Diamond Oceans Possible on Uranus, Neptune

By melting and resolidifying diamond, scientists explain how such liquid diamond oceans may be possible.

By Eric Bland | Fri Jan 15, 2010 07:14 AM ET

When scientists melted diamond under high temperatures and pressure and then resolidified, the solid diamond chunks floated on top of liquid diamond.

THE GIST:

**** Like ice on water, solid diamond floats on liquid diamond.***

**** The finding explains possible liquid diamond oceans on other planets.***

**** Diamond oceans may cause off-kilter planetary tilts.***

Oceans of liquid diamond, filled with solid diamond icebergs, could be floating on Neptune and Uranus, according to a recent article in the journal Nature Physics.

The research, based on the first detailed measurements of the melting point of diamond, found diamond behaves like water during freezing and melting, with solid forms floating atop liquid forms. The surprising revelation gives scientists a new understanding about diamonds and some of the most distant planets in our solar system.

"Diamond is a relatively common material on Earth, but its melting point has never been measured," said Eggert. "You can't just raise the temperature and have it melt, you have to also go to high pressures, which makes it very difficult to measure the temperature."

Other groups, notably scientists from Sandia National Laboratories, successfully melted diamond years ago, but they were unable to measure the pressure and temperature at which the diamond melted.

Diamond is an incredibly hard material. That alone makes it difficult to melt. But diamond has another quality that makes it even harder to measure its melting point. Diamond doesn't like to stay diamond when it gets hot. When diamond is heated to extreme temperatures it physically changes, from diamond to graphite.

The graphite, and not the diamond, then melts into a liquid. The trick for the scientists was to heat the diamond up while simultaneously stopping it from transforming into graphite.

Eggert and his colleagues took a small, natural, clear diamond, about a tenth of a carat by weight and half a millimeter thick, and blasted it with lasers at ultrahigh pressures like those found on gas giants like Neptune and Uranus.

The scientists liquefied the diamond at pressures 40 million times greater than what a person feels when standing at sea level on Earth. From there they slowly reduced the temperature and pressure.

When the pressure dropped to about 11 million times the atmospheric pressure at sea level on Earth and the temperature dropped to about 50,000 degrees, solid chunks of diamond began to appear. The pressure kept dropping, but the temperature of the diamond remained the same, with more and more chunks of diamond forming.

Then the diamond did something unexpected. The chunks of diamond didn't sink. They floated. Microscopic diamond ice burgs floated in a tiny sea of liquid diamond. The diamond was behaving like water.

With most materials, the solid state is more dense than the liquid state. Water is an exception to that rule; when water freezes, the resulting ice is actually less dense than the surrounding water, which is why the ice floats and fish can survive a Minnesota winter.

An ocean of diamond could help explain the orientation of Uranus' and Neptune's magnetic field as well, said Eggert. Roughly speaking, the Earth's magnetic poles match up with the geographic poles. The magnetic and geographic poles on Uranus and Neptune do not match up; in fact, they can be up to 60 degrees off of the north-south axis.

If Earth's magnetic field were that far off it would place the magnetic north pole in Texas instead of off a Canadian island. A swirling ocean of liquid diamond could be responsible for the discrepancy.

Up to 10 percent of Uranus and Neptune is estimated to be made from carbon. A huge ocean of liquid diamond in the right place could deflect or tilt the magnetic field out of alignment with the rotation of the planet.

The idea that there are oceans of liquid diamond on Neptune and Uranus is not a new idea, said Tom Duffy, a planetary scientist at Princeton University.

The new Nature Physics article makes diamond oceans "look more and more plausible," said Duffy.

More research on the composition of Neptune and Uranus is needed before a truly definitive conclusion can be made, however, and this kind of research is very difficult to conduct.

Scientists can either send spacecraft to these planets, or they can try to simulate the conditions on Earth. Both options require years of preparation, expensive equipment, and are subject to some of the toughest environments in the universe.

Drowsiness, staring and other mental lapses may signal Alzheimer's disease

ST. PAUL, Minn. – Older people who have "mental lapses," or times when their thinking seems disorganized or illogical or when they stare into space, may be more likely to have Alzheimer's disease than people who do not have these lapses, according to a study published in the January 19, 2010, print issue of Neurology®, the medical journal of the American Academy of Neurology.

These mental lapses, also called cognitive fluctuations, are common in a type of dementia called dementia with Lewy bodies, but researchers previously did not know how frequently they occurred in people with Alzheimer's disease and, equally important, what effect fluctuations might have on their thinking abilities or assessment scores.

The study involved 511 people with an average age of 78. Researchers interviewed the participant and a family member, evaluated the participants for dementia and tested their memory and thinking skills.

People with three or four of the following symptoms met the criteria for having mental lapses:

* Feeling drowsy or lethargic all the time or several times per day despite getting enough sleep the night before
* Sleeping two or more hours before 7 p.m.
* Having times when the person's flow of ideas seems disorganized, unclear, or not logical
* Staring into space for long periods

A total of 12 percent of the people with dementia in the study had mental lapses. Of 216 people with very mild or mild dementia, 25 had mental lapses. Of the 295 people with no dementia, only two had mental lapses.

Those with mental lapses were 4.6 times more likely to have dementia than those without mental lapses. People with mental lapses also tended to have more severe Alzheimer's symptoms and perform worse on tests of memory and thinking skills than people who did not have lapses.

"When older people are evaluated for problems with their thinking and memory, doctors should consider also assessing them for these mental lapses," said senior study author James E. Galvin, MD, MPH, of Washington University School of Medicine in St. Louis, who is a member of the American Academy of Neurology.

Rare glimpse of the crystal cave

Mexico's Cave of Crystals stunned geologists when it was first discovered in 2000. The underground chamber contains some of the largest natural crystals ever found - some of the selenite structures have grown to more than 10m long. Professor Iain Stewart got a rare glimpse of the subterranean spectacle while filming for the new BBC series How the Earth Made Us.

We kept on being told how difficult it was going to be to film in the Naica Cave, but nothing really prepares you for the extremes of that cavern.

It's about 50C in there, but it's the virtually 100% humidity added on top that makes it a potential killer.

That combination means that when you breathe air into your body, the surface of your lungs is actually the coolest surface the air encounters. That means the fluid starts to condense inside your lungs - and that's really not good news.

When the cave was first discovered it was just an accident. Miners working in the Naica silver mine broke through the walls of the cavern and were astounded to discover these enormous crystals - the biggest anywhere on Earth.

But when the first people went in to explore, they were almost overcome by the conditions - and there's some pretty hairy video footage of them coming out of the cave on the verge of losing consciousness. So we knew the dangers were real.

When you first look at the kit your first thought is: "Is that it?"

There's a special cooling suit - which is basically like a suit of chain mail but filled with ice cubes.

Then there's a breathing system which feeds cool, dry air into your mask.

It's OK to take the mask off for a short while, but do without it for more than about 10 minutes, and it's likely that you're going to start keeling over.

I was lucky of course. All I had to do was stand there and talk, but the cameraman and all the others helping set out the lights were having to work in these conditions, wearing these cumbersome suits, and they really struggled.

We had a doctor outside the cave to monitor our vital signs, and we were coming out of the cavern with our heart rates up at 180.

The biggest danger was falling over; rescuing someone inside would have been very tricky.

Despite all the dangers, my overwhelming memory is the sheer beauty of the place. Whenever people around me were faffing around with equipment, I'd just stop and look around at the crystals.

It's such a glorious place, it's like being in a modern art exhibit.

I kept reminding myself: "You're in the Naica Cave", because there's only a handful of geologists that have ever been in there, and so I was aware of how incredibly privileged I was.

Yet remarkably, for the people who own and run the Naica mine, the crystal cave is a side-show, a distraction. They don't make any money out of it and sooner or later, when the economics of the mine change, it will close. The pumps will be taken out, the mine and the cave will flood, and the crystals will once more be out of our reach.

But perhaps we should console ourselves with the thought that there are certainly lots more crystal caves waiting to be discovered. For starters, the geology of the area around the cave suggests that there could be more crystal caves in the area around Naica. But more broadly, the Earth's crust must be riddled with wonders like this. We know more about the outer edges of the Solar System than we do about the first kilometre of the Earth's crust.

As we learn more about the crust, we can be sure that there will be discoveries even more spectacular than Naica. I just hope I'm around to see them.

Pumping autistic children full of an industrial chelator

The double standard of the anti-vaccine "autism biomed" movement never ceases to amaze me.

Imagine if you will, that a pharmaceutical company examined a chemical used for industrial purposes. Imagine further that the chemical this pharmaceutical company decided to look at originated as an industrial chelator designed to separate heavy metals from polluted soil and mining drainage. Imagine still further that that pharmaceutical company wanted to use that chemical as a treatment for autism, a chelator to be given to children. Finally, imagine that the drug company was giving this chemical to children without anything resembling any sort of competent preclincal testing or toxicology testing. Then suppose that, in order to avoid having to obtain FDA approval, the pharmaceutical company rebranded its chelating agent as a "supplement," using the DSHEA of 1994 to bypass any need for extensive clinical trial testing for safety and efficacy in order to be able to market this chemical directly to consumers. What do you think the reaction would be of the crew at Age of Autism and other anti-vaccine blogs?

I think I know. They'd scream bloody murder. That's what they'd do. And they'd be absolutely right.

Yet, that's exactly what Professor Boyd Haley, a Professor of Chemistry at the University of Kentucky and former chairman of the Department of Chemistry there whose career tanked after he fell down the rabbithole of mercury-autism pseudoscience has done. Trine Tsouderos of the Chicago Tribune, the reporter who has worked on two previous excellent exposes of the anti-vaccine movement and "autism biomed" movement has documented something that I had from time to time been meaning to write about but for whatever reason hadn't, has documented it in a third excellent story to add to her trifecta entitled OSR#1: Industrial chemical or autism treatment? Parents giving kids compound created for use in mining, sold as supplement.

An industrial chemical developed to help separate heavy metals from polluted soil and mining drainage is being sold as a dietary supplement by a luminary in the world of alternative autism treatments.

Called OSR#1, the supplement is described on its Web site as an antioxidant not meant to treat any disease. But the site lists pharmacies and doctors who sell it to parents of children with autism, and the compound has been promoted to parents on popular autism Web sites.

"I sprinkle the powder into Bella's morning juice and onto Mia and Gianna's gluten free waffle breakfast sandwich," wrote Kim Stagliano, managing editor of Age of Autism and mother of three girls on the autism spectrum, in an enthusiastic post last spring. "We've seen some nice 'Wows!' from OSR."

A search of medical journals unearthed no papers published about OSR#1, though the compound's industrial uses have been explored in publications such as the Journal of Hazardous Materials.

Ah, testimonials for giving your autistic children an untested industrial chemical! Don't you love the double standard?

Depressingly, but not surprisingly, not only is the anti-vaccine movement not criticizing this practice, but it's enthusiastically embracing it. Indeed, the anti-vaccine crank blog, Age of Autism, has been enthusiastically pimping Haley's wonder supplement for over a year now. Examples include Kim Stagliano's glowing testimonial that attributes improvements that could almost certainly be due to growth and development that Tsouderos quoted in her article:

My three girls began taking OSR several months ago. OSR has been the only recent addition to their treatment. I can tell you that Gianna is now in two mainstream classes in school, Mia is telling me what day it is and what's on her schedule at school and Bella is.... well, Bella is cuter than ever and her receptive speech has improved to where she can follow directions and communicate with her PECS. I've seen some minor sleep disruption that passed in two of the three girls.

Because OSR makes autistic children cuter, I guess. Oddly enough, Stagliano and the crew at AoA seem not at all concerned that this chemical has not undergone adequate safety testing. Indeed, when AoA got wind that Tsouderos's article would soon see print, it launched a pre-emptive attack. In the comments the mercury cultists even stooped so far as to make fun of Tsouderos' first name. Stay classy, AoA. Stay classy. Oh, well. I suppose it's not as bad as being portrayed as a baby-eating cannibal.

In any case, Haley does not like being questioned about OSR by anyone who's not a toady, sycophant, or lackey (like AoA) whose message he can't easily control (as he can AoA's), and he really doesn't like being questioned by skeptical reporters. No, he doesn't like it at all:

Boyd Haley, president of the Lexington, Ky.-based company that produces the compound, acknowledged its industrial origins but calls his product "a food" that is "totally without toxicity." He said he has been taking the supplement for nearly three years.

"Look, I put myself on the line," he said. "I have taken 250 milligrams per day, on the average."

