointestinal tract," the researchers noted in their report. "Bitter receptor antagonists hold promise as tools to explore the role of bitter receptor signaling in these other systems."

The method used by Slack, along with Wolfgang Meyerhof of the German Institute of Human Nutrition Potsdam-Rehbrücke and their interdisciplinary team, allowed the researchers to screen the activity of thousands of molecules against human bitter taste receptors, and specifically those receptors that respond to saccharin. Those studies led them to GIV3727, a chemical that was not previously known to have any particular taste properties. Further study led to the surprising discovery that GIV3727 works on five other human bitter receptors too.

Controlled human taste tests of artificially sweetened solutions with and without GIV3727 found that the ingredient had the desired effect. That is, almost everyone selected the beverages containing GIV3727 as being less bitter. Taste intensity ratings revealed that GIV3727 had an ability to reduce bitter tastes significantly. Importantly, those effects came without interfering with study participants' ability to taste sweetness.

The researchers said that there remains some possibility that GIV3727 might work for some people a little better than it does for others, noting that even though the chemical completely abolished bitter taste receptors in the laboratory, some people were apparently still able to detect bitterness to some degree. Those differences might be explained by known differences among people in bitter taste receptor genes, the researchers said.

The researchers include Jay P. Slack, Givaudan Flavors Corporation, Cincinnati, OH; Anne Brockhoff, German Institute of Human Nutrition Potsdam-Rehbruecke, Nuthetal, Germany; Claudia Batram, German Institute of Human Nutrition Potsdam-Rehbruecke, Nuthetal, Germany; Susann Menzel, German Institute of Human Nutrition Potsdam-Rehbruecke, Nuthetal, Germany; Caroline Sonnabend, German Institute of Human Nutrition Potsdam-Rehbruecke, Nuthetal, Germany; Stephan Born, German Institute of Human Nutrition Potsdam-Rehbruecke, Nuthetal, Germany; Maria Mercedes Galindo, German Institute of Human Nutrition Potsdam-Rehbruecke, Nuthetal, Germany; Susann Kohl, German Institute of Human Nutrition Potsdam-Rehbruecke, Nuthetal, Germany; Sophie Thalmann, German Institute of Human Nutrition Potsdam-Rehbruecke, Nuthetal, Germany; Liliana Ostopovici-Halip, Institute of Chemistry, Romanian Academy, Timisoara, Romania; Christopher T. Simons, Givaudan Flavors Corporation, Cincinnati, OH; Ioana Ungureanu, Givaudan Flavors Corporation, Cincinnati, OH; Kees Duineveld, Givaudan Nederland BV, Naarden, Netherlands; Cristian G. Bologa, University of New Mexico School of Medicine, Albuquerque, NM; Maik Behrens, German Institute of Human Nutrition Potsdam-Rehbruecke, Nuthetal, Germany; Stefan Furrer, Givaudan Flavors Corporation, Cincinnati, OH; Tudor I. Oprea, University of New Mexico School of Medicine, Albuquerque, NM; and Wolfgang Meyerhof, German Institute of Human Nutrition Potsdam-Rehbruecke, Nuthetal, Germany.

Nobel winner ties mental illness to immune defect

Bone-marrow transplants cure mice of hair-pulling compulsion

Salt Lake City– A Nobel Prize-winning University of Utah geneticist discovered that bone marrow transplants cure mutant mice who pull out their hair compulsively. The study provides the first cause-and-effect link between immune system cells and mental illness, and points toward eventual new psychiatric treatments.

"We're showing there is a direct relationship between a psychiatric disorder and the immune system, specifically cells named microglia that are derived from bone marrow" and are found in the brain, says Mario Capecchi, a distinguished professor of human genetics at the University of Utah School of Medicine. "There's been an inference. But nobody has previously made a direct connection between the two."

The findings – published in the Friday, May 28 issue of the journal Cell – should inspire researchers "to think about potential new immune-based therapies for psychiatric disorders," says Capecchi, a 2007 Nobel laureate in physiology or medicine.

Capecchi and colleagues showed that pathological grooming and hair-pulling in mice – a disorder similar to trichotillomania (trick-o-til-o-MAY-nee-ah) in humans – is caused by a mutant Hoxb8 gene that results in defective microglia, which are immune system cells that originate in bone marrow and migrate from blood to the brain. Microglia defend the brain and spinal cord, attacking and engulfing infectious agents.

Mice with pathological grooming appear to groom normally, but do so too often and for too long, leading to hair removal and self-inflicted skin wounds. The disease of pulling out head or body hair is common in humans; studies in seven international communities found trichotillomania affecting 1.9 to 2.5 of every 100 people.

In the key experiment, geneticist Shau-Kwaun Chen, Capecchi and colleagues transplanted bone marrow from normal mice into 10 mice that had a mutant Hoxb8 gene and compulsively pulled out their own chest, stomach and side fur. As the transplant took hold during ensuing months, grooming behavior became normal, four mice recovered completely and the other six showed extensive hair growth and healing of wounds.

"A lot of people are going to find it amazing," says Capecchi. "That's the surprise: bone marrow can correct a behavioral defect."

Nevertheless, "I'm not proposing we should do bone marrow transplants for any psychiatric disorder" in humans, he says. Bone marrow transplants are expensive, and the risks and complications are so severe they

generally are used only to treat life-threatening illnesses, including certain cancers and disabling autoimmune diseases such as lupus.

Capecchi says that mice with the mutant gene that causes pathological grooming now can be used to study the surprising connections between the immune system's microglia cells and mental illness – and ultimately to produce new treatments.

"We think it's a very good model for obsessive-compulsive disorder," he says.

The researchers also transplanted bone marrow into normal mice from Hoxb8 mutant, hair-pulling mice. The normal mice started pulling out their hair compulsively. Normal mice transplanted with normal bone marrow kept grooming normally, while mutant mice implanted with mutant bone marrow exhibited severe grooming and self-mutilation. Half died, probably due to difficulty re-establishing mutant bone marrow.

Capecchi and colleagues also proved that reduced sensitivity to pain among mutant Hoxb8 mice is not the cause of the animals' compulsive grooming and hair removal, as some researchers had believed.

Mutant Microglia from Marrow Link Immunity and Mental Disorder

Capecchi says previous studies have linked the immune system and psychiatric disorders, but not in a cause-and-effect manner. "If you look at people who are depressed, often you find their immune system isn't working normally," Capecchi says. And studies have shown that genes that confer a higher rate of depression, schizophrenia, obsessive-compulsive disorder, bipolar disorder and autism also "have something to do with the immune system," he adds.

The new findings "provide direct evidence for an association between neuropsychiatric diseases and dysfunction of the immune system or of the blood-forming system," says Capecchi.

Hox genes orchestrate embryo development. Hoxb8 is responsible for maintaining "myeloid progenitor cells," including those that give rise to monocytes, which are white blood cells that move from the circulatory system to the brain and become microglia.

It was surprising that the new study identified mutant microglia cells that originate in bone marrow as the cause of compulsive hair-pulling in mice. Researchers expected to find the mutant Hoxb8 in brain nerve cells that control grooming. It is the first study to suggest "there is a connection between microglia and behavior – and a direct connection," Capecchi says.

Capecchi says nerve cells or neurons represent only about 10 percent of the brain, and the rest is made of various glial cells, including microglia. There are two kinds of microglia in the brain. Sixty percent are "resident" microglia that form in an embryo's brain even before the blood circulation system develops. The second kind of microglia in the brain – 40 percent of the total – originates in bone marrow, and then moves to the brain, circumventing the blood-brain barrier.

The geneticists believed the mutant microglia originated in bone marrow because they did not find them among the resident microglia present in the mouse brain at birth, but instead saw microglia with mutant Hoxb8 first migrate into the mouse brain two days after birth. To identify the cells in the brain with active mutant Hoxb8 genes, the researchers used a method that attached a fluorescent yellow-green label to such cells.

Pathological Grooming is Different than Scratching an Itchy Rump

Capecchi first reported in 2002 that mice with mutant Hoxb8 genes displayed compulsive grooming and pulling out the hair on their chest, stomach and sides. Over the years, some researchers attributed this to reduced pain sensitivity also observed in mutant Hoxb8 mice, apparently due to nerve damage in the spinal cord. The idea was that reduced sensitivity to pain would make mice scratch more in response to an itch. In the new study, the Utah geneticists concluded that compulsive grooming and reduced sensitivity to pain were due to separate malfunctions of the Hoxb8 gene; the bone marrow transplants that cured hair-pulling did not restore the loss of pain sensitivity.

Also, mutating Hoxb8 genes in microglia from bone marrow made the mice groom pathologically but didn't make them insensitive to pain. Mutating Hoxb8 in the spinal cord resulted in reduced sensitivity to pain, but not compulsive grooming.

Finally, in earlier studies of mice insensitive to pain due to mutant Hoxb8, the mice used paws to scratch too much and cause hair loss and wounds on their rumps, near the tail. But mice in the Utah study used their teeth to remove hair on their chest, stomach and sides. They followed a normal head-to-rear grooming pattern, but did it excessively.

To be Determined: How Mutant Microglia Cause Hair-Pulling

How do mutant immune cells from bone marrow cause pathological grooming?

All we know now is that there are 15 percent fewer microglia in the brain when Hoxb8 is mutant, Capecchi says. "In the next wave of experiments, we can ask how microglia affect behavior. We anticipate it has to affect neural circuitry in some way."

He speculates ways mutant microglia might trigger pathological grooming: The microglia could make cytokines that activate or inhibit nerve activity, and thus influence behavior. Because microglia have long extensions that "feel" the synapses that connect nerve cells, they might be involved in controlling nerve-signal transmissions, he says. For now, "we have no idea which will be right," Capecchi says.

In Capecchi's 2002 study of mice with compulsive grooming, the researchers recorded the number and duration of each mouse's grooming sessions using a video recorder, which was very labor intensive to analyze. So in the new study, the mouse cages were placed on sensitive vibration-detecting platforms capable of distinguishing mouse vibration from different activities such as eating, drinking, grooming, climbing, sitting still, walking and scratching. They tested the method's accuracy by using a video camera to double check what the mice were doing at times.

The result: Mice with the mutant Hoxb8 gene spent about twice as much time grooming as their normal littermates.

The new study was funded by the Howard Hughes Medical Institute and the National Institutes of Health. Capecchi is senior author. The first author is Chen, who recently completed a Ph.D. in human genetics. They conducted the study with human genetics postdoctoral fellows Petr Tvrdik, Erik Peden and Sen Wu; Gerald Spangrude, an internal medicine professor; and Scott Cho, a graduate student in Spangrude's lab.

Capecchi shared the 2007 Nobel Prize in Physiology or Medicine for developing "gene targeting" in mice, a method of knocking genes out of action to see what goes wrong and thus learn each gene's normal function.

Scientists Challenge 'Breakthrough' on Fossil Skeleton

By JOHN NOBLE WILFORD

The fossil skeleton known as Ardi, hailed in some quarters as the scientific "breakthrough" of 2009, has now drawn critics who dispute claims that the species lived in dense woodlands rather than grassy plains, which have been long considered the favored habitat of early prehumans and perhaps account for their transition to upright walking.

Another scientist has stepped forward to challenge Ardi's classification as a member of the human lineage after the divergence from African apes. Its primitive anatomy, he contends, suggests a species predating the common ancestor of the human and chimpanzee family trees.

Two critiques are being published Friday in the journal Science, along with responses from the research team that reported last October the first detailed description and interpretation of the 4.4-million-year-old skeleton of Ardipithecus ramidus, or Ardi. The specimen, an adult female, probably stood four feet tall and was more than a million years older than Lucy, the famous skeleton of the species Australopithecus afarensis.

An international team led by Tim D. White of the University of California, Berkeley, discovered the fossils in 1992. It took 17 years to reconstruct and analyze the skeleton and related specimens and also to study the habitat in which the species had lived, in what is now Ethiopia. The team's comprehensive report appeared in Science, which called it the "breakthrough of the year."

It was perhaps inevitable that a discovery of such magnitude should draw critical fire, as Dr. White himself acknowledged this week in an e-mail message. "It was bound to generate some give and take," he said. "So from that point of view, this is just part of normal science."

The question of Ardi's habitat was raised by Thure E. Cerling, a geochemist at the University of Utah, and seven other geologists and anthropologists. They said they used the White team's own data for soils and silica from ancient plants, and found it did not support an interpretation that Ardi lived in thick woods.
Instead, Dr. Cerling's group said, "We find the environmental context of Ar. ramidus at Aramis to be represented by what is commonly referred to as tree- or bush-savanna, with 25 percent or less woody canopy cover."

The critics said that a landscape with a minimum of 60 percent trees and shrubs was required to meet the definition of a closed-canopy woodland. In other words, the findings did not, as Dr. White's team inferred, overturn what is known as the savanna hypothesis associated with the evolution of upright walking - bipedalism - as a distinctive characteristic setting prehumans apart from ancestral apes.

Members of Dr. Cerling's group said they were not advocating this conventional hypothesis, simply noting that Ardi data supported it rather than contradicted it.

In its published response, the White team said the critics ignored "the totality of the fossil, geological and geochemical evidence" presented in its original papers. There were indeed grasses at the site, the team noted, but the abundant fossils there were of mammals adapted to wooded life, and this established Ardi as "a denizen of the closed habitats," not the open savanna.

Francis H. Brown, also a Utah geologist and an experienced researcher of early human origins who was a co-author of the Cerling paper, said in a recent interview, “We’re trying to set the record straight - we don’t think open savanna grassland is what Ardi lived in, nor is it a closed wooded environment.”

Another scientist, Esteban E. Sarmiento of the Human Evolution Foundation in East Brunswick, N.J., challenged the identification of Ar. ramidus as a hominid - a species of the human lineage that arose from an ancestor in common with the branch leading to modern chimpanzees.

“Sufficient support for this claim, however, is lacking,” Dr. Sarmiento, a vertebrate zoologist, wrote in a one-page article in Science. He cited the Ardi skeleton’s primitive aspects and molecular and anatomical studies that he said suggested Ar. ramidus “predates the human/African ape divergence.”

In its rebuttal, Dr. White’s team noted that Dr. Sarmiento based his argument on biomolecular estimates of the hominid-ape divergence at three million to five million years ago. These dates are unreliable, the team wrote, and other fossil discoveries have pushed the divergence time back sometime before six million years ago. Dr. White said in his e-mail message that Dr. Sarmiento had failed “to recognize as significant the multiple and independent features of the Ardipithecus cranium, dentition and skeleton,” which he added “uniformly align this primate with all later hominids, including Lucy, to the exclusion of any other ape, living or fossil.”

A few anthropologists have expressed doubts, as yet unpublished, about Ardi’s place in the human lineage. Richard G. Klein, a Stanford University anthropologist and another co-author of the Cerling paper, said in an interview, “I frankly don’t think Ardi was a hominid, or bipedal.”

Daniel E. Lieberman, a paleoanthropologist at Harvard who was neither a critic nor defender in the dispute, said he was “convinced that Ardi is a hominid.” But he added, “Everybody has questions about the kind of hominid it is, and about what this has to say about the last common ancestor of hominids and chimps.”

Supplement may prevent alcohol-related brain, skull defects

Augusta, Ga. - The dietary supplement CDP-choline, sold as a brain-boosting agent and under study for stroke and traumatic brain injury, may block skull and brain damage that can result from alcohol consumption early in pregnancy, Medical College of Georgia researchers report.