Federal law requires manufacturers to explain why a new dietary ingredient reasonably can be expected to be safe. The Food and Drug Administration told the Tribune that Haley had not submitted sufficient information.

In an interview, Haley said that the compound had been tested on rats and that a food safety study was conducted on 10 people. Asked to provide documentation of the studies, he stopped communicating with the Tribune.

More telling is comparing Boyd Haley from four years ago to Boyd Haley now:

In a 2006 interview for the magazine Medical Veritas, Haley told a reporter from AutismOne Radio that he was interested in developing better chelators for people.

"We've made compounds that ... work tremendously" in a test tube, he said. "However, we've got to show that they're not toxic. That costs a lot of money and it's very difficult to do, you have to have the right facilities. That's where we're hung up right now, the question is, 'How do we get somebody to do these studies?'"

In January 2008 Haley changed the name of his company from Chelator Technologies Inc. to CTI Science Inc. Less than a month later, he notified the FDA he would be introducing the compound as a new dietary ingredient.

Heh. I like how Tsouderos described Medical Veritas as a "magazine" and not a journal. That's perfect, because MV is as cranky a journal as JPANDS.

I will give Haley credit for chutzpah, tough. On the OSR website, the company denies explicitly that OSR is a chelator, even though it appears to be chemically identical to...an industrial chelator developed by Haley's colleague David Atwood at the University of Kentucky! Curiouser and curiouser. Indeed, the ever-vigilant Kathleen Seidel first documented that this was the case a year and a half ago in a series of posts that included A Fine White Powder; The Industrial Treatment; and An Inquiry Emerges. All are worth your reading completely, as they show unequivocally that OSR is indeed a chelator and that Haley had been discussing his new "chelators" at various autism quackery conferences, his attempt to "rebrand" it as an anti-oxidant and deny its industrial past.

More interesting still is how the company claims that the drug has undergone extensive toxicity testing in both rats and humans but the results of that testing are nowhere to be found in the medical literature. Even if that's true, I find it irresponsible to the point of recklessness to give an industrial chemical like this to children without its having undergone phase 1 clinical testing to define its toxicity and maximal tolerated dose and its having undergone phase 2 and 3 testing to show that it's actually good for a medical condition and that the risk-benefit ratio is favorable. In the absence of this data, what we are dealing with is unethical experimentation on autistic children.

Not that this is anything new for the anti-vaccine movement. Think Lupron.

Tousderos's story is instructive in two ways. First, it reveals more plainly than anything I can think of the utter hypocrisy and double standard behind the anti-vaccine movement and the "autism biomed" movement. They say they want "natural" treatments like dietary manipulations and supplements; yet, they are not only not fearful of sprinkling a white chemical powder made for industry on their children's food. Secondly, it shows how the DSHEA of 1994 has allowed nearly free rein to the unscrupulous to sell virtually anything with

minimal FDA interference, even if it's selling synthetic chemicals to children. All they have to do is to declare it a "supplement," and they can sell virtually anything.

More importantly, however, this story shows a new trend that began last year in the media. This most welcome trend involves newspapers and media outlets deemphasizing the false "balance" construct so common in lazy journalism about pseudoscientific movements like the anti-vaccine movement. In its place, at least in this case, there is a more realistic portrayal of the state of medical science. Experts say plainly that there's nothing too this stuff and it might be dangerous. No more swallowing the claims of pseudoscience credulously, without checking out these claims and finding out that, far more often than not, they don't check out.

In journalism, 2010 is staring out OK, particularly as I watch the anti-vaccine movement lose its mind in the after Tsouderos' article.

Appendicitis may be related to viral infections

DALLAS – Can you catch appendicitis?

And if you do, is it necessarily an emergency that demands immediate surgery?

Yes and no, according to a new study by UT Southwestern Medical Center surgeons and physicians.

The researchers evaluated data over a 36-year period from the National Hospital Discharge Survey and concluded in a paper appearing in the January issue of Archives of Surgery that appendicitis may be caused by undetermined viral infection or infections, said Dr. Edward Livingston, chief of GI/endocrine surgery at UT Southwestern and senior author of the report.

The review of hospital discharge data runs counter to traditional thought, suggesting that appendicitis doesn't necessarily lead to a burst appendix if the organ is not removed quickly, Dr. Livingston said.

"Just as the traditional appendix scar across the abdomen is fast becoming history, thanks to new single-incision surgery techniques that hide a tiny scar in the bellybutton, so too may the conventional wisdom that patients with appendicitis need to be operated on as soon as they enter the hospital," said Dr. Livingston. "Patients still need to be seen quickly by a physician, but emergency surgery is now in question."

Appendicitis is the most common reason for emergency general surgery, leading to some 280,000 appendectomies being performed annually.

Appendicitis was first identified in 1886. Since then, doctors have presumed quick removal of the appendix was a necessity to avoid a subsequent bursting, which can be an emergency. Because removing the appendix solves the problems and is generally safe, removal became the standard medical practice in the early 20th century.

But this latest research studying appendicitis trends from 1970 to 2006 suggests immediate removal may not be necessary. Evidence from sailors at sea without access to immediate surgery and from some children's hospitals, whose practice did not call for emergency surgery, hinted that non-perforated appendicitis may resolve without surgery, said Dr. Livingston.

In undertaking the study, the researchers screened the diagnosis codes for admissions for appendicitis, influenza, rotavirus and enteric infections. They found that seasonal variations and clustering of appendicitis cases support the theory that appendicitis may be a viral disease, like the flu, Dr. Livingston said.

Statistical data revealed peaks, which may be outbreaks of appendicitis, in the years 1977, 1981, 1984, 1987, 1994 and 1998. In addition, researchers uncovered some seasonal trends for appendicitis, documenting a slight increase in appendicitis cases during the summer.

"The peaks and valleys of appendicitis cases generally matched up over time, suggesting it is possible that these disorders share common etiologic determinates, pathogenetic mechanisms or environmental factors that similarly affect their incidence," Dr. Livingston said.

Researchers have been able to rule out flu and several other common infections as a direct cause. They also were able to rule out several types of intestinal viruses.

Appendicitis afflicts about one in 10 people during their lifetime. The condition occurs when the appendix becomes obstructed, but doctors are unsure why. Dr. Livingston and other UT Southwestern researchers in 1995 identified an unexpected rise in appendicitis cases, reversing a downward trend throughout the previous 25 years.

"Though appendicitis is fairly common, it still remains a frustrating medical mystery," Dr. Livingston said. "While we know surgical removal is an effective treatment, we still don't know the purpose of the appendix, nor what causes it to become obstructed."

Other UT Southwestern researchers involved in the Archives of Surgery paper were Dr. Robert W. Haley, chief of epidemiology, and Dr. Adam Alder, a resident and lead author. The team also collaborated with economists at Southern Methodist University on novel statistical methodologies to uncover the associations.

Study suggests theory for insect colonies as 'superorganisms'

New A team of researchers including scientists from the University of Florida has shown insect colonies follow some of the same biological "rules" as individuals, a finding that suggests insect societies operate like a single "superorganism" in terms of their physiology and life cycle.

For more than a century, biologists have marveled at the highly cooperative nature of ants, bees and other social insects that work together to determine the survival and growth of a colony.

The social interactions are much like cells working together in a single body, hence the term "superorganism" — an organism comprised of many organisms, according to James Gillooly, Ph.D., an assistant professor in the department of biology at UF's College of Liberal Arts and Sciences.

Now, researchers from UF, the University of Oklahoma and the Albert Einstein College of Medicine have taken the same mathematical models that predict lifespan, growth and reproduction in individual organisms and used them to predict these features in whole colonies.

By analyzing data from 168 different social insect species including ants, termites, bees and wasps, the authors found that the lifespan, growth rates and rates of reproduction of whole colonies when considered as superorganisms were nearly indistinguishable from individual organisms. The findings will be published online this week in the Proceedings of the National Academy of Sciences Early Edition.

"This PNAS paper regarding the energetic basis of colonial living in social insects is notable for its originality and also for its importance," said Edward O. Wilson, a professor of biology at Harvard University and co-author of the book "The Super-Organism," who was not involved in the research. "The research certainly adds a new perspective to our study of how insect societies are organized and to what degree they are organized."

The study may also help scientists understand how social systems have arisen through natural selection — the process by which evolution occurs. The evolution of social systems of insects in particular, where sterile workers live only to help the queen reproduce, has long been a mystery, Gillooly said.

"In life, two of the major evolutionary innovations have been how cells came together to function as a single organism, and how individuals joined together to function as a society," said Gillooly, who is a member of the UF Genetics Institute. "Relatively speaking, we understand a considerable amount about how the size of multicellular organisms affects the life cycle of individuals based on metabolic theory, but now we are showing this same theoretical framework helps predict the life cycle of whole societies of organisms."

Researchers note that insect societies make up a large fraction of the total biomass on Earth, and say the finding may have implications for human societies.

"Certainly one of the reasons folks have been interested in social insects and the consequences of living in groups is that it tells us about our own species," said study co-author Michael Kaspari, Ph.D., a presidential professor of zoology, ecology and evolutionary biology at the University of Oklahoma and the Smithsonian Tropical Research Institute. "There is currently a vigorous debate on how sociality evolved. We suggest that any theory of sociality be consistent with the amazing convergence in the way nonsocial and social organisms use energy."

In addition to Gillooly and Kaspari, Chen Hou from the Albert Einstein College of Medicine, and Hannah B. Vander Zanden of the University of Florida participated in the study.

Mayo Clinic Proceedings: Study finds decrease in postoperative delirium in elderly patients

ROCHESTER, Minn. -- A recent study, published in the January issue of Mayo Clinic Proceedings, demonstrates that in elderly patients undergoing hip fracture repair under spinal anesthesia with propofol sedation, the prevalence of delirium can be decreased by 50 percent with light sedation, compared to deep sedation.

"These data show that, for every 3.5 to 4.7 patients treated in this manner, one incident of delirium will be prevented," says Frederick Sieber, M.D., primary investigator of the study from the Department of Anesthesiology and Critical Care Medicine, Johns Hopkins Medicine in Baltimore. "Therefore, interventions capable of reducing the occurrence of postoperative delirium would be important from a public health perspective."

Several demographic and perioperative variables are associated with postoperative delirium in elderly patients after hip fracture repair. The most important is preoperative dementia. Other risk factors for postoperative delirium include age, systemic disease and functionality. Inhalational and intravenous anesthetics, opioids, benzodiazepines and anticholinergic drugs are all known or suspected risk factors for postoperative delirium.

Although postoperative delirium usually resolves within 48 hours of onset, delirium can persist and is associated with poor functional recovery, increased length of stay in hospitals, higher costs, and greater likelihood of placement in an assisted-living facility after surgery.

In addition to decreasing the prevalence of delirium, lighter sedation in this group of elderly surgical patients was associated with a reduction in delirium that averaged almost one day for each patient in the light sedation group. The effects of lighter sedation were observed in patients with or without preoperative cognitive dysfunction.

Limiting depth of sedation during spinal anesthesia is a simple, safe and cost-effective intervention for preventing postoperative delirium in elderly patients that could be widely and readily adopted, say Dr. Sieber.

Call for AIDS denialists to be held accountable

New study provides more proof that withholding HIV treatments led to thousands of deaths in South Africa

Despite irrefutable proof that HIV treatments have proven benefits, AIDS denialists continue to deny their value. In a paper just published online in Springer's journal AIDS and Behavior, Professor Myron Essex and Dr. Pride Chigwedere, from the Harvard School of Public Health AIDS Initiative in the US, provide additional proof that withholding HIV treatments with proven benefits led to the death of 330,000 people in South Africa as the result of AIDS denialist policies. They also show that the harm has not been reversed and highlight that when denialism enters public health practice, as in South Africa, the consequences are disastrous.

AIDS denialists refute that HIV causes AIDS, that antiretroviral drugs are useful, and lastly, that millions of people worldwide have died from AIDS. AIDS denialists represent a growing movement that has considerable visibility on the Internet. Despite their views, it is estimated that from 2000 to 2005, at least 330,000 South Africans died prematurely and 35,000 babies were infected with HIV as a result of former president Thabo Mbeki's decision to withhold antiretroviral drugs, based on advice from American AIDS denialists.

In their thought-provoking paper, Essex and Chigwedere review the potent effects of HIV treatments and their missed opportunities in South Africa. They respond persuasively to AIDS denialist arguments with robust scientific evidence. They also discuss the key implications of the relationship between AIDS denialism and public health practice, using South Africa as the example. Finally, they argue for accountability for the human rights violations and loss of hundreds of thousands of lives, as well as the need to reform public health practice to include standards and accountability.