Alcohol consumption in early pregnancy increases levels of a little-known lipid called ceramide, significantly increasing suicide among cells critical to skull and brain formation, Dr. Erhard Bieberich, biochemist in the MCG Schools of Graduate Studies and Medicine, reports in Cell Death and Disease.

Resulting neural crest damage includes the brain's "skin" – the multi-layered meninges that provides protection and nourishment – producing less TGF-β1, a growth factor critical for brain and bone development. That finding may help explain the cranial bone and cognitive defects that can result in fetal alcohol syndrome.

"There is just a little window," Bieberich said, about four weeks after conception when neural crest cells emerge for a few days before morphing into other cell types that help form numerous organs. This is often before a woman knows she is pregnant. The studies indicate the potential for lasting damage to the fetus if a woman drinks, for example, several glasses of wine within an hour during that window.

MCG researchers suspected ceramide, known to induce cell death and be activated by alcohol, as a culprit in the damage. They found high levels of ceramide both in mouse cells and pregnant mice exposed to alcohol along with a five-fold increase in apoptotic, or dying cells. "There is a clear correlation," he said.

Researchers thought neural crest cells were tough cells whose function could be replaced if they happened to get injured. Instead they found that 25 percent of mouse embryos exposed to alcohol during that critical period had defects in the fibrous joints that connect the skull. "You get a snowball effect: The neural crest is damaged, the meninges doesn't develop properly and tissue like bone and brain that are regulated by the meninges don't develop properly either," Bieberich said.

When they added ceramide-neutralizing CDP-choline to the mouse cells, cell death and ceramide levels were reduced. Alcohol prompts the body to produce more ceramide from the brain lipid sphingomyelin, a major component of cell membranes. They found that CDP-choline pushes back toward producing less ceramide, preventing damage providing the drinking stops.

"Ceramide can be bad or good," notes Bieberich, who has shown, for example, ceramide's role in helping early stem cells evolve into embryonic tissue. But alcohol upsets the natural balance.

Follow up studies, funded by the March of Dimes, include determining whether CDP-choline can rescue cells after the fact or whether it or a similar supplement would need to be taken preventively. "Hopefully we can rescue some of the cells by triggering or signaling the back reaction," Bieberich said. He also wants to see if CDP-choline affords the same protection in pregnant mice that it does in laboratory cells.

Dr. Guanghu Wang, MCG research scientist, is the study's co-author.

Exchange meat for sex? No thank you

* 15:52 27 May 2010 **by Ewen Callaway**

Prostitution might be the world's oldest profession, but it's not nearly as ancient as some had suggested. It turns out that there is no support for the widespread belief that male chimpanzees trade meat for sex, suggesting that sexual bartering among humans may be an evolutionarily recent phenomenon.

"I kept finding references to 'meat for sex' all over the place, saying this is what chimpanzees do," says Ian Gilby, a primatologist at Duke University in Durham, North Carolina. "Knowing from observation and reading the evidence, they really don't."

Most reports of male chimps trading meat for sex are anecdotal, Gilby says. Only one study has found statistically meaningful, if indirect, support for such swaps, showing that male chimpanzees are more likely to hunt for monkeys when oestrous females are around.

Yet when Gilby's team examined observations from four chimpanzee communities in Uganda and Tanzania spanning 28 years, they found no evidence that female fertility affected whether males hunted or not.

Other evidence also questions the idea of meat for sex, Gilby says. Males with access to meat were no likelier to share it with oestrous females – who can become pregnant – than with non-oestrous females. Nor do they preferentially give meat to older females, who tend to be more likely to conceive than younger females.

Why share?

What's more, sex rarely occurs right after meat-sharing, and males who share meat are no likelier to have sex than males who don't share, Gilby's team report.

Why, then, do chimpanzees share meat, if not for sex? One possibility is that chimpanzees use meat to gain coalitional support and even grooming services from other males and females, Gilby says. The extent of meat sharing tends to correlate with grooming, but no one has yet demonstrated any sort of quid pro quo.

A more likely explanation is that chimps share meat because others beg, Gilby says. He has found that the more a chimp eating meat is harassed, the more he shares; that begging slows the speed at which chimps eat meat; and that begging tends to stop one meat is shared.

"It doesn't involve males thinking about who owes them favours," Gilby says. "It is essentially 'you're in my face bugging me, because you're there harassing me for meat I can't eat'."

Dead and buried?

The meat-for-sex hypothesis may not be ready for burial just yet, however.

Last year, Cristina Gomes and Christophe Boesch at the Max Planck Institute of Evolutionary Anthropology in Leipzig, Germany, found that, over a 22-month period, female chimpanzees were more likely to mate with males who offered them meat than with males who did not share. However, they found no evidence for immediate meat-for-sex trades, nor did they find that males who shared more meat got more sex.

One explanation for this discrepancy could be the cost of short-term exchanges, Gomes says. Males who hunt risk ceding their access to oestrous females to other chimpanzees. Long-term exchanges could be a way of gaining the benefits of meat for sex, without taking such risks.

Gomes also notes that Gilby's team examined only east African chimpanzees, and points out that the west African animals she studied in the Ivory Coast's Taï National Park behave differently. Compared to their eastern brethren, western chimps share meat more often but have less sex.

Journal reference: Journal of Human Evolution, DOI: 10.1016/j.jhevol.2010.02.006

Ultrasound could boost tissue implant success

New research published in SAGE-Hindawi open-access Journal of Tissue Engineering

London, UK - When we think of ultrasound, it's usually imaging the inside of the body that springs to mind. However, while ultrasound imaging typically requires frequencies that are 50 to 2500 times higher than those human ear can detect, recent increasing evidence indicates that ultrasound at lower frequency can also be used to help certain body tissues to heal and regenerate. Now research that appears in Open Access Journal of Tissue Engineering published by SAGE-Hindawi suggests that ultrasound could also help tissue grafts to survive and thrive following surgery.

Ultrasound can improve cell viability, thanks to its ability to get molecules moving, and researchers have used it to increase blood flow to tissues in the process of healing and regenerating. In particular, low-intensity ultrasound (LIUS) has been used to help regenerate cartilage and bone, and in tissue engineering to stimulate cells.

Surgeons use a patient's own fatty tissue (adipose tissue) in procedures including facial plastic surgery, treating burn victims, breast reconstruction and surgery on the vocal cords. But how well these tissue grafts survive can vary, and the time period after the surgery before a blood supply is re-established is particularly

critical. If the graft doesn't get sufficient oxygen and glucose, and clear away waste, the grafted tissue will wither and die.

An international research team, including researchers from MIT, the Center for Laryngeal Surgery and Voice Rehabilitation at Massachusetts General Hospital, Boston and Ben Gurion University in Beer-Sheva, Israel, set out to test whether ultrasound could improve the viability of grafted tissue during the post-op period.

The researchers used adipose cells cultured from tissue left over from tummy-tuck operations as well as mouse muscle cells (C2C12 cells) for their experiments. Over a six-day period, the test cells were treated with LIUS at 30mW/cm2 for short bursts of three or ten minutes. They assayed for the number of cells, metabolism (by observing how much glucose they consumed and how much lactate they produced), viability and for signs of damage to the cells.

The C2C12 muscle cells stimulated with LIUS showed greater cell numbers and better viability than controls. Also for the first time the researchers obtained preliminary evidence that LIUS can influence the viability of the cultured adipose cells (known as organoids) in an in vitro organ culture model. Adipose tissue treated with LIUS showed significantly increased metabolic activity, and had fewer markers for tissue damage than tissue not treated with LIUS.

If the technique was used on a patient, the way that ultrasound might enhance molecular motion would probably depend on local variations in tissue density. "Depending on the location of the probe, one can expect variable effects of LIUS," says senior author Steven Zeitels, MD, Director of the Center for Laryngeal Surgery and Voice Rehabilitation.

It's also not clear whether the increased metabolic activity and proliferation of the cells seen in this experiment was simply due to LIUS's mechanical and thermal effect in stimulating molecules to move around more. "In the context of using LIUS to enhance autograft survival, the possibility that the LIUS can directly activate signalling pathways in implanted cells needs to be taken into account. It may eventually be possible to manipulate cellular responses by fine-tuning this technique." says lead author Hyoungshin Park, PhD, from MIT.

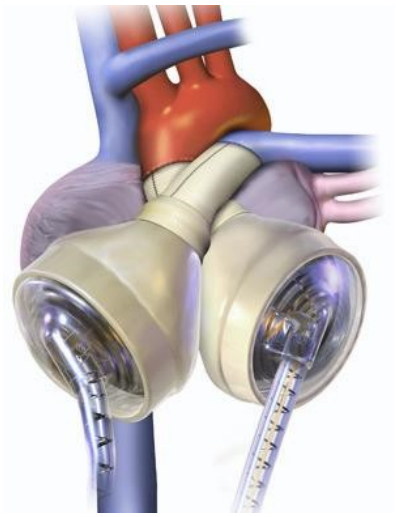
It remains to be seen whether these laboratory results will hold up in in vivo studies, but these preliminary results suggest important avenues to pursue in efforts to improve graft survival.

Indirect low-intensity ultrasonic stimulation for tissue engineering by Hyoungshin Park, Michael Yip, Beata Chertok, Joseph Kost, James B. Kobler, Robert Langer, and Steven M. Zeitels is published in the Journal of Tissue Engineering. The Journal is Open Access and the paper is free to read online now from http://www.sage-hindawi.com/journals/jte/2010/973530.html.

Arizona man is first to take artificial heart home

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

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



Artificial heart **Image: SynCardia Systems**

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

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

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

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

How do the artificial hearts work?

Surgeons remove both existing ventricles and replace each with a vessel, similar to an upturned funnel, which contains a flexible diaphragm. All four valves of the heart are also removed. The artificial right ventricle

is then hooked up to the cardiovascular system so that it can accept "used" blood that arrives, deoxygenated, from the rest of the body, and then pump this out to the lungs for reoxygenation.

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

Why does this keep someone hospital-bound?

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

So how did Okeke "escape"?

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

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

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

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

Is the SynCardia heart the only option?

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

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

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

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

What other body parts can be replaced with implants?

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

To double spud production, just add a little spit

ITHACA, N.Y. – When it comes to potentially doubling the output of the world's fourth largest food crop, the secret may be in the spit. Researchers at Cornell University, as well as the University of Goettingen and National University of Colombia, have discovered that when a major South American pest infests potato tubers, the plant produces bigger spuds.

The secret to this increased yield, they write in the peer-reviewed journal Ecological Applications (April 28, 2010), is found that the saliva of the Guatemalan potato moth larvae (Tecia solanivora). The major pest, which forces many farmers to spray plants with pesticides every two weeks, contains compounds in its foregut that elicits a system-wide response in the Colombian Andes commercial potato plant (Solanum tuberosum) to produce larger tubers.

The researchers found that when the spit of the tuber moth caterpillar gets into a tuber, all the other tubers of the plant grow bigger, said co-author André Kessler, Cornell assistant professor of ecology and evolutionary biology. Researchers believe that compounds from the insect's saliva somehow increases the rate of the plant's photosynthesis to compensate for the tubers lost to the caterpillar damage. As a result of more photosynthesis, more carbon is drawn into the plant and used to create starch, which makes for bigger tubers.

Plants have a number of responses to insects and other animals that eat them, including changing metabolism or producing toxins, said Kessler. In turn, the herbivores may develop strategies to counter the plant's defenses and influence its signaling pathways. "This could be an example where the co-evolutionary arms race led to a beneficial outcome for both," said Kessler.

Another key seems to be getting the right mix of potato and pest. When the larvae infested fewer than 10 percent of the tubers, the plant produced marketable yields (after infested tubers were removed) that weighed 2.5 times more than undamaged plants, according to the study. When up to 20 percent of the potatoes were damaged, marketable yields still doubled. When as many as half of the potatoes were infested, yields equaled those of plants with no infestation.

The findings have implications for potato farmers. Once isolated, the compound could lead to considerably higher yields in some varieties.

Initially, researchers wanted to show how these pests reduced potato yields, but they actually they found yield increases, said Katja Poveda, the study's principal investigator, at the Agroecology Institute of the University of Goettingen, Germany, and the Cornell entomology department.

"The moth eats all varieties of potatoes, but so far only this one variety responded" with increased yields among seven varieties that were tested as part of a larger project, said Poveda. Future experiments will test more commercial varieties, as well as wild potatoes, she added.

The potato study was funded by the German Research Foundation.

Experimental treatment protects monkeys from lethal Ebola virus post-exposure

Scientists using tiny particles of genetic material to interfere in the replication process of the deadly Ebola virus have successfully prevented monkeys exposed to that virus from dying of hemorrhagic fever. The proof-of-concept study, published in this week's issue of The Lancet, suggests that such protection also should be possible in humans.

"Over the past decade, we have evaluated numerous therapeutic approaches for the treatment of lethal viruses, such as Ebola," said co-author Dr. Lisa E. Hensley of the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID). "None of them have conferred complete protection to Ebola virus-infected primates - until now."

Using particles called small interfering RNAs (siRNAs), the authors targeted a protein (called the L protein) that is essential for Ebola virus replication. RNA inhibitors, as they are commonly called, are based on a natural gene silencing mechanism used by all cells, and RNAi therapeutics rely on a delivery technology to be effective.

Lipid nanoparticles (LNPs) are the most widely used siRNA delivery approaches. In this study, the research team used a proprietary technology called SNALP, or stable nucleic acid-lipid particles, to deliver the therapeutics to disease sites in animal models infected with the Zaire strain of Ebola virus (ZEBOV).

A group of three rhesus macaques was given anti-ZEBOV siRNAs intravenously, 30 minutes after exposure to the virus, and again on days 1, 3, and 5. A second group of four macaques was given the treatment after 30 minutes, and on days 1, 2, 3, 4, 5, and 6, after challenge with ZEBOV.

Two of the three animals in the first group (which received four post-exposure treatments) were protected from lethal ZEBOV infection and survived. All four of the monkeys given seven post-exposure treatments were protected. The treatment regimen in the second study was well tolerated, with minor changes in liver enzymes that might have been related to viral infection.

The study represents the first demonstration of complete protection against a lethal human infectious disease in nonhuman primates using RNAi, according to lead author Dr. Thomas W. Geisbert of the Boston University School of Medicine.

"We believe this work justifies the immediate development of Ebola SNALP as a countermeasure to treat Ebola infected patients, either in outbreaks or accidental laboratory exposures," he said.

Ebola virus causes hemorrhagic fever with case fatality rates as high as 80 percent in humans. The virus, which is infectious by aerosol (although more commonly spread through blood and bodily fluids of infected patients), is of concern both as a global health threat and a potential agent of biological warfare or terrorism.

Currently there are no available vaccines or therapies, so researchers working with Ebola virus must do so in maximum containment (Biosafety Level 4) laboratories. In these specially designed laboratories, investigators wear positive pressure "space suits" and breathe filtered air as they work, and all laboratory waste streams are sterilized.

The SNALP-RNAi therapeutic used in the study was developed by Tekmira Pharmaceuticals Corporation of Vancouver, BC. Previous research showed that these siRNAs completely protected guinea pigs when administered shortly after a lethal dose of ZEBOV was administered. While rodent studies are useful for

screening prospective medical countermeasures, they are frequently not useful for prediction of efficacy in the more stringent non-human primate models.

Further studies in monkeys would be necessary to refine dosing, toxicology and other issued before the treatment could be licensed for human use.

"The significance of this report goes beyond the protection against Ebola virus," said COL John P. Skvorak, commander of USAMRIID. "It also represents the potential for this concept to be applied to other viral infections."