The authors conclude: "There is a need for honesty and peer review in situations that impact public health policy. When AIDS denialism enters public health practice, the consequences are tragic. The implications start in honest science but extend to the need for accountability and, perhaps, public health reform."

Reference

1. Chigwedere P & Essex M (2010). AIDS denialism and public health practice. AIDS & Behavior; DOI 10.1007/s10461-009-9654-7

The article is available online free of charge at:
http://www.springerlink.com/content/108174nr1788q73w/?p=b6e3d7065a854a2b8a17ac9f3f014a2dπ=0

Really?

The Claim: If You Have a Seafood Allergy, Avoid CT Scans

By ANAHAD O'CONNOR

THE FACTS Seafood allergies represent the most common form of food allergies in adults, affecting about 2 percent to 3 percent of Americans. But myths about the condition abound.

The most prevalent falsehood may be that allergies to shellfish in particular, which account for most seafood allergies, are caused by an intolerance to their iodine content. As a result, many patients who show up at hospitals for CT scans and other X-ray imaging procedures that involve ingesting iodine-containing contrast agents worry about severe allergic reactions.

According to studies, the notion is a myth: The allergies are caused by proteins in the animals, not their iodine content. But researchers have found that the myth persists at least in part because doctors help propagate it.

One study said the belief was so prevalent that about 70 percent of radiologists and cardiologists who were surveyed said they regularly asked patients whether they had seafood allergies before administering radiocontrast agents before procedures, and 40 percent said they would not administer them to patients who answered yes.

In reality, the general risk of an adverse reaction to a contrast agent ranges from 0.2 percent to 17 percent (depending on several factors), with severe reactions extremely rare. But studies show that an allergy of any kind, be it asthma or an allergy to shellfish or another food, raises the risk by the same amount. Ultimately, no more than 15 percent of patients with seafood allergies experience reactions.

THE BOTTOM LINE Seafood allergies are not caused by iodine.

Vitamin D supplementation can reduce falls in nursing care facilities

Giving people living in nursing facilities vitamin D can reduce the rate of falls, according to a new Cochrane Review. This finding comes from a study of many different interventions used in different situations. In hospitals, multifactorial interventions and supervised exercise programs also showed benefit.

Older people living in nursing facilities or who have been admitted to hospital are much more likely to suffer a fall than those living in the community. In these settings, falls fairly often result in head injuries and fractures, with rates of hip fracture more than ten times higher in nursing facilities than in the community. It is important to try to prevent falls to avoid unnecessary stress for older people and their families, and to reduce pressure on staff and resources. However, prevention is complicated as falls usually happen for several or many different reasons.

"Many of the preventive measures used to avoid falls in older people are combined in what are called multifactorial interventions, so it can be very difficult to separate out the effects of all the different measures," said lead researcher Ian Cameron, who is based at Sydney Medical School at the University of Sydney in Ryde, Australia.

The current review included 41 trials involving 25,422 older people, who were mostly women. Five trials tested the effects of giving vitamin D to patients in nursing facilities, where it was found to be an effective measure for preventing falls. The researchers found that multifactorial interventions, which often incorporated exercise, medication, or environmental factors including appropriate equipment, reduced the risk of falls in hospitals. In nursing homes, the effects of multifactorial interventions were not significant overall. However, the researchers concluded that multifactorial interventions provided by multidisciplinary teams in these facilities may reduce the rate and risk of falls.

"In our review, we saw limited evidence that these combined interventions work, but we could more confidently recommend them if they were delivered by a multidisciplinary team," said Cameron. "Currently, there's no one component of any of these programmes that stands out as more important than any other and we're also missing data on whether increased supervision or new technologies such as alarm systems are of any benefit."

Genome Study Provides a Census of Early Humans

By NICHOLAS WADE

From the composition of just two human genomes, geneticists have computed the size of the human population 1.2 million years ago from which everyone in the world is descended.

They put the number at 18,500 people, but this refers only to breeding individuals, the “effective” population. The actual population would have been about three times as large, or 55,500.

Comparable estimates for other primates then are 21,000 for chimpanzees and 25,000 for gorillas. In biological terms, it seems, humans were not a very successful species, and the strategy of investing in larger brains than those of their fellow apes had not yet produced any big payoff. Human population numbers did not reach high levels until after the advent of agriculture.

Geneticists have long known that the ancestors of modern humans numbered as few as 10,000 at some time in the last 100,000 years. The critically low number suggested that some catastrophe, like disease or climate change induced by a volcano, had brought humans close to the brink of extinction.

If the new estimate is correct, however, human population size has been small and fairly constant throughout most of the last million years, ruling out the need to look for a catastrophe.

The estimate, reported in the issue on Tuesday of The Proceedings of the National Academy of Sciences, was made by a team of population geneticists at the University of Utah led by Chad D. Huff and Lynn B. Jorde.

The human population a million years ago was represented by archaic species like Homo ergaster in Africa and Homo erectus in East Asia. The Utah team says its estimate of 18,500 implies “an unusually small population for a species spread across the entire Old World.”

But that estimate would apply to the worldwide population only if there were inbreeding between the humans on the different continents. If not, and if modern humans are descended from just one of these populations, like Homo ergaster in Africa, then the estimate would apply only to that.

Richard G. Klein, a paleoanthropologist at Stanford, said it was hard to believe the population from which modern humans are descended was as small as 18,500 “unless they were geographically restricted to Africa or a small part of it.”

There is no independent way of assessing a genetics-based estimate of population size at this period, Dr. Klein said, although archaeologists have developed ways of assessing ancient populations of more recent times.

The Utah team based its estimate on the genetic variation present in two complete human genomes, one prepared by the government’s human genome project and the other by J. Craig Venter, the genome sequencing

pioneer. The government decoded a single copy of a mosaic genome derived from a medley of people, apparently of European and Asian origin. Dr. Venter decoded both copies of his own genome, the one inherited from his father and the one from his mother.

The Utah team thus had three genomes to work with and looked at ancient elements known as Alu insertions, the youngest class of which appeared in the human genome around a million years ago. The amount of variation seen in the DNA immediately surrounding the Alu insertions gave a measure of the size of human population at that time.

Their estimate agrees almost exactly with an earlier one, also based on Alu insertions but with sparser data. The insertions tag ancient regions of the genome that are unaffected by the recent growth in population, Dr. Huff said.

Most modern European males descend from farmers who migrated from the Near East

Study led by University of Leicester published in PLoS Biology

A new study from the University of Leicester has found that most men in Europe descend from the first farmers who migrated from the Near East 10,000 years ago. The findings are published January 19 in the open-access journal PLoS Biology.

The invention of farming is perhaps the most important cultural change in the history of modern humans. Increased food production led to the development of societies that stayed put, rather than wandering in search of food. The resulting population growth culminated in the seven billion people who now live on the planet. In Europe, farming spread from the 'Fertile Crescent', a region extending from the eastern Mediterranean coast to the Persian Gulf and including the Tigris and Euphrates valleys.

There has been much debate about whether the westerly spread of agriculture from the Near East was driven by farmers actually migrating, or by the transfer of ideas and technologies to indigenous hunter-gatherers. Now, researchers have studied the genetic diversity of modern populations to throw light on the processes involved in these ancient events.

The new study, funded by the Wellcome Trust, examines the diversity of the Y chromosome, which is passed from father to son. Mark Jobling, who led the research, said: "We focused on the commonest Y-chromosome lineage in Europe, carried by about 110 million men – it follows a gradient from south-east to north-west, reaching almost 100% frequency in Ireland. We looked at how the lineage is distributed, how diverse it is in different parts of Europe, and how old it is." The results suggested that the lineage spread together with farming from the Near East.

Dr Patricia Balaresque, first author of the study, added: "In total, this means that more than 80% of European Y chromosomes descend from incoming farmers. In contrast, most maternal genetic lineages seem to descend from hunter-gatherers. To us, this suggests a reproductive advantage for farming males over indigenous hunter-gatherer males during the switch from hunting and gathering, to farming – maybe, back then, it was just sexier to be a farmer."

***Funding**: MAJ was supported by a Wellcome Trust Senior Fellowship in Basic Biomedical Science (grant number 057559); PB, GRB, SMA, ZHR, and CTS were supported by the Wellcome Trust (www.wellcome.ac.uk). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.*

***Citation**: Balaresque P, Bowden GR, Adams SM, Leung H-Y, King TE, et al. (2010) A Predominantly Neolithic Origin for European Paternal Lineages. PLoS Biol 8(1):e1000285. doi:10.1371/journal.pbio.1000285*

The Cancer Genome Atlas identifies distinct subtypes of deadly brain cancer

The most common form of malignant brain cancer in adults, glioblastoma multiforme (GBM), is not a single disease but appears to be four distinct molecular subtypes, according to a study by The Cancer Genome Atlas (TCGA) Research Network. The researchers of this study also found that response to aggressive chemotherapy and radiation differed by subtype. Patients with one subtype treated with this strategy appeared to succumb to their disease at a rate approximately 50 percent slower than patients treated with less aggressive therapy. This effect was seen to a lesser degree in two of the subtypes and not at all in the fourth subtype.

Although the findings do not affect current clinical practice, the researchers said the results may lead to more personalized approaches to treating groups of GBM patients based on their genomic alterations. The study, published Jan. 19, 2010 in Cancer Cell, provides a solid framework for investigation of targeted therapies that may improve the near uniformly fatal prognosis of this cancer. The research team for TCGA is a collaborative effort funded by the National Cancer Institute (NCI) and the National Human Genome Research Institute (NHGRI), both parts of the National Institutes of Health. "TCGA is mobilizing the entire cancer community to find new strategies in detecting and treating cancer faster," said NIH Director Francis Collins, M.D., Ph.D. "These findings are just a hint of what we expect to result from the comprehensive data generated by TCGA over the next few years." GBM is a very fast-growing type of tumor. In recent years, three of every 100,000

Americans have been diagnosed with GBM, representing the highest incidence rate among malignant brain tumors. Most patients with GBM die of the disease within approximately 14 months of diagnosis.
"These new findings offer critical insights into stratifying patients based on the unique molecular characteristics of their disease," said John E. Niederhuber, M.D., NCI director. "As we learn more and more about the genetic underpinnings of cancer, we hope to achieve a similar level of molecular understanding for all cancers and eventually to generate recipes of highly targeted therapies uniquely suited to the individual patient."

The TCGA researchers expanded on previous studies, which had established gene expression profiling as a means to identify distinct subgroups of GBM.

"We discovered a bundle of events that unequivocally occur almost exclusively within a subtype," said lead author D. Neil Hayes, M.D., University of North Carolina at Chapel Hill. "These are critical events in the history of the tumor's development and spread, and evidence is increasing that they may relate to the initial formation of the tumors."

TCGA researchers reported that the nature of these events indicate that the underlying pathology of each subtype may begin from different types of cells. This may provide a better understanding of which cell types undergo changes that ultimately drive initial cancer formation. This finding has potential clinical significance since determining the types of cells that form GBM is critical for establishing effective treatment regimens. Because the response to aggressive chemotherapy and radiation differed by subtype, some classes of drugs would be expected to work for some tumor subtypes and not others.

"The ability to differentiate GBM tumors based on their altered genetic code lays the groundwork for more effective treatment strategies to combat this deadly cancer," said Eric D. Green, M.D., Ph.D., NHGRI director. "These findings demonstrate the power of using a cancer's genome to unravel the molecular changes that occur in the various cancer types targeted by TCGA. I'm optimistic that this type of knowledge will someday lead to improved personalized therapies and care for cancer patients."

The new findings build on TCGA's detailed view of GBM genomic changes reported in Nature in October 2008. TCGA, launched in 2006, is a comprehensive and coordinated effort to accelerate understanding of the molecular basis of cancer through the application of genome analysis technologies, including large-scale genome sequencing.

TCGA data are being made rapidly available to the research community through a database, http://cancergenome.nih.gov/dataportal. The database provides direct access to most analytic datasets, with other data, such as patient treatment records, available to qualified researchers through an NIH review and approval process. The TCGA Research Network consists of more than 150 researchers at dozens of institutions across the nation. A full list of participants is available at http://cancergenome.nih.gov/wwd/program.

More details about The Cancer Genome Atlas, including Quick Facts, Q&A, graphics, glossary, a brief guide to genomics and a media library of available images can be found at http://cancergenome.nih.gov.