The study was a collaborative effort between USAMRIID, Boston University and Tekmira, and was partly funded by the Defense Threat Reduction Agency's Transformational Medical Technologies Initiative.

Safety Rules Can't Keep Up With Biotech Industry

By ANDREW POLLACK and DUFF WILSON

They are the highly trained, generally well-paid employees in the vanguard of American innovation: people who work in biotechnology labs. But the cutting edge can be a risky place to work.

The casualties include an Agriculture Department scientist who spent a month in a coma after being infected by the E. coli bacteria her colleagues were experimenting with.

Another scientist, working in a New Zealand lab while on leave from an American biotechnology company, lost both legs and an arm after being infected by meningococcal bacteria, the subject of her vaccine research.

Last September, a University of Chicago scientist died after apparently being infected by the focus of his research: the bacterium that causes plague.

Whether handling deadly pathogens for biowarfare research, harnessing viruses to do humankind's bidding or genetically transforming cells to give them powers not found in nature, the estimated 232,000 employees in the nation's most sophisticated biotechnology labs work amid imponderable hazards. And some critics say the modern biolab often has fewer federal safety regulations than a typical blue-collar factory.

Even the head of the federal Occupational Safety and Health Administration acknowledges that his agency's 20th-century rules have not yet caught up with the 21st-century biotech industry.

"Worker safety cannot be sacrificed on the altar of innovation," said David Michaels, OSHA's new director. "We have inadequate standards for workers exposed to infectious materials."

The current OSHA rules governing laboratories, for example, were not written with genetic manipulation of viruses and bacteria in mind. "The OSHA laboratory standard deals with chemicals," Mr. Michaels said. "It doesn't deal with infectious agents."

Earlier this month, as a first step toward possible new regulations, the agency issued a sweeping request for information on occupational risks from infectious agents, and for suggestions on how best to reduce them. The focus is mainly on hospital and other health care workers, but any rules are expected to also cover industry laboratory workers.

Some safety experts in the biotechnology industry argue that there is no big safety problem, and that workers are adequately protected by various voluntary guidelines on safe laboratory practices and by OSHA's general rule that employers provide a safe workplace. "The OSHA requirement applies to all industries, including the pharmaceutical industry," said John H. Keene, a biosafety consultant to industry and former president of the American Biological Safety Association, a professional society for those involved in biolab safety.

But at least three trends are stoking concern among safety advocates. In the wake of the 2001 anthrax attacks, the federal government stepped up research involving biowarfare threats, like anthrax, Ebola and many other of the world's deadliest pathogens. Another factor is that the new techniques of so-called synthetic biology allow scientists to make wholesale genetic changes in organisms rather than just changing one or two genes, potentially creating new hazards. Just this month, the genome pioneer J. Craig Venter announced the creation of a bacterial cell containing totally synthetic DNA, which Dr. Venter described as the first species "whose parent is a computer."

The third trend involves the shifting focus of the pharmaceuticals industry - potentially the largest source of new biotechnology jobs. Drug makers, responding to competition from cheap generic medications, are moving beyond the traditional business of making pills in chemical factories to focus instead on vaccines and biologic drugs that are made in vats of living cells.

There are currently few good statistics on biolab accidents. One study, reviewing incidents discussed in scientific journals from 1979 to 2004, counted 1,448 symptom-causing infections in biolabs, resulting in 36 deaths. About half the infections were in diagnostic laboratories, where patient blood or tissue samples are analyzed, and half in research laboratories.

But that may be a “substantial underestimation,” the study’s authors wrote, because many incidents are never made public. The study was done by two biosafety experts and published in the book “Biological Safety: Principles and Practices.”

A survey done by the Bureau of Labor Statistics in 2006 found that the rate of workplace injury and illness in corporate scientific research laboratories was well below the average for all industries. The survey included labs in industries like information technology as well as biotechnology, and excluded labs handling the most dangerous pathogens.

Allegations about a more recent case came to light only through a lawsuit. It was filed against the drug giant Pfizer by Becky McClain, a former molecular biologist at the company’s largest research center, which employs 3,500 people in Groton, Conn.

Ms. McClain, now 52, says she has suffered bouts of temporary paralysis after being infected by a genetically engineered virus at the Groton lab. A jury last month awarded Ms. McClain $1.37 million, saying Pfizer had fired her for raising questions about laboratory safety.

Pfizer said it went to considerable effort to accommodate Ms. McClain and dismissed her for refusing to return to a safe workplace. The company also pointed out that OSHA had found that Ms. McClain was not fired for raising safety concerns. But the jury ruled otherwise, saying Ms. McClain was indeed fired for raising safety concerns of public interest.

The jury never actually addressed whether a workplace virus had made Ms. McClain ill, because the judge threw out that claim, in part for lack of evidence. Mr. Michaels, the OSHA director, declined to comment on the McClain verdict, but said the issues under dispute in her case underscored the gaps in regulatory protection for lab workers.

For almost all private businesses, OSHA requires employers to report workplace deaths and serious accidents. But the information is usually kept in-house by employers and given to OSHA only if requested during an annual spot check of 80,000 companies - a small fraction of the approximately seven million employers bound by OSHA regulations.

Moreover, OSHA does not have jurisdiction over many academic and government biolabs, where there have been dozens of known cases of worker illness or at least exposure to harmful agents.

Many laboratories in both the public and private sectors adhere to practices in a safety manual published jointly by the Centers for Disease Control and Prevention and the National Institutes of Health. Employees of government biolabs and others that receive federal research grants for genetic engineering are covered in part by stricter guidelines from the National Institutes of Health, and some companies voluntarily follow those guidelines. But other private industry workers are dependent on OSHA.

Mr. Michaels said that rather than trying to establish new rules for each infectious agent or for any specific hazards, he expected OSHA to eventually require employers, in consultation with their employees, to identify all potential hazards in their workplaces and to take steps to reduce them. OSHA would then have the power to cite employers for failure to adequately implement this process.

“OSHA has 2,000 inspectors for 130 million-plus workers in seven million workplaces,” Mr. Michaels said. “We can’t take them on one at a time.”

Despite the fact that some worker advocates are pointing to Ms. McClain’s case as representative of broader problems, they are hard pressed to cite other examples of workers in biotechnology companies being harmed.

But these advocates contend that the reason more cases in private industry are not coming to light is that current rules do not put enough pressure on companies to report them. And OSHA’s general safety requirement is notoriously difficult to enforce.

“We don’t know how many Becky McClains there are,” said Adam M. Finkel, who worked for OSHA both as a regional administrator and a director of health standards. “Everybody knows there’s new stuff being made every day that’s incredibly dangerous, but nobody knows how to get their arms around it.”

Mystery fossil is ancestor of squid

By Katia Moskvitch Science reporter, BBC News

The ancestors of modern squid may have existed half a billion years ago - a lot earlier than previously thought. In a new study, Canadian researchers identified a previously unclassifiable fossil that was long believed to belong perhaps to the shrimp family. They called it Nectocaris pteryx - a small soft-bodied cephalopod with two tentacles rather than the eight or 10 seen in today's octopuses. The new survey's results were presented in the journal Nature. The findings make the ancestors of modern squid and octopuses at least 30 million years older.

Evolutionary biologist Martin Smith, the main author of the study, told PA news agency that the findings bring cephalopods much closer to the first appearance of complex animals.
"We go from very simple pre-Cambrian life-forms to something as complex as a cephalopod in the geological blink of an eye, which illustrates just how quickly evolution can produce complexity," said Mr Smith.