***Reference**: Verhaak RGW, Hoadley KA, et al. Integrated Genomic Analysis Identifies Clinically Relevant Subtypes of Glioblastoma Characterized by Abnormalities in PDGFRA, IDH1, EGFR, and NF1. Cancer Cell, Jan 19, 2010. DOI 10.1016/j.ccr.2010.12.020.*

Researchers find that common stomach pathogen may protect against tuberculosis

Davis, Calif. – It's been implicated as the bacterium that causes ulcers and the majority of stomach cancers, but studies by researchers at Stanford University, UC Davis, and the University of Pittsburgh have found that Helicobacter pylori (H. pylori) also may play a protective role – against the worldwide killer, tuberculosis (TB).

In an article appearing online Wednesday in PloS ONE, Jay Solnick, UC Davis professor of medicine and microbiology, and his co-authors report that H. pylori infection may enhance immunity against tuberculosis, a disease endemic in many parts of the world, and for which there is no effective vaccine.

"Here is a bacterium that we know is sometimes harmful and that is clearly associated with cancer," Solnick said. "But it's not that simple."

Solnick explains that up until the 20th century, when public health improved and antibiotic use was widespread, virtually everyone was infected with H. pylori. That remains the case today in most developing countries, implying that H. pylori may have evolved with its human host because it confers some selective benefit.

"These new findings suggest that one such benefit may that H. pylori provides protection against tuberculosis, and perhaps other infectious diseases as well," he said.

Tuberculosis is second only to HIV as a cause of death due to a single infectious agent; an estimated one third of the world population has latent TB infection. But only 30 percent of people exposed to TB ever become infected, and only 10 percent of those infected will develop active tuberculosis disease.

"One explanation may be the presence of chronic infection of the stomach with H. pylori," Solnick said. The findings also may eventually aid in managing TB, since H. pylori infection may help determine whether someone infected with TB gets a latent, asymptomatic infection or active disease.

The collaborative research effort began with the hypothesis that a person's immune responses to individual infections are modified by the existence of other infections, said Sharon Perry, an epidemiologist at Stanford University, and the study's lead author.

Early studies funded by the National Institutes of Health showed that a patient infected with H. pylori had elevated immune responses to TB antigens. Perry's work expanded to test the hypothesis in patients from immigrant populations in Santa Clara County, then in households in Gambia and Pakistan, where TB is prevalent. In the two-year study, they found that individuals exposed to TB who then progressed to active disease were less likely to be infected with H. pylori than those who were not infected with H. pylori. Protection against tuberculosis may have been a result of enhanced immune responses to TB antigens in those infected with H. pylori, since H. pylori induces expression of interferon gamma and other cytokines, which are important for immunity against viral and bacterial infections.

At this point, Perry and Stanford University professor Julie Parsonnet wanted to test the theory in non-human primates. They enlisted Solnick at UC Davis, in conjunction with JoAnne Flynn of the Department of Microbiology and Molecular Genetics and Immunology at the University of Pittsburgh School of Medicine.

With a grant from the Bill and Melinda Gates Foundation, Solnick, Parsonnet, and Flynn looked at the role of H. pylori in 41 monkeys challenged with TB. Again, the findings were striking. Of the 30 monkeys that tested positive for H. pylori, only 5 developed active TB, but 6 of 11 monkeys that were negative for H. pylori developed active disease.

"The one-disease, one-pathogen paradigm doesn't tell the whole story," said Perry. "It is incomplete as an explanation of the clinical outcomes of chronic infection. In fact, the thousands of organisms that live with us play a role in shaping our immune response to specific infections."

Solnick cites the "hygiene hypothesis" as one possible explanation. That theory suggests that a reduction in exposure to infectious diseases can make the immune system less able to fight other challenges. Conversely, exposure to certain pathogens may aid immune response to other infections.

The authors acknowledge the findings are preliminary and propose several follow-up studies. First, Solnick, Parsonnet and Flynn have proposed research to test whether experimental infection of H. pylori will protect monkeys from TB, and whether it will enhance the protective effect of immunization. If successful, they will test a recombinant H. pylori strain that expresses TB antigens for possible immunization against TB. These studies will be performed in collaboration with Ondek Ltd, founded by Barry Marshall, who was awarded the Nobel Prize in 2005 for the discovery of H. pylori.

Lost city of Atlantis 'could be buried in southern Spain'

Archaeologists have begun the search for an ancient civilization in southern Spain that some believe could help pinpoint the legendary lost city of Atlantis.

By Fiona Govan in Madrid

A team of researchers from Spain's Higher Council for Scientific Study (CSIC) are examining a marshy area of Andalusian parkland to find evidence of a 3,000-year-old settlement.

They believe that Tartessos, a wealthy civilization in southern Iberia that predates the Phoenicians, may have had its capital in the heart of what is now the Donana national park.

Until now historians had dismissed the region as a possible site believing that it had been submerged since the ice age. But it is claimed new evidence suggests the waters may have receded in time for the Tartessians to build an urban centre, which was later destroyed in a tsunami.

The Hinojos marshes, an area close to the mouth of the Guadalquiver river where it meets the Atlantic, have now been pinpointed as the site most likely to provide evidence of a lost city.

Archaeological findings have already proved the existence of Tartessian culture at sites on the opposite bank of the river. "If they existed on the other side, they must also have been here (in Donana)," Sebastian Celestino, the archaeologist leading the project told the newspaper El Pais. "There were earthquakes and one of them caused a tsunami that razed everything and which coincided with the era in which Tartessian power was at its height."

Aerial photos show the existence of large circular and rectangular forms that could not have been produced by nature. The images, together with literary accounts by ancient Greek geographers have given weight to the theory that a great Tartessian city once existed within the park.

The Tartessian civilization, which developed in southern Spain between the 11th and 7th centuries BC and became rich trading gold and silver from local mines, has long been linked by mythologists to the Atlantis legend.

While the Spanish researchers refuse to speculate on whether they are on the brink of discovering Atlantis others believe their research could be a breakthrough in a centuries old quest.

"Evidence is mounting that suggests the story of Atlantis was not mere fiction, fable or myth, but a true story as Plato always maintained," said Georgeos Diaz-Montexano, a Cuban archeologist who has spent the last 15 years searching for the submerged city. "Atlantis is not exactly where the CSIC is looking, but it is close," he claimed. The theory is just the latest in a long list of suggested locations for Atlantis, including various Mediterranean islands, the Azores, the Sahara desert, Central America and Antarctica.

Gene linked to schizophrenia may reduce cancer risk

People who inherit a specific form of a gene that puts them on a road to schizophrenia may be protected against some forms of cancer, according to a new study by scientists at The Feinstein Institute for Medical Research.

The MET proto-oncogene is activated in a variety of tumor malignancies. The gene has recently also been linked to autism and has a role in neurodevelopment, which is why Katherine E. Burdick, PhD and her colleagues decided to look for a relationship between MET and schizophrenia in their large sample of patients. Such an association may help explain the family-based data that suggest that inheriting an enhanced risk for schizophrenia reduces one's chances of developing cancer.

In a study published in the American Journal of Psychiatry, Dr. Burdick and colleagues examined the relationship between 21 single-nucleotide polymorphisms (SNPs) in MET and schizophrenia in 173 patients and 137 normal volunteers. They found that several varieties of MET influenced the risk for schizophrenia, as well as general cognitive ability. The authors were able to replicate their findings in a second sample of 107 patients and 112 healthy volunteers. "The results add to the growing evidence suggesting an intriguing relationship between cancer-related genes and schizophrenia susceptibility," the scientists wrote.

It remains unclear exactly how the gene actually may increase the risk for schizophrenia while protecting against some forms of cancer. However, evidence from research on MET in autism provides some insight. Specifically, it is known that MET is activated (increased activity) when tumors develop and can increase the chance that cancer cells multiply and infiltrate other tissue.

The activation of MET during normal neurodevelopment is critical to ensure that neurons grow and migrate to position themselves correctly in the human cortex. In autism, it appears that while the brain is developing, reduced MET activity results in structural and functional changes in the brain that may increase a person's risk for developing the disorder. The Feinstein investigators speculate that the same risk-inducing mechanism may be at play in its link to schizophrenia.

New theory on the origin of primates

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

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

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

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

Divergence between strepsirrhines (lemurs and lorises) and haplorhines (tarsiers and anthropoids) is correlated with intense volcanic activity on the Lebombo Monocline in Africa about 180 million years ago. The

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

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

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

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

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

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

Clot-causing heart pouch may raise stroke risk

Discovery can aid efforts to prevent recurring strokes

Irvine, Calif. - UC Irvine cardiologists have found a pouchlike structure inside the heart's left atrial chamber that may be a potent source of stroke-causing blood clots.

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

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

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

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

PrEP treatment prevented HIV transmission in humanized mice

CHAPEL HILL -- Systemic pre-exposure administration of antiretroviral drugs provides protection against intravenous and rectal transmission of HIV in mice with human immune systems, according to a new study published January 21, 2010 in the online journal PLoS ONE.

"These results provide evidence that a universal approach to prevent all forms of HIV transmission in all settings might be possible," said J. Victor Garcia-Martinez, Ph.D., professor in the department of medicine at the University of North Carolina at Chapel Hill School of Medicine and senior author of the study. "This could greatly facilitate the implementation of a single program capable of targeting virtually all groups of people at high risk of HIV infection."

According to data from the national Centers for Disease Control and Prevention, HIV diagnoses increased by a staggering 15 percent between 2004 and 2007. Rectal exposure is the leading cause of HIV transmission among men who have sex with men, and since the beginning of the epidemic, more than 500,000 have been diagnosed with HIV in the United States alone and more than 300,000 have died.

These latest findings are welcome news after the recent announcements that an AIDS vaccine trial in Thailand showed only marginal success and a large international trial of a vaginal microbicide found no evidence that it reduces the risk of HIV infection.

The research, using pre-exposure prophylaxis (PrEP) with antiretrovirals, was conducted using a humanized mouse model developed by Garcia-Martinez and colleagues at the University of Texas Southwestern Medical Center. The animals are known as "BLT" mice, because they are transplanted with human bone marrow, liver and thymus cells, which results in a fully functioning human immune system.

"Although results from humanized mice cannot be extrapolated directly to humans, our data indicate that one intervention approach could potentially block multiple routes of HIV transmission in people," said the paper's lead author, Paul Denton, Ph.D., who is a research instructor in the department of medicine at the UNC School of Medicine.

The humanized mice were either control mice and received no drugs or were administered the commonly prescribed antiretroviral drug therapy Truvada and then exposed to HIV – either rectally or intravenously – at a level much higher than would occur in typical human exposure. None of the nine treated BLT mice that were exposed rectally showed any sign of the virus after exposure; they were completely protected. However, 12 of the 19 control BLT mice became HIV positive following rectal exposure.

Among humanized mice exposed intravenously, a transmission route which is more difficult to block, all six of the control BLT mice became infected, but seven of the eight treated BLT mice – 90 percent – were protected against the virus.

Garcia-Martinez's team previously demonstrated that PrEP is also highly effective against vaginal HIV transmission and with this study their research shows that PrEP can prevent HIV spread by the three modes that account for over 90 percent of all HIV infections worldwide.

Results of this study not only have important human clinical implications, but also could significantly improve drug studies. There are already PrEP trials in humans, but their continuation is threatened due in part to ethical concerns over administering drugs to healthy people with no hard evidence that they will work.

"Now the head of a clinical trial can take this research to a ministry of health or review board and say, 'Look, we have positive experimental evidence that if we do this right it has a chance to work,'" Denton said.

Mark Wainberg, Ph.D., who is professor of microbiology and virology at McGill University in Montréal and director of the McGill AIDS Centre, said, "This is outstanding work that helps to advance the field of HIV prevention science. This research provides excellent rationale for the continuation of PrEP clinical trials."

"It is painfully clear that treatment alone will not put a dent in the progression of the AIDS epidemic," said Garcia-Martinez, also an investigator in the UNC Center for AIDS Research. "There is a strong need for interventions like PrEP that could prevent new infections and slow the epidemic."

The research was funded by the National Institutes of Health and the Foundation for AIDS Research (AmFAR). Study co-authors from UNC include John F. Krisko, Francisco Martinez-Torres and Wei Zou.

Some mouse sperm can identify, and even cooperate with, its brethren

Spermatozoa from the same individual cluster together, improving motility in the race to the egg

CAMBRIDGE, Mass. -- Some mouse sperm can discriminate between its brethren and competing sperm from other males, clustering with its closest relatives to swim faster in the race to the egg. But this sort of cooperation appears to be present only in certain promiscuous species, where it affords an individual's sperm a competitive advantage over that of other males.

The work is described this week in the journal Nature by biologists Heidi S. Fisher and Hopi E. Hoekstra of Harvard University.

"The race among sperm toward the egg is fierce, but never more so than when sperm of different males compete," says Fisher, a postdoctoral researcher in Harvard's Department of Organismic and Evolutionary Biology. "In some species where females mates with multiple males, groups of sperm join forces in order to outswim their uncooperative competitors. We've shown that in deer mice, cooperation only occurs among close relatives -- sperm from the same male."

This ability of sperm to discriminate between related and unrelated sperm is not seen in monogamous species, in which sperm of different males are unlikely to ever interact. The results suggest that competition among males drives cooperative behavior among their sperm.

Fisher and Hoekstra studied sperm from two species of deer mice, Peromyscus polionotus and Peromyscus maniculatus. Although closely related, these two species differ greatly in their sexual behavior: P. polionotus is monogamous, while P. maniculatus females are promiscuous, mating with successive males as little as one minute apart.

The scientists found that only sperm from the promiscuous species showed the ability to discriminate between closely related and more distantly related sperm. When sperm from different P. polionotus males was combined in a Petri dish, it showed no selective aggregation.

"This finding that sperm can discriminate suggests that sperm may be much more complex than we've appreciated," says Hoekstra, John L. Loeb Associate Professor of the Natural Sciences at Harvard. "Because more than 95 percent of mammals are promiscuous, it's possible this ability to discriminate and cooperate may be fairly widespread."

Fisher and Hoekstra say it's not yet clear exactly how sperm identifies its relatives. Previous research by a different group at Harvard has suggested that a single gene allows cooperative yeast to recognize related individuals. Fisher and Hoekstra found that one mouse's sperm can even discriminate against that of its brother, suggesting that the recognition system must be very fine-tuned.

"Whatever the recognition factor is, it would have to be highly variable," Fisher says. "It may involve a hyper-variable protein expressed on the outside of the sperm head."

The current work builds upon research published in 2002 by Harry Moore and colleagues at the University of Sheffield. Moore found that sperm from wood mice could clump together to increase swimming velocity during their migration towards the egg, but did not identify kinship as the factor determining which spermatozoa join forces.

"Since all but one sperm fail to fertilize after joining a group, this altruistic behavior has been assumed, but never demonstrated, to occur only between closely related sperm," Hoekstra says. "Our results show that the temporary alliances among sperm are not passively formed, rather they represent a complex discriminatory behavior driven by sexual selection."

Moore also investigated whether human sperm clusters together in the same way, finding little evidence that it does.

"Most rodent sperm has a hooked head, enabling mouse sperm to cluster together," Fisher says. "In humans, the sperm head is rounder, which does not facilitate clustering."

Fisher and Hoekstra's work was funded by the National Institutes of Health and the Arnold and Mabel Beckman Foundation.

'Survival of the cutest' proves Darwin right

Domestic dogs have followed their own evolutionary path, twisting Darwin's directive 'survival of the fittest' to their own needs – and have proved him right in the process, according to a new study by biologists Chris Klingenberg, of The University of Manchester and Abby Drake, of the College of the Holy Cross in the US.

The study, published in The American Naturalist today (20 January 2010), compared the skull shapes of domestic dogs with those of different species across the order Carnivora, to which dogs belong along with cats, bears, weasels, civets and even seals and walruses.

It found that the skull shapes of domestic dogs varied as much as those of the whole order. It also showed that the extremes of diversity were farther apart in domestic dogs than in the rest of the order. This means, for instance, that a Collie has a skull shape that is more different from that of a Pekingese than the skull shape of the cat is from that of a walrus.

Dr Drake explains: "We usually think of evolution as a slow and gradual process, but the incredible amount of diversity in domestic dogs has originated through selective breeding in just the last few hundred years, and particularly after the modern purebred dog breeds were established in the last 150 years."

By contrast, the order Carnivora dates back at least 60 million years. The massive diversity in the shapes of the dogs' skulls emphatically proves that selection has a powerful role to play in evolution and the level of diversity that separates species and even families can be generated within a single species, in this case in dogs.

Much of the diversity of domestic dog skulls is outside the range of variation in the Carnivora, and thus represents skull shapes that are entirely novel.

Dr Klingenberg adds: "Domestic dogs are boldly going where no self respecting carnivore ever has gone before. "Domestic dogs don't live in the wild so they don't have to run after things and kill them – their food comes out of a tin and the toughest thing they'll ever have to chew is their owner's slippers. So they can get away with a lot of variation that would affect functions such as breathing and chewing and would therefore lead to their extinction. "Natural selection has been relaxed and replaced with artificial selection for various shapes that breeders favour."

Domestic dogs are a model species for studying longer term natural selection. Darwin studied them, as well as pigeons and other domesticated species.

Drake and Klingenberg compared the amazing amount of diversity in dogs to the entire order Carnivora. They measured the positions of 50 recognizable points on the skulls of dogs and their 'cousins' from the rest of the order Carnivora, and analyzed shape variation with newly developed methods.

The team divided the dog breeds into categories according to function, such as hunting, herding, guarding and companion dogs. They found the companion (or pet) dogs were more variable than all the other categories put together.

According to Drake, “Dogs are bred for their looks not for doing a job so there is more scope for outlandish variations, which are then able to survive and reproduce.”

Dr Klingenberg concludes: “I think this example of head shape is characteristic of many others and is showing it so clearly, showing what happens when you consistently and over time apply selection.

“This study illustrates the power of Darwinian selection with so much variation produced in such a short period of time. The evidence is very strong.”

Mammals 'floated to Madagascar'

By Mark Kinver Science and environment reporter, BBC News

The ancestors of the current mammals found on the island of Madagascar could have been transported on floating vegetation from Africa, a study says. Researchers modelled ancient ocean currents and found that favourable conditions existed in the same period as when mammals arrived on the island.

The idea of "rafting" first emerged in 1940, but some argued that a "land bridge" allowed animals to walk there. The findings have been published online on the Nature website.

Madagascar, the fourth largest island on the planet, is deemed one of the world's biological hotspots.

Because of its isolation, most of its mammals, half its birds, and many of its plant species exist nowhere else on Earth.

The first mammals are believed to have appeared on the island about 60 million years ago, 100 million years after the landmass was thought to have separated from Africa. This led to the emergence of two main hypotheses on how mammals managed to inhabit the island: via a "land bridge" or floating vegetation.

Ticket to ride

Using a climate model used by the Intergovernmental Panel on Climate Change (IPCC), co-author Matthew Huber - a palaeoclimate modeller at Purdue University in Indiana, US - adapted it to shed light on the past.

"I had been doing these simulations for some time," he told BBC News. "The paper's lead author (Dr Jason Ali from the University of Hong Kong) asked me to look at the Madagascar region because he thought that the ocean currents were different during that time. "I looked, and - sure enough - the ocean currents went in the opposite direction than they do today," he explained.

"The reason is primarily because, in the past, both Madagascar and Africa were 15 degrees further south.

This meant that the 430km (270 mile) Mozambique Channel that separates the two landmasses was located in a different ocean "gyre" (circular ocean current), which had an important impact on the direction and strength of the currents within the channel.

Dr Huber said that the model showed that this provided the right conditions to allow mammals to be transported across the channel. "What the model suggests is that occasionally - say one month in 100 years - the currents were strong enough to allow a raft, for example a large log, carrying a family of lemurs to make the journey in about three weeks," he explained. "Biologists and palaeontologists say that rafting is the only sensible way for this [dispersal] to have happened. But the problem has always been the currents."

"When you looked at present ocean currents, the journey is impossible. "So scientists have been stuck because when you are faced with impossibilities, what do you do?"

Current thinking

As a result, a number of scientists favoured the theory that a land bridge existed in the past.

But the theory would have required a "radical rethinking of the region's plate tectonics", Dr Huber explained.

"What we have done is resolved this conundrum by saying that ocean currents were actually different in the past. "So it was possible - not probable, but possible."

The idea of mammals being transported on "rafts" of vegetation was first mooted back in 1940 by US researcher George Simpson.

He developed the "sweepstakes" hypothesis because the biodiversity on Madagascar was unique, lacking "megafauna" such as elephants, lions and zebras.

If the animals had reached Madagascar via a "land bridge" - meaning the landmass was connected to the African continent - Simpson argued that large mammals would have also made the journey. He added that the match between the currents and the arrival of new mammals on Madagascar was "pretty good".

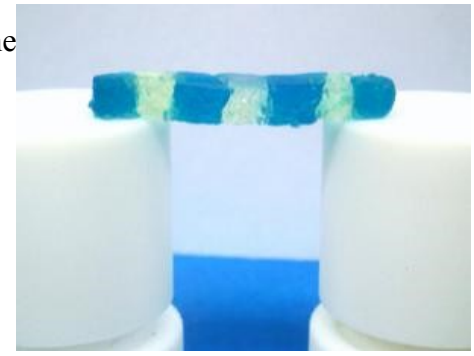
It is understood that the common ancestor of present-day lemurs arrived on Madagascar between 60 million and 50 million years ago; tenrecs (such as hedgehogs) appeared 42-25 million years ago, and rodents between 24 million and 20 million years ago. "About 20 million years ago, the 'flow' of species stopped," Dr Huber

observed. "When I look at my simulations for 20 million years ago, the currents are going the same way as they do today."

He explained that change in the direction of the current in the Mozambique Channel was a result of the slow northward movement of Africa and Madagascar. This meant that the influence of the southern oceanic gyre was gradually weakened, causing the "sweepstake" route to be closed. He said: "The 'switch' might have turned off gradually between 50 million and 20 million years ago, but by 20 million years ago, the journey was impossible."

Smart mud could be the new plastic

* 20 January 2010 **by Colin Barras**



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

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

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

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

Self-repairing hydrogel

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

Some other hydrogels rely on covalent chemical bonds rather than supramolecular forces for their strength. One disadvantage of this is that when the covalent bonds break, the material irreversibly loses its strength, says Aida. Supramolecular forces, on the other hand, can easily reform, so if the material fails under stress it can quickly regain its strength.

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

New class of materials

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

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

Aida says that strengthening the material is as simple as increasing the quantities of clay, sodium polyacrylate and glue, provided transparency is not important. *Journal reference: Nature, DOI: 10.1038/nature08693.*

MIT: New research suggests that near-Earth encounters can 'shake' asteroids

Findings open the door to new field of asteroid seismology

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

By analyzing telescopic measurements of near-Earth asteroids (NEAs), or asteroids that come within 30 million miles of Earth, Binzel has determined that if an NEA travels within a certain range of Earth, roughly one-quarter of the distance between Earth and the moon, it can experience a "seismic shake" strong enough to bring fresh material called "regolith" to its surface. These rarely seen "fresh asteroids" have long interested astronomers because their spectral fingerprints, or how they reflect different wavelengths of light, match 80

percent of all meteorites that fall to Earth, according to a paper by Binzel appearing in the Jan. 21 issue of Nature. The paper suggests that Earth's gravitational pull and tidal forces create these seismic tremors.

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

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

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

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

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

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

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

***Source**: "Earth encounters as the origin of fresh asteroid surfaces," by R. Binzel, A. Morbidelli, S. Merouane, F. DeMeo, M. Birlan, P. Vernazza, C. Thomas, A. Rivkin, S. Bus and A. Tokunaga, in Nature, published online Jan. 21, 2010.*

The human brain uses a grid to represent space

'Grid cells' that act like a spatial map in the brain have been identified for the first time in humans, according to new research by UCL scientists which may help to explain how we create internal maps of new environments.

The study is by a team from the UCL Institute of Cognitive Neuroscience and was funded by the Medical Research Council and the European Union. Published today in Nature, it uses brain imaging and virtual reality techniques to try to identify grid cells in the human brain. These specialised neurons are thought to be involved in spatial memory and have previously been identified in rodent brains, but evidence of them in humans has not been documented until now.

Grid cells represent where an animal is located within its environment, which the researchers liken to having a satnav in the brain. They fire in patterns that show up as geometrically regular, triangular grids when plotted on a map of a navigated surface. They were discovered by a Norwegian lab in 2005 whose research suggested that rats create virtual grids to help them orient themselves in their surroundings, and remember new locations in unfamiliar territory.

Study co-author Dr Caswell Barry said: "It is as if grid cells provide a cognitive map of space. In fact, these cells are very much like the longitude and latitude lines we're all familiar with on normal maps, but instead of using square grid lines it seems the brain uses triangles.