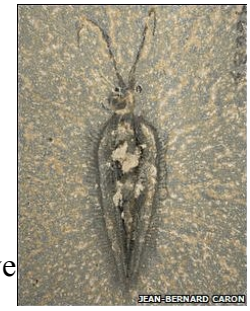
The authors described Nectocaris as a kite-shaped creature that was flattened from top to bottom. They say it was between two and five cm long and had large, stalked eyes. The tiny animal is believed to have been a carnivore that hunted for prey with two long grasping tentacles. It used a nozzle-like funnel under its eyes that could "swivel like a pivoted cannon" to jet itself around the ocean - just like modern squids and octopuses.

An artist's drawing of a Nectocaris pteryx The ancient squid hunted using its two long tentacles

The fossil isn't a new find - it was discovered decades ago in the Burgess Shale deposits atop a mountain in Yoho National Park in British Columbia, Canada.

The Burgess Shale Formation is one of the world's most famous fossil fields.

Scientists tried to describe the fossil for the first time in 1976 - but back then, they just weren't sure where it belonged on the evolutionary tree. They dubbed it "unclassified".
According to Jean-Bernard Caron, Mr Smith's co-author, researchers originally thought the mystery creature could have been a relative of anything from a lobster to a fish.
But after Mr Smith, a University of Toronto PhD student, decided to re-examine the fossil together with 91 new specimens collected in recent years, scientists were finally able to give the animal its proper place in history.



Fossil of Nectocaris pteryx Nectocaris was a small, kite-shaped creature

Teenagers who died didn't take Miaow Miaow

Helen Thomson, biomedical news editor

A landmark case that pushed through laws banning the drug mephedrone - popularly known as 'Miaow Miaow' - has come under strong criticism. A toxicology report of the two teenagers thought to have died from the drug showed neither had actually taken it.

"Legal high kills two teens," cried the Daily Express earlier this year. There followed a steady stream of stories in the UK media of the dangers of the then little known "legal high".

The government subsequently rushed through an emergency ban on the drug and related compounds that became law in early April. Although implicated in 27 deaths, a report by the International Centre for Drug Policy at University College London found it to be a contributing factor in just one.
Today, this knee jerk reaction came under further criticism following the negative toxicology tests. Reacting to this finding, David Nutt, chair of neuropsychopharmacology at Imperial College London, said: "If these reports are true, the previous government's rush to ban mephedrone never had any serious scientific credibility."

"This shocking news should be a salutary lesson to the tabloid journalists and prejudiced politicians who held a gun to the heads of the ACMD [Advisory Council on the Misuse of Drugs] and demanded that this drug should be banned, before a single autopsy had been completed," adds Colin Blakemore, professor of neuroscience at the University of Oxford. "The only good that might emerge from this fiasco is a long-overdue review of drug control policy."

Rutgers cell biologist pinpoints how RNA viruses copy themselves

RNA viruses hijack cellular enzyme to create viral replication factories on cell membranes

Nihal Altan-Bonnet, assistant professor of cell biology, Rutgers University in Newark, and her research team have made a significant new discovery about RNA (Ribonucleic acid) viruses and how they replicate themselves.

Certain RNA viruses – Poliovirus, Hepatitis C virus and Coxsackievirus – and possibly many other families of viruses copy themselves by seizing an enzyme from their host cell to create replication factories enriched in a specific lipid, explains Altan-Bonnet. Minus that lipid – phosphatidylinositol-4-phosphate (Pl4P) – these RNA viruses are not able to synthesize their viral RNA and replicate. The key structural components on cell membranes, lipids often serve as signaling molecules and docking sites for proteins.

Viral replication is the process by which virus particles make new copies of themselves within a host cell. Those copies then can go on to infect other cells. An RNA virus is a virus that has RNA, rather than DNA, as its genetic material. Many human pathogens are RNA viruses, including SARS virus, West Nile virus, HIV, and the ones Altan-Bonnet has been studying.

As reported in the May 28, 2010 issue of Cell, Altan-Bonnet and her co-researchers for the first time have uncovered that certain RNA viruses take control of a cellular enzyme to design a replication compartment on the cell's membrane filled with PI4P lipids. Those lipids, in turn, allow the RNA viruses to attract and stimulate the enzymes they need for replication. In uninfected cells, the levels of PI4P lipids are kept low, but in virally infected cells those levels increase dramatically. The findings by Altan-Bonnet and her colleagues not only open several possibilities for preventing the spread of various viral infections, but also may help to shed new light on the regulation of RNA synthesis at the cellular level and potentially on how some cancers develop.

"The goal of the virus is to replicate itself," notes Altan-Bonnet. "For its replication machines to work, the virus needs to create an ideal lipid environment which it does by hijacking a key enzyme from its host cell."

Altan-Bonnet and her team also were able to identify the viral protein (the so-called 3A protein in Poliovirus and Coxsackievirus infections) that captures and recruits the cellular enzyme (phosphatidylinositol-4-kinase III beta). Additionally, her lab was able to impede the replication process by administering a drug that blocked the activity of the cellular enzyme once it had been hijacked. Drug therapies to prevent viral replication potentially also could be targeted to prevent the hijacking of the enzyme.

Once that enzyme is hijacked, cells are prevented from normally operating their secretory pathway, the process by which they move proteins to the outside of the cell. In many cases, the impeding of that process can result in the slow death of the cell, leading to such problems as cardiac and vascular complications in those infected with the Coxsackievirus and neurological damage in those with Poliovirus.

Utilizing their recent findings, Altan-Bonnet and her team now plan to investigate PI4P dependence in other viruses as well as the role other lipids may play in different virus families. For example, the SARS virus also requires a lipid-rich environment for its replication, so her lab now is working with SARS researchers on determining what lipid is necessary for that virus's replication. In addition, they will be examining the role of lipids in regulating RNA synthesis in cells, potentially providing new insight into some of the cellular mutations that occur in cancer.

"Given that a lot of what we know about cellular processes historically comes from the study of viruses, our studies may provide insight into the novel roles lipids play in regulating the expression of genetic material in cells," notes Altan-Bonnet.

Altan-Bonnet's research into RNA replication is supported with grants from the National Science Foundation and the Busch Foundation. To learn more about Altan-Bonnet's research, visit http://newarkbioweb.rutgers.edu/Altan-Bonnet%20Lab/.

How short can a planet's year be?

* 18:19 28 May 2010 **by Ken Croswell**

HOW short can a planet's year be? That's the question raised by a planet orbiting its star in less than an Earth day. The planet, named 55 Cancri e, was discovered years ago. It is a "super-Earth" – a world with a mass several times that of Earth – and orbits a star like our sun.

Now Rebekah Dawson and Daniel Fabrycky at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts, say gaps in the observational record meant the planet's orbital period – originally thought to be about three days – was miscalculated.

Their analysis shows that the planet's true year is 17 hours and 41 minutes. There may be a planet around the star SWEEPS-10 with an even shorter year, but its existence is unconfirmed.

"We expect that 55 Cancri e will not hold the status of shortest orbital period for long," says Dawson.

If a planet could orbit our sun at a distance equivalent to the sun's radius without burning up, its year would be about 3 hours.

Planets orbiting more compact objects, such as white dwarfs, pulsars and black holes, might have even shorter years since they can get closer in. However, no confirmed planets have so far been found around white dwarfs or black holes.

Cold sore virus may contribute to cognitive and brain abnormalities in schizophrenia

Exposure to the common virus that causes cold sores may be partially responsible for shrinking regions of the brain and the loss of concentration skills, memory, coordinated movement and dexterity widely seen in patients with schizophrenia, according to research led by Johns Hopkins scientists.

"We're finding that some portion of cognitive impairment usually blamed solely on the disease of schizophrenia might actually be a combination of schizophrenia and prior exposure to herpes simplex virus 1 infection, which reproduces in the brain," says study leader David J. Schretlen, Ph.D., an associate professor in the Department of Psychiatry at Johns Hopkins University School of Medicine.

The research, described in the May Schizophrenia Research, could lead to new ways to treat or prevent the cognitive impairment that typically accompanies this mental illness, including with antiviral drugs, the scientists say.