Lead author Dr Christian Doeller added: "Although we can't see the grid cells directly in the brain scanner, we can pick up the regular six-fold symmetry that is a signature of this type of firing pattern. Interestingly, the study participants with the clearest signs of grid cells were those who performed best in the virtual reality spatial memory task, suggesting that the grid cells help us to remember the locations of objects."

Professor Neil Burgess, who leads the team, commented: "The parts of the brain which show signs of grid cells - the hippocampal formation and associated brain areas - are already known to help us navigate our

environment and are also critical for autobiographical memory. This means that grid cells may help us to find our way to the right memory as well as finding our way through our environment. These brain areas are also amongst the first to be affected by Alzheimer's disease which may explain why getting lost is one of the most common early symptoms of this disease."

Notes to Editors *1. For more information or to interview the researchers quoted, please contact Ruth Howells in the UCL Media Relations Office on tel: +44 (0)20 7679 9739, mobile: +07790 675 947, email: ruth.howells@ucl.ac.uk*

Consumers over age 50 should consider steps to cut copper and iron intake

With scientific evidence linking high levels of copper and iron to Alzheimer's disease, heart disease, and other age-related disorders, a new report in ACS' Chemical Research in Toxicology suggests specific steps that older consumers can take to avoid build up of unhealthy amounts of these metals in their bodies. "This story of copper and iron toxicity, which I think is reaching the level of public health significance, is virtually unknown to the general medical community, to say nothing of complete unawareness of the public," George Brewer states in the report.

The article points out that copper and iron are essential nutrients for life, with high levels actually beneficial to the reproductive health of younger people. After age 50, however, high levels of these metals can damage cells in ways that may contribute to a range of age-related diseases.

"It seems clear that large segments of the population are at risk for toxicities from free copper and free iron, and to me, it seems clear that preventive steps should begin now." The article details those steps for people over age 50, including avoiding vitamin and mineral pills that contain cooper and iron; lowering meat intake: avoiding drinking water from copper pipes; donating blood regularly to reduce iron levels; and taking zinc supplements to lower copper levels.

The droplet moves because the gel sets up a pH gradient within the maze. The acid changes the surface tension of the oil droplet, but because of the pH gradient, it affects opposite sides of the droplet unequally. The surface tension is different at the slightly more acidic "front" of the droplet than at the back. This difference is what is ultimately responsible for moving the droplet towards the maze's exit *(Journal of the American Chemical Society, DOI: 10.1021/ja9076793). "Risks of Copper and Iron Toxicity during Aging in Humans" http://pubs.acs.org/stoken/presspac/presspac/full/10.1021/tx900338d*

Blood test for schizophrenia could be ready this year

A blood test for diagnosing schizophrenia — the most serious form of mental illness — could be available this year, according to an article in the current issue of Chemical & Engineering News, ACS' weekly newsmagazine. The disorder, with symptoms that can include hallucinations and delusional thoughts, affects more than two million people in the United States and millions more worldwide.

C&EN Senior Editor Celia Henry Arnaud mentions the test as one part of a much broader discussion of how scientists are using non-brain cells to study schizophrenia in an attempt to speed the identification of biomarkers of the disease and develop new diagnostic tests. She notes that schizophrenia does not just involve the brain, but also abnormal levels of certain proteins that appear in other parts of the body. The article highlights groundbreaking research by a group of scientists in the United Kingdom indicating that 40 percent of the chemical changes in the brains of schizophrenia patients also occur in other body parts. The U.K. scientists are studying these biomarkers in the skin, immune cells, and blood of patients to provide a real-time picture of the disease. Most previous studies, in contrast, were done with brain tissue taken from patients after death, the article notes.

The scientists have already identified several schizophrenia biomarkers in the blood and are working with a company that plans to launch a blood test for diagnosing schizophrenia in 2010. The test could help confirm diagnoses made on the basis of psychiatric evaluations and allow earlier diagnosis so that patients can be treated earlier.

"A Systemic Look at Schizophrenia" This story is available at http://pubs.acs.org/cen/science/88/8803sci1.html

What a maze-solving oil drop tells us of intelligence

* 21 January 2010 by Colin Barras

DYED pink and doped with acid, the small, inanimate drop of oil is deposited at the entrance to the maze - and immediately sets off towards the exit. A few minutes later, it emerges at the other end.

No one would equate this apparently astonishing problem-solving with intelligence. But new theories on human intelligence and the brain suggest the simple molecular processes governing the oil droplet's apparently smart behaviour may be fundamentally similar to those that govern how we act.

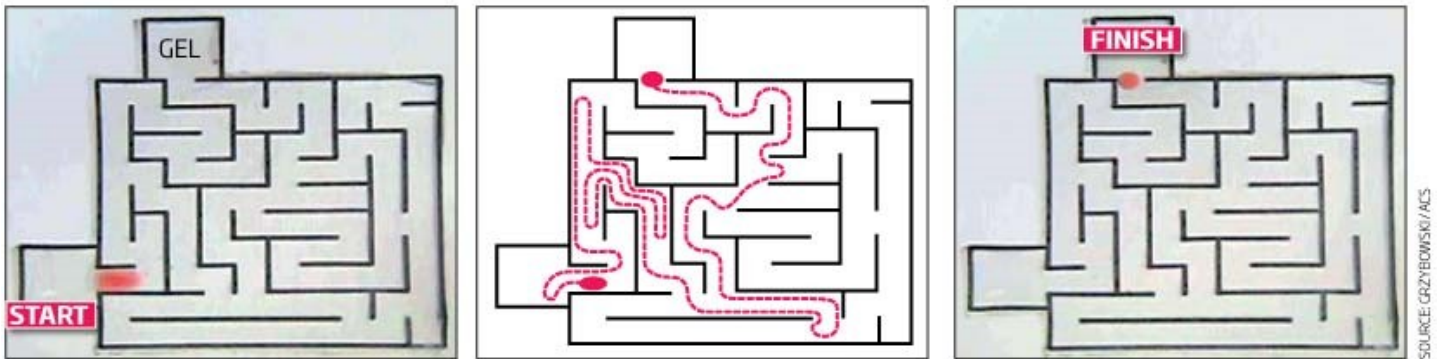
A decade ago Toshiyuki Nakagaki, now at Hokkaido University in Sapporo, Japan, reported that the slime mould Physarum polycephalum could negotiate a maze to reach food at the exit. Boldly, his team wrote in Nature: "this implies that cellular materials can show a primitive intelligence".

Now Bartosz Grzybowski, a chemist at Northwestern University in Evanston, Illinois, has shown that a simple oil droplet floating on top of an aqueous solution can also navigate a complex maze - in this case to reach an acid-soaked lump of gel at the exit.Nakagaki is unwilling to extend the notion of intelligence to the oil droplet. "It is nonsense for me to consider intelligence in non-living systems," he says. But Andy Clark, a philosopher at the University of Edinburgh, UK, suggests that this does not do Grzybowski's set-up justice. Much of biology boils down to chemistry, Clark points out. "The mere fact that it's just physical stuff doing what it does can't be a strike against the droplets," he says. "Whatever intelligence is, it can't be intelligent all the way down. It's just dumb stuff at the bottom."

So why does the dumb droplet appear to be moving in an intelligent way? The answer is all around us, says Clark. The aqueous environment surrounding the droplet is structured to such a high degree by the pH gradient that it makes the dumb droplet appear smart. "It's a neat demonstration of just how much problem-solving punch you can get from a minimal internal structure in a nicely enabling environment."

Intelligent oil?

An acid-soaked gel sets up a pH gradient in the aqueous maze which drives the pink oil droplet to the finish, despite errors along the way



SOURCE: GRZYBOWSKI/ACS

Humans rely on the same trick, says Clark. It forms the basis of the extended mind theory, which Clark and David Chalmers, now at the Australian National University in Canberra, proposed in the late 1990s. They say the division between mind and environment is less rigid than previously thought; the mind uses information within the environment as an extension of itself.

While a person can learn a route through a maze and then negotiate the maze by memory, a person would appear equally smart to an outsider if they simply followed signposts in the maze to reach the exit. "A smart person, like the droplets, is often smart due to canny combinations of internal and external structure," says Clark.

It's a powerful idea that is filtering into theories about artificial intelligence. Rolf Pfeifer at the University of Zurich in Switzerland is exploring how to "outsource" some of the cognitive load of artificially intelligent systems. He points out evidence that the way our knees absorb the energy of a jump is controlled by the material properties of the leg itself: the reactions happen too quickly to be controlled by the brain or even a reflex. Through careful choice of materials, Pfeifer is now applying that idea in his robot creations by designing body parts that are capable, to some degree, of autonomously reacting to their environment.

Karl Friston, a neuroscientist at University College London, goes further. He says the human brain and the oil droplet do share some fundamental attributes, in particular in the way they both respond to their environment.

This ties in with Bayesian brain theory, which pictures our brains as attempting to understand the world by observing the environment and making, then improving, predictions about what will happen next. Friston is working on a unified theory of the brain (New Scientist, 31 May 2008, p 30) that mathematically describes how the brain continually improves its predictions by observing its environment and minimising errors.

He sees "deep similarities" between his theory and the droplet's movement. As the droplet moves towards the exit it is moving towards a state of chemical equilibrium, where it has minimised its free energy.

Work on artificial neural networks has shown that the same principles apply to these networks: by minimising the difference between the predictions a network makes and what it actually senses happening, the network is also driven towards equilibrium. Friston is now showing how the equations that govern neural networks and thermodynamic systems apply to real brains.

The bottom line is that the "dumb" droplet is simply obeying fundamental principles. But because it is using exceptionally ordered information in the environment along the way, it moves "in an apparently purposeful way", Friston says.

None of this, of course, justifies calling Grzybowski's oil droplet "intelligent". But it does suggest that by highlighting the importance of the environment, his maze experiment may have hit on a fundamental connection between apparently intelligent behaviour at all levels: the ability to read and respond to environmental cues.

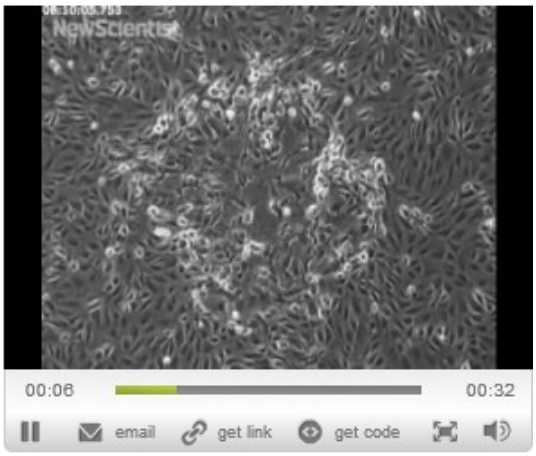
Viruses use 'hive intelligence' to focus their attack

* 19:00 21 January 2010 **by Jessica Hamzelou**

A tactic familiar from insect behaviour seems to give viruses the edge in the eternal battle between them and their host – and the remarkable proof can be seen in a video.

The video catches viruses only a few hundred nanometres in size in the act of hopping over cells that are already infected. This allows them to concentrate their energies on previously uninfected cells, accelerating the spread of infection fivefold.

Geoffrey Smith and his team of virologists at Imperial College London were curious about the vaccinia virus, and set up a video microscope to watch how the virus spreads through cells.



Video: Hopping virus spreads faster

Vaccinia was used in the vaccine that rid the world of smallpox some 35 years ago. It doesn't cause disease in humans or any other animal, and its origin is unknown.

The traditional idea of how viruses spread goes like this. A virus first enters a cell and hijacks its machinery to make its own viral proteins and replicate. Thousands of replicated viruses then spread to neighbouring cells to wreak havoc.

When Smith watched the vaccinia virus infecting monkey liver cells, he thought that it was spreading far too quickly. "It takes 5 to 6 hours for the virus to replicate, but it was spreading from cell to cell within 1 or 2 hours," he says.

Vaccinia is known to spread from cell to cell in a characteristic way. After attaching to the cell membrane of its target, it releases a protein that enters the cell, where it communicates with actin – a protein that helps maintain the cell's structure. The actin responds by growing longer, and then attaches itself to the virus, still sitting on the surface of the cell, as a so-called "actin tail". This tail helps the virus take off from the cell and find the next victim.

Smith's team labelled the virus with green fluorescent protein, and labelled some – but not all – cells with a red marker that tagged the actin. They found, to their amazement, that a virus leaving a cell would travel to another cell and merely bounce off it if it already contained the virus.

The researchers could tell that a single virus had travelled over more than one cell because some viruses which left a cell with an uncoloured actin tail picked up a red actin tail from another cell. "This means that the viruses can change their actin tails as they bounce along the surfaces of cells," says Smith. "This allows the virus to reach distant cells really quickly."

Smith reckons that two viral proteins which are presented on the surface of the infected cell effectively tell the virus not to bother reinfecting that cell. When he looked at virus strains lacking each of these proteins, the virus spread at the slower rate that would expected without the "bouncing infection" mechanism. "It's as if the proteins are telling the virus: 'Hey guys, there's no point in coming in here'," says Smith. "If you think about it, it makes sense – it's very Darwinian."

This finding is "pretty cool", says Erik Barton, a virologist at Purdue University, Indiana. "What I find most fascinating is that it suggests that viruses can function with a sort of primitive 'hive mentality' to ensure efficient use of host cell resources, akin to the way worker bees tell others where to locate the best food sources."

Finding ways to block the cell surface proteins might provide new antiviral drugs, Barton adds.

Tim Harrison, a molecular virologist at University College London, agrees that the idea is an interesting one, but he points out that the theory might not apply to all viruses. "I'm not sure how important this will turn out to be. It depends on how widespread the phenomenon is among viruses and whether it hold true in the body as it does in cell culture." *Journal reference: Science, DOI: 10.1126/science.1183173*

Engineers 'can learn from slime'

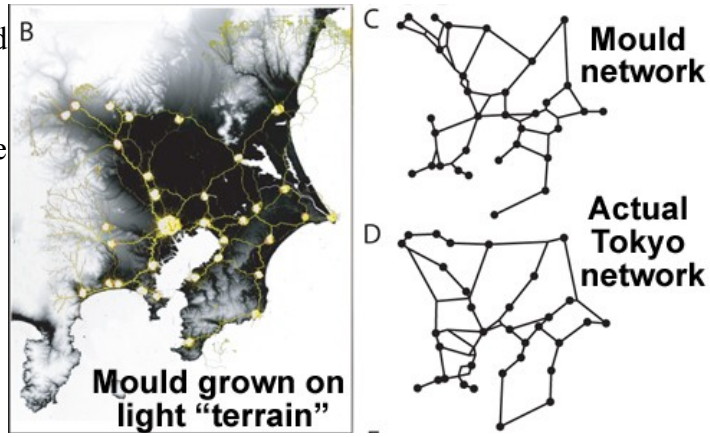
The way fungus-like slime moulds grow could help engineers design wireless communication networks.

Scientists drew this conclusion after observing a slime mould as it grew into a network that was almost identical to the Tokyo rail system. The scientists describe their ideas for "biologically inspired networks" in the journal Science.

They have incorporated the slime mould's efficient strategy into a mathematical formula.

This "slime formula" could help engineers develop better, more efficient designs.

Efficient slime



The single amoeboid cells of slime moulds fuse and spread into a network as they feed and grow.

"These biological networks have been honed by many cycles of evolutionary selection pressure," wrote the researchers in their article.

The research team, led by Dr Atsushi Tero from Hokkaido University, Japan, wanted to capture this evolved efficiency, which they say could be used to inform human engineering decisions.

The scientists put the slime to the test by allowing it to grow on a wet surface on which they placed oat flakes in locations that corresponded to the cities surrounding Tokyo. They placed the slime mould, Physarum polycephalum , in the centre.

As it grew outwards, it organised itself into a network around the food that closely resembled the train network connecting Tokyo to its surrounding cities.

The researchers then converted this growth "strategy" into a mathematical formula.

The researchers say that this model could provide a starting point for improving the efficiency and even decreasing the cost of "self-organised networks", such as computer and mobile communication networks that are not centrally controlled.

Mould solves maze

One of the researchers, Dr Mark Fricker from Oxford University, UK, told BBC News that the whole idea of using slime moulds in this way came from Toshiyuki Nakagaki, a scientist also based at Hokkaido University.

A decade ago, Dr Nakagaki showed that the slime could find the most efficient way through a maze.

"Toshi has been working on getting them to solve all sorts of problems," said Dr Fricker, "and extending that work to show they form robust networks."

Professor Wolfgang Marwan of Otto von Guericke University, Germany - who was not connected to the research - described the significance of the findings.

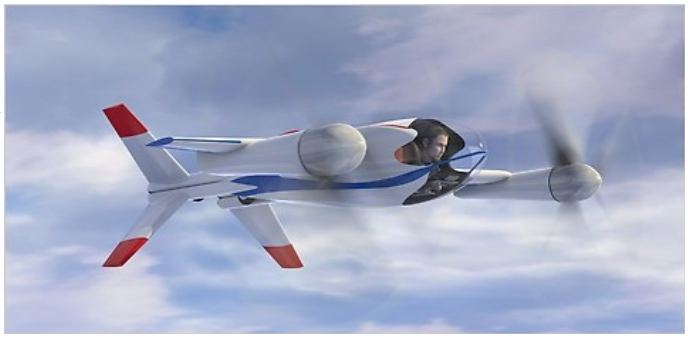
The researcher, ***writing in the journal***, said: "The work provides a fascinating and convincing example that biologically inspired mathematical models can lead to completely new, highly efficient algorithms... for applications in such areas as computer science."

In Transit - A Guide to Intelligent Travel

January 21, 2010, 4:19 pm

NASA Announces Designs for Personal Flying Suit

By DAN SALTZSTEIN



Forget the Segway. Leave that jet pack behind. NASA is working on a personal flying suit.

Conceptual designs for the experimental vehicle, called Puffin, were introduced by Mark D. Moore, an aerospace engineer at NASA's Langley Research Center, at a meeting of the American Helicopter Society on Jan. 20 in San Francisco. The Puffin is designed to be 12 feet in length, with a total wingspan of 14 and a half feet; it would weigh in at 300 pounds (without a pilot).

A conceptional rendering of the Puffin personal flying suit. **NASA/Analytical Mechanics Associates**

Two major elements distinguish the Puffin suit from the jet packs of '50s-era sci-fi flicks. First, it is completely self-contained: the pilot would actually step into the suit, which has a cockpit-like area and helicopter-style blades, allowing for high-altitude flying (unlike those sci-fi jet packs).

Second, it is designed to be powered by electric motors, making it relatively quiet, lightweight and more reliable (electric motors have fewer moving parts than conventional ones), and with a low environmental impact.

Of course, the Puffin is just a theory at the moment. It might be best used for covert military missions or rescue operations. But if it does emerge as an option for conventional flight, traffic jams might take on a whole new meaning.

Bacteria cells produce light show

By Victoria Gill Science reporter, BBC News

Scientists have produced a very unusual light show, engineering bacterial cells to fluoresce in synchrony.

The researchers turned the cells into synchronised "genetic clocks" - programming them to switch a fluorescent protein on and off. These waves of activity could eventually be used to make biological sensors, or to programme cells to release timed doses of medicine. The researchers report the advance in the journal Nature.

Synchronised waves, or oscillations, are important to scientists because they control crucial functions in the human body, such as the sleep-wake cycle, learning processes and the regular release of substances including insulin.

This same team of researchers, which was led by Dr Jeff Hasty from the University of California San Diego, US, first produced "flashing" cells a year ago. These bacterial clocks could be tuned to alter the rate at which they blinked on and off. But this latest advance allows the cells "talk to each other" and synchronise their activity as they grow into a colony.

"If you want a sensor - if you want to use the rate at which the cells switch on and off to signal something about the environment, you need a synchronised signal," explained Dr Hasty.

To achieve this, he and his team incorporated two genes into the bacterial cells.

One of the genes produced what he described as "a negative feedback system". This was the key component that stimulated oscillations in the cells - effectively switching the fluorescent protein on and off.

The other gene produced a chemical that travelled between the cells, allowing them to talk to each other and communicate the rate of his oscillation.

Professor Martin Fussenegger, a scientist from the Swiss science and technology university ETH Zurich, who was not involved in the study, said that this was "the first time that time-keeping devices in different individual cells had been synchronised". "It's a dramatic achievement. The real breakthrough [will be] when we can do this in mammalian cells, and this has laid the foundation for that," he told BBC News.

"Oscillators could eventually be designed to produce insulin every six hours [in diabetic patients].

"When doctors tell you to take this pill three times a day, that's this is nothing more than an oscillation - a dose at a frequency. An engineered oscillator could do this automatically."

In this same issue of Nature, the editors have marked what many scientists consider to be the 10th anniversary of the birth of synthetic biology - the discipline that sets out to engineer or manipulate life.

"Part of the whole excitement of synthetic biology was to make a branch of molecular biology into an engineering discipline," said Dr Hasty. "The aim is to use computational tools to design biological circuits from scratch. "We're not quite there yet, but we can already design some of these [simple] systems."

Lung cancer patients who quit smoking double their survival chances

Research: Influence of smoking cessation after diagnosis of early stage lung cancer on prognosis: Systematic review of observational studies with meta-analysis

People diagnosed with early stage lung cancer can double their chances of survival over five years if they stop smoking compared with those who continue to smoke, finds a study published on bmj.com today.

This is the first review of studies to measure the effects of continued smoking after diagnosis of lung cancer and suggests that it may be worthwhile to offer smoking cessation treatment to patients with early stage lung cancer.

Worldwide, lung cancer is the most commonly diagnosed form of cancer. In the UK, it is second only to breast cancer, accounting for around 39,000 new cancer diagnoses annually.

Smoking increases the risk of developing a primary lung cancer; lifelong smokers have a 20-fold increased risk compared with non-smokers. But it is not known whether quitting after a diagnosis of lung cancer has any benefit.

So researchers at the University of Birmingham analysed the results of 10 studies that measured the effect of quitting smoking after diagnosis of lung cancer on prognosis.

Differences in study design and quality were taken into account to minimise bias.

They found that people who continued to smoke after a diagnosis of early stage lung cancer had a substantially higher risk of death and a greater risk of the tumour returning compared with those who stopped smoking at that time. Data suggested that most of the increased risk of death was due to cancer progression.

Further analysis found a five year survival rate of 63-70% among quitters compared with 29-33% among those who continued to smoke. In other words, about twice as many quitters would survive for five years compared with continuing smokers.

These findings support the theory that continued smoking affects the behaviour of a lung tumour, say the authors. They also provide a strong case for offering smoking cessation treatment to patients with early stage lung cancer. Further trials are needed to examine these questions, they conclude.

An accompanying editorial says this study adds more to the evidence that it is never too late for people to stop, even when they have lung cancer.

How does an outfielder know where to run for a fly ball?

Virtual-reality baseballs give researchers insight into long-standing mystery

Rockville, MD — While baseball fans still rank "The Catch" by Willie Mays in the 1954 World Series as one of the greatest baseball moments of all times, scientists see the feat as more of a puzzle: How does an outfielder get to the right place at the right time to catch a fly ball?

Thousands of fans (and hundreds of thousands of YouTube viewers) saw Mays turn his back on a fly ball, race to the center field fence and catch the ball over his shoulder, seemingly a precise prediction of a fly ball's path that led his team to victory. According to a recent article in the Journal of Vision ("Catching Flyballs in Virtual Reality: A Critical Test of the Outfielder Problem"), the "outfielder problem" represents the definitive question of visual-motor control. How does the brain use visual information to guide action?

To test three theories that might explain an outfielder's ability to catch a fly ball, researcher Philip Fink, PhD, from Massey University in New Zealand and Patrick Foo, PhD, from the University of North Carolina at Ashville programmed Brown University's virtual reality lab, the VENLab, to produce realistic balls and simulate catches. The team then lobbed virtual fly balls to a dozen experienced ball players.

"The three existing theories all predict the same thing: successful catches with very similar behavior," said Brown researcher William Warren, PhD. "We realized that we could pull them apart by using virtual reality to create physically impossible fly ball trajectories."

Warren said their results support the idea that the ball players do not necessarily predict a ball's landing point based on the first part of its flight, a theory described as trajectory prediction. "Rather than predicting the landing point, the fielder might continuously track the visual motion of the ball, letting it lead him to the right place at the right time," Warren said.

Because the researchers were able to use the virtual reality lab to perturb the balls' vertical motion in ways that would not happen in reality, they were able to isolate different characteristics of each theory. The subjects tended to adjust their forward-backward movements depending on the perceived elevation angle of the incoming ball, and separately move from side to side to keep the ball at a constant bearing, consistent with the theory of optical acceleration cancellation (OAC). The third theory, linear optical trajectory (LOT), predicted that the outfielder will run in a direction that makes the visual image of the ball appear to travel in a straight line, adjusting both forward-backward and side-to-side movements together.