Doctors have long known that cognitive impairment, including problems with psychomotor speed, concentration, learning, and memory, are prevalent features of schizophrenia, which affects an estimated one percent of the U.S. population. Cognitive deficits often surface months to years before symptoms that are traditionally used to diagnose this disease, such as delusions or hallucinations.

Some previous studies have shown that schizophrenic patients with antibodies to herpes simplex virus 1 (HSV-1), the virus that causes cold sores, often have more severe cognitive deficits than patients without these antibodies. Other studies have shown that patients with HSV-1 antibodies have decreased brain volumes compared to patients without the antibodies. However, it has been unclear whether the cognitive deficits are directly related to the decreased brain volume.

To investigate, Schretlen and his colleagues recruited 40 schizophrenic patients from outpatient clinics at the Johns Hopkins and Sheppard Enoch Pratt hospitals in Baltimore, Md. Blood tests showed that 25 of the patients had antibodies for HSV-1 and 15 didn't. The researchers gave all of the patients tests to measure speed of coordination, organizational skills and verbal memory. The patients then underwent MRI brain scans to measure the volume of particular regions of their brains.

As in previous studies, results showed that patients with antibodies to HSV-1 performed significantly worse on the cognitive tests than patients without the antibodies. But expanding on those earlier studies, analysis of the brain scans showed that the same patients who performed poorly on the tests also had reduced brain volume in the anterior cingulate, which controls processing speed and the ability to switch tasks. There was also shrinkage in the cerebellum, which controls motor function.

These results suggest that HSV-1 might be directly causing the cognitive deficits by attacking these brain regions, Schretlen says.

Though the researchers aren't sure why schizophrenia might make brains more vulnerable to a viral assault, Schretlen says the results already suggest new ways of treating the disorder. Data from other studies has shown that antiviral medications can reduce psychiatric symptoms in some patients with schizophrenia. "If we can identify schizophrenic patients with HSV-1 antibodies early on, it might be possible to reduce the risk or the extent of cognitive deficits," he adds.

Other Johns Hopkins researchers who participated in this study include Tracy D. Vannorsdall, Ph.D., Jessica M. Winicki, B.A., Takatoshi Hikida, M.D., Akira Sawa, M.D., Ph.D., Robert H. Yolken, M.D., and Nicola G. Cascella, M.D.

Revealing the ancient Chinese secret of sticky rice mortar

WASHINGTON - Scientists have discovered the secret behind an ancient Chinese super-strong mortar made from sticky rice, the delicious "sweet rice" that is a modern mainstay in Asian dishes. They also concluded that the mortar — a paste used to bind and fill gaps between bricks, stone blocks and other construction materials - remains the best available material for restoring ancient buildings. Their article appears in the American Chemical Society (ACS) monthly journal, Accounts of Chemical Research.

Bingjian Zhang, Ph.D., and colleagues note that construction workers in ancient China developed sticky rice mortar about 1,500 years ago by mixing sticky rice soup with the standard mortar ingredient. That ingredient is slaked lime, limestone that has been calcined, or heated to a high temperature, and then exposed to water. Sticky rice mortar probably was the world's first composite mortar, made with both organic and inorganic materials.

The mortar was stronger and more resistant to water than pure lime mortar, and what Zhang termed one of the greatest technological innovations of the time. Builders used the material to construct important buildings like tombs, pagodas, and city walls, some of which still exist today. Some of the structures were strong enough to shrug off the effects of modern bulldozers and powerful earthquakes.

Their research identified amylopectin, a type of polysaccharide, or complex carbohydrate, found in rice and other starchy foods, as the "secret ingredient" that appears to be responsible for the mortar's legendary strength.

"Analytical study shows that the ancient masonry mortar is a kind of special organic-inorganic composite material," the scientists explained. "The inorganic component is calcium carbonate, and the organic component is amylopectin, which comes from the sticky rice soup added to the mortar. Moreover, we found that amylopectin in the mortar acted as an inhibitor: The growth of the calcium carbonate crystal was controlled, and a compact microstructure was produced, which should be the cause of the good performance of this kind of organic-organic mortar."

To determine whether sticky rice can aid in building repair, the scientists prepared lime mortars with varying amounts of sticky rice and tested their performance compared to traditional lime mortar. "The test results of the modeling mortars shows that sticky rice-lime mortar has more stable physical properties, has greater mechanical strength, and is more compatible, which make it a suitable restoration mortar for ancient masonry," the article notes.

Acupuncture's molecular effects pinned down

New insights spur effort to boost treatment's impact significantly

Scientists have taken another important step toward understanding just how sticking needles into the body can ease pain. In a paper published online May 30 in Nature Neuroscience, a team at the University of Rochester Medical Center identifies the molecule adenosine as a central player in parlaying some of the effects of acupuncture in the body. Building on that knowledge, scientists were able to triple the beneficial effects of acupuncture in mice by adding a medication approved to treat leukemia in people.

The research focuses on adenosine, a natural compound known for its role in regulating sleep, for its effects on the heart, and for its anti-inflammatory properties. But adenosine also acts as a natural painkiller, becoming active in the skin after an injury to inhibit nerve signals and ease pain in a way similar to lidocaine.

In the current study, scientists found that the chemical is also very active in deeper tissues affected by acupuncture. The Rochester researchers looked at the effects of acupuncture on the peripheral nervous system – the nerves in our body that aren't part of the brain and spinal cord. The research complements a rich, established body of work showing that in the central nervous system, acupuncture creates signals that cause the brain to churn out natural pain-killing endorphins.

The new findings add to the scientific heft underlying acupuncture, said neuroscientist Maiken Nedergaard, M.D., D.M.Sc., who led the research. Her team is presenting the work this week at a scientific meeting, Purines 2010, in Barcelona, Spain.

"Acupuncture has been a mainstay of medical treatment in certain parts of the world for 4,000 years, but because it has not been understood completely, many people have remained skeptical," said Nedergaard, co-director of the University's Center for Translational Neuromedicine, where the research was conducted.

"In this work, we provide information about one physical mechanism through which acupuncture reduces pain in the body," she added.

To do the experiment, the team performed acupuncture treatments on mice that had discomfort in one paw. The mice each received a 30-minute acupuncture treatment at a well known acupuncture point near the knee, with very fine needles rotated gently every five minutes, much as is done in standard acupuncture treatments with people.

The team made a number of observations regarding adenosine:

* In mice with normal functioning levels of adenosine, acupuncture reduced discomfort by two-thirds.
* In special "adenosine receptor knock-out mice" not equipped with the adenosine receptor, acupuncture had no effect.
* When adenosine was turned on in the tissues, discomfort was reduced even without acupuncture.
* During and immediately after an acupuncture treatment, the level of adenosine in the tissues near the needles was 24 times greater than before the treatment.

Once scientists recognized adenosine's role, the team explored the effects of a cancer drug called deoxycoformycin, which makes it harder for the tissue to remove adenosine. The compound boosted the effects of acupuncture treatment dramatically, nearly tripling the accumulation of adenosine in the muscles and more than tripling the length of time the treatment was effective.

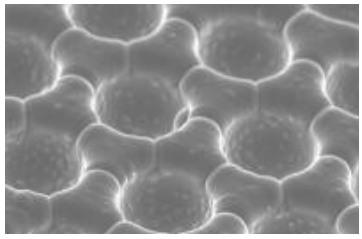
"It's clear that acupuncture may activate a number of different mechanisms," said Josephine P. Briggs, M.D., director of the National Center for Complementary and Alternative Medicine at the National Institutes of Health. "This carefully performed study identifies adenosine as a new player in the process. It's an interesting contribution to our growing understanding of the complex intervention which is acupuncture," added Briggs, who is the spouse of co-author Jurgen Schnermann.