Fink said these results focus on the visual information a ball player receives, and that future studies could bring in other variables, such as the effect of the batter's movements or sound.

"As a first step we chose to concentrate on what seemed likely to be the most important factor," Fink said. "Fielders might also use information such as the batter's swing or the sound of the bat hitting the ball to help guide their movements."

New study: Human running speeds of 35 to 40 mph may be biologically possible

New evidence identifies critical variable imposing biological limit to running speed

Jamaican sprinter Usain Bolt's record-setting performances have unleashed a wave of interest in the ultimate limits to human running speed. A new study published in the Journal of Applied Physiology offers intriguing insights into the biology and perhaps even the future of human running speed.

The newly published evidence identifies the critical variable imposing the biological limit to running speed, and offers an enticing view of how the biological limits might be pushed back beyond the nearly 28 miles per hour speeds achieved by Bolt to speeds of perhaps 35 or even 40 miles per hour.

The new paper, "The biological limits to running speed are imposed from the ground up," was authored by Peter Weyand of Southern Methodist University; Rosalind Sandell and Danille Prime, both formerly of Rice University; and Matthew Bundle of the University of Wyoming.

"The prevailing view that speed is limited by the force with which the limbs can strike the running surface is an eminently reasonable one," said Weyand, associate professor of applied physiology and biomechanics at SMU in Dallas.

"If one considers that elite sprinters can apply peak forces of 800 to 1,000 pounds with a single limb during each sprinting step, it's easy to believe that runners are probably operating at or near the force limits of their muscles and limbs," he said. "However, our new data clearly show that this is not the case. Despite how large the running forces can be, we found that the limbs are capable of applying much greater ground forces than those present during top-speed forward running."

In contrast to a force limit, what the researchers found was that the critical biological limit is imposed by time – specifically, the very brief periods of time available to apply force to the ground while sprinting. In elite sprinters, foot-ground contact times are less than one-tenth of one second, and peak ground forces occur within less than one-twentieth of one second of the first instant of foot-ground contact.

The researchers took advantage of several experimental tools to arrive at the new conclusions. They used a high-speed treadmill capable of attaining speeds greater than 40 miles per hour and of acquiring precise measurements of the forces applied to the surface with each footfall. They also had subjects' perform at high speeds in different gaits. In addition to completing traditional top-speed forward running tests, subjects hopped on one leg and ran backward to their fastest possible speeds on the treadmill.

The unconventional tests were strategically selected to test the prevailing beliefs about mechanical factors that limit human running speeds – specifically, the idea that the speed limit is imposed by how forcefully a runner's limbs can strike the ground.

However, the researchers found that the ground forces applied while hopping on one leg at top speed exceeded those applied during top-speed forward running by 30 percent or more, and that the forces generated by the active muscles within the limb were roughly 1.5 to 2 times greater in the one-legged hopping gait.

The time limit conclusion was supported by the agreement of the minimum foot-ground contact times observed during top-speed backward and forward running. Although top backward vs. forward speeds were substantially slower, as expected, the minimum periods of foot-ground contact at top backward and forward speeds were essentially identical.

According to Matthew Bundle, an assistant professor of biomechanics at the University of Wyoming, "The very close agreement in the briefest periods of foot-ground contact at top speed in these two very different gaits points to a biological limit on how quickly the active muscle fibers can generate the forces necessary to get the runner back up off the ground during each step."

The researchers said the new work shows that running speed limits are set by the contractile speed limits of the muscle fibers themselves, with fiber contractile speeds setting the limit on how quickly the runner's limb can apply force to the running surface.

"Our simple projections indicate that muscle contractile speeds that would allow for maximal or near-maximal forces would permit running speeds of 35 to 40 miles per hour and conceivably faster," Bundle said.

Common heart medications may also protect against Parkinson's disease, study finds

UCLA researchers have discovered that a specific type of medication used to treat cardiovascular conditions such as hypertension, angina and abnormal heart rhythms may also decrease the risk of developing Parkinson's disease.

In the first large-scale population-based study of its kind, Dr. Beate Ritz, professor of epidemiology at the UCLA School of Public Health, in collaboration with researchers from the Danish Cancer Society, found that a specific sub-class of dihydropyridine cardiovascular medications was associated with a 26 to 30 percent decrease in the risk of Parkinson's. The findings appear in an upcoming print edition of the journal Annals of Neurology and are currently available online.

Parkinson's disease, the second most common neurodegenerative disorder in the United States, is characterized by a loss of voluntary movement, the result of the death of neurons in an area of the brain known as the substantia nigra, which is involved in movement control.

Neurons of the substantia nigra that are important in Parkinson's are known to have calcium channels in their cell membranes. These calcium channels are structures that allow the cells to transmit electrical charges to each other. Muscles like the heart also contain calcium channels, and the opening of the calcium channel in the heart causes a muscle contraction.

Because cardiac and smooth muscles depend on calcium channels to function, substances that block or modify their action have been used for decades to treat hypertension, angina and arrhythmia in humans. In the heart, the dihydropyridine class of drugs acts on a specific type of channel known as the L-type. Within the dihydropyridine class is a sub-class of medications that can cross the blood-brain barrier, giving them the potential to act on neurons in the brain. It turns out that the neurons that degenerate in Parkinson's disease also contain a type of L-type calcium channel.

For their study, the researchers turned to Denmark, a country that provides its population with free and equal access to health care. Each health service–related event and prescription is recorded in a database using a unique personal identification number assigned to each Danish citizen at birth or the granting of citizenship.

Using this database, Ritz and her colleagues conducted a population-based, case-control study to evaluate medical histories and medication usage for 1,931 Parkinson's patients and 9,651 unaffected subjects for a period up to 12 years prior to the diagnosis of Parkinson's.

By separately evaluating different classes of a variety of drugs prescribed for hypertension, researchers found that only calcium channel blockers of the dihydropyridine sub-class that cross the blood-brain barrier were associated with a significant decrease in the risk of developing Parkinson's. Other classes of anti-hypertension medications, and dihydropyridines that were not able to cross the blood-brain barrier, were not associated with a lower risk.

"The key was to consider the mode of action of these drugs and whether or not they cross the blood-brain barrier," Ritz said. "Some do and some don't. We found that of all the hypertension medications taken by our study subjects, only the subset of dihydropyridine class drugs that cross into the brain, where they might be able to act on the calcium channels of neurons, provided a protective effect. This supports the idea that the mode of action of a given drug and whether it penetrates into the brain are important factors when studying drugs for neuroprotection."

Although the results are intriguing, Ritz cautions that more detailed studies and a more complete understanding of the biology underlying the action of these medications in the brain are warranted, particularly as some Parkinson's patients can suffer from low blood pressure, a condition which could be worsened by taking calcium channel blockers inappropriately.

In addition to Ritz, study authors included Shannon L. Rhodes and Lei Qian of UCLA, Dr. Eva Schernhammer of Brigham and Women's Hospital and Harvard Medical School, and Dr. Jorgen Olsen and Dr. Soren Friis of the Danish Cancer Society. The authors declare no conflict of interest.

Double trouble: Bacterial super-infection after the flu

San Diego, CA – Current research suggests that the flu may predispose to secondary bacterial infections, which account for a significant proportion of mortality during flu pandemics. The related report by Lee et al, "A mouse model of lethal synergism between influenza virus and Haemophilus influenzae," appears in the February 2010 issue of The American Journal of Pathology.

Influenza affects between three and five million people annually, causing up to 500,000 deaths worldwide. While most people will recover in one to two weeks, others will develop life-threatening conditions such as pneumonia or bronchitis. High-risk groups for seasonal influenza include the very young and old, people with compromised immune systems, and pregnant women. However, during influenza pandemics, mortality may be significant in previously healthy young adults.

A common complication of flu infection is a secondary "super-infection" by bacteria, which greatly increases the morbidity and mortality of the disease. The most common bacterial agents found following flu pandemics have been Streptococcus pneumoniae, Haemophilus influenzae, Group A Streptococcus, and Staphylococcus aureus. Furthermore, reports of infection with antibiotic-resistant strains have been increasing in recent years.

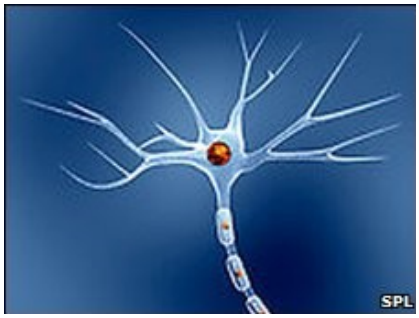
To explore the mechanisms governing the increased pathogenesis of flu upon super-infection, a group led by Dr. Sally R. Sarawar of the Torrey Pines Institute for Molecular Studies, San Diego, California confirmed that otherwise nonlethal influenza and H. influenzae infections cause high mortality rates in mice when flu infection precedes H. influenzae infection. Their data confirm a restricted time period for this heightened susceptibility and highlight that excessive bacterial, and not viral, growth is associated with increased lethality. The fact that this increased mortality was observed in both immunocompromised and immunocompetent mice suggests that even normal healthy people are at increased risk for complications following bacterial super-infection.

Lee et al suggest that the "lethal synergy between influenza virus and the bacterial respiratory pathogen, H. influenzae, is mediated by innate immunity. They observed that severe damage to the airways was an early event in the co-infected mice, eventually leading to death. This underscores the need for early antiviral and antibiotic treatment to combat severe disease in human patients and highlights the importance of vaccination and effective hygiene measures to prevent secondary bacterial infections during influenza infection. This new model will be useful for further investigating the mechanisms underlying severe disease caused by the interaction between influenza virus and bacteria, which may have resulted in numerous deaths during influenza pandemics and continues to constitute a significant clinical problem in susceptible individuals." Currently ongoing studies suggest that this model may also be useful for identifying target molecules for the development of novel therapeutic agents and strategies.

This work was supported by the National Institutes of Health Grant AI59429 and by a grant from the Infectious Disease Science Center.
Lee LN, Dias P, Han D, Yoon S, Shea A, Zakharov V, Parham D, Sarawar SR: A mouse model of lethal synergism between influenza virus and Haemophilus influenzae. Am J Pathol 176: 800-811

Prions 'may keep nerves healthy'

Experiments on mice may help scientists understand the workings of the prion protein linked to brain disease vCJD.



Swiss researchers say there is evidence that prions play a vital role in the maintenance of the sheath surrounding our nerves. They say it is possible that an absence of prions causes diseases of the peripheral nervous system. One expert said there was growing evidence that the prion had a number of important roles in the body.

As well as the latest research in the journal Nature Neuroscience, other studies have indicated prions may protect us from Alzheimer's disease or even play a role in our sense of smell.

Removing prion proteins led to a breakdown of the myelin sheath surrounding the nerve

The prion protein only came to the attention of scientists in recent years as they searched for the cause of vCJD - the human variant of BSE, or Mad Cow Disease. This degenerative and incurable brain condition is now thought to be caused by a "mis-folded" version of the prion. However, there is still little understanding of what the protein is supposed to do in its normal, healthy, form.

Healthy prions

The study, by scientists at the University Hospital in Zurich, looked at mice bred with fewer prion proteins.

While these mice are known to be resistant to prion diseases equivalent to vCJD in humans, they showed a number of abnormalities, including a degeneration, later in life, of the peripheral nerve cells, and the protective myelin sheath which surrounds them. Peripheral nerves are those which link the limbs and organs to the central nervous system - the spinal cord and brain.

Looking more closely, researchers examined the effects of removing the prion protein in both the nerve cells themselves, and the Schwann cells surrounding them, which are responsible for making the myelin sheath.

While removing protein from the Schwann cells had no effect, taking it from the neurons led to a breakdown of the myelin and degeneration of the nerve cells. They said that the knowledge that prion protein played some role in the healthy upkeep of nerve cells could offer a new avenue of research into diseases affecting humans.

However, scientists caution that it is too early to pick out a particular peripheral nerve condition which might correspond to the mouse experiments.

Recent work

Professor Nigel Hooper, from the University of Leeds, agreed that the role of the protein was not well understood.

His own work, published in 2007, suggested that it might offer some protection from the development of Alzheimer's disease. But he said this was unlikely to be the complete answer.

He said: "Most people started by focusing on prions in relation to a human disease, and have only recently started to examine what it normally does. "There is some evidence that it could have a number of different roles, depending on its whereabouts in the body - a recent paper linked it to olfaction or the sense of smell."