The paper includes three first co-authors: Nanna Goldman, technical associate Michael Chen, and post-doctoral associate Takumi Fujita. Other authors from Rochester include Qiwu Xu; medical student Tina Jensen; former student Wei Liu and former post-doctoral associate Yong Pei; assistant professors Takahiro Takano and Kim Tieu; and research assistant professors Weiguo Peng, Fushun Wang, Xiaoning Han, and Lane Bekar. Also contributing were Jiang-Fan Chen from Boston University and Jürgen Schnermann from the National Institute of Diabetes and Digestive and Kidney Diseases.
Funding for the work came from the New York State Spinal Cord Injury Program and the National Institutes of Health.

From butterflies' wings to bank notes -- how nature's colors could cut bank fraud

Scientists have discovered a way of mimicking the stunningly bright and beautiful colours found on the wings of tropical butterflies. The findings could have important applications in the security printing industry, helping to make bank notes and credit cards harder to forge.

The striking iridescent colours displayed on beetles, butterflies and other insects have long fascinated both physicists and biologists, but mimicking nature's most colourful, eye-catching surfaces has proved elusive.



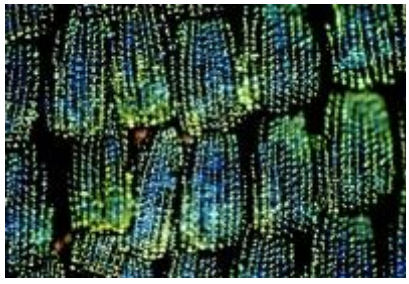
This is partly because rather than relying on pigments, these colours are produced by light bouncing off microscopic structures on the insects' wings.

Mathias Kolle, working with Professor Ullrich Steiner and Professor Jeremy Baumberg of the University of Cambridge, studied the Indonesian Peacock or Swallowtail butterfly (Papilio blumei), whose wing scales are composed of intricate, microscopic structures that resemble the inside of an egg carton.

This SEM image of concavities is covered by a conformal multilayer stack of 11 alternating layers of titania and alumina. **Mathias Kolle, University of Cambridge**

Because of their shape and the fact that they are made up of alternate layers of cuticle and air, these structures produce intense colours.

Using a combination of nanofabrication procedures – including self-assembly and atomic layer deposition – Kolle and his colleagues made structurally identical copies of the butterfly scales, and these copies produced the same vivid colours as the butterflies' wings.



According to Kolle: "We have unlocked one of nature's secrets and combined this knowledge with state-of-the-art nanofabrication to mimic the intricate optical designs found in nature."

"Although nature is better at self-assembly than we are, we have the advantage that we can use a wider variety of artificial, custom-made materials to optimise our optical structures." As well as helping scientists gain a deeper understanding of the physics behind these butterflies' colours, being able to mimic them has promising applications in security printing.

The bright green wings of the P. blumei butterfly result from the mixing of the different colors of light that are reflected from different regions of the scales found on the wings of these butterflies. **Mathias Kolle, University of Cambridge**

"These artificial structures could be used to encrypt information in optical signatures on banknotes or other valuable items to protect them against forgery. We still need to refine our system but in future we could see structures based on butterflies wings shining from a £10 note or even our passports," he says.

Intriguingly, the butterfly may also be using its colours to encrypt itself – appearing one colour to potential mates but another colour to predators.

Kolle explains: "The shiny green patches on this tropical butterfly's wing scales are a stunning example of nature's ingenuity in optical design. Seen with the right optical equipment these patches appear bright blue, but with the naked eye they appear green. "This could explain why the butterfly has evolved this way of producing colour. If its eyes see fellow butterflies as bright blue, while predators only see green patches in a green tropical environment, then it can hide from predators at the same time as remaining visible to members of its own species."The results are published today in Nature Nanotechnology.

The hidden health power of spices and herbs is revealed in recent studies

By Karen Schrock

BOSTON- As most of us learned in school, fruit is delicious because it evolved to be eaten - if plants can entice animals to eat their seeds, they'll be spread far and wide in handy packets of fertilizer. But spices are different. Spices and herbs such as thyme, oregano, turmeric and cinnamon get their singular flavors from compounds that are actually toxic in concentrated doses - and plants probably evolved to express these toxins so their leaves and berries would not be eaten.

So why do we humans cultivate them and put them all over our food? Nobody knows for sure, but as explained today in a presentation here at the annual meeting of the Association for Psychological Science, scientists are starting to discover a whole host of health benefits from common herbs and spices - and it's possible that we humans evolved a taste for these toxic compounds because they help our bodies function better.

Spices top the list of foods rich in antioxidants, explained Marianne Gillette, a vice president at McCormick & Company, whose background is in experimental taste research. One half teaspoon of ground cinnamon has as many antioxidants as a half cup of blueberries; a half teaspoon of dried oregano rivals three cups of raw spinach.

And the health benefits go far beyond antioxidants. A UCLA paper published May 9 in the American Journal of Clinical Nutrition found that adding a mixture of herbs and spices to hamburgers reduced the level of carcinogenic compounds created by grilling - such as the dangerous malondialdehyde that forms when beef fat oxidizes. Malondialdehyde damages DNA in cells, which is thought to lead to replication errors and possibly cancer. Not only did the burgers with the spice mixture - a palatable blend of oregano, rosemary, ginger, black pepper and others - have lower levels of malondialdehyde when tested in the lab, but subjects who ate the spiced burgers had fewer DNA breaks in their cells afterwards.

Of course, the healthfulness of spices and herbs is nothing new to some - traditional medicine all over the world has been using them in remedies for millennia. Although many such uses have yet to be validated by experimental studies, new benefits are being suggested by studies all the time. Take ginger - three University of Georgia pilot studies (not yet published) suggest that eating a small amount of ginger daily for 11 days or more can reduce muscle pain and inflammation after exercise.

The UCLA and Georgia studies were funded by the McCormick Science Institute, the spice company's research arm dedicated to performing and funding studies on the biophysiological effects of the spices it sells. Obviously McCormick hopes to benefit if people start eating more spices in the interest of health. But the work they fund represents only a small fraction of the dozens of studies appearing independently from research institutions around the world - Italian researchers found that saffron improves vision in the elderly; Thai scientists showed that ginger aids digestion - adding to a growing body of working suggesting that spicing things up a little adds more than just flavor.

U of A discovery offers promising research for spinal-cord injury treatments

Researchers in the University of Alberta's Faculty of Rehabilitation Medicine have made an important discovery that could lead to more effective treatments for spinal-cord injuries. Karim Fouad and David Bennett have identified one of the body's natural self-repair mechanisms that kick in after injury.

To help understand the discovery the researchers say it is important to first describe the neurons in the spinal cord that control muscle contractions. These neurons represent a fairly autonomous part of the nervous system that control many basic functions such as walking and bladder control. These neurons are brought into a state of readiness by a transmitter called serotonin. Serotonin originates in the brain and projects down the spinal cord where it binds to serotonin receptors on the neurons. This process turns a quiet neuron into one that's ready to respond to fast inputs from the brain.

When someone suffers a spinal-cord injury they can lose almost all serotonin projections, so it was previously thought that the serotonin receptors were inactive. But the U of A researchers found that serotonin receptors are spontaneously active after spinal-cord injury, despite the absence of serotonin. Their study shows that this receptor activity is an essential factor in the recovery of functions like walking. Fouad and Bennett say this significant discovery provides important insight into how the spinal cord responds and changes after an injury, which is essential to developing meaningful treatments.

But, the researchers add, there is a dark side. While the serotonin receptors remain active after injury, they are permanently turned on. Fouad and Bennett say this activity is what contributes to muscle spasms, a common problem for people with severe spinal-cord injury. The pair says the next step in helping patients who won't be able to regain control of muscle contractions is to examine how to block these serotonin receptors to stop the spasms from occurring, in particular by using already available drugs or by designing more targeted drugs.

Fouad and Bennett's research will be published May 30, 2010, in the journal Nature Medicine.