http://bit.ly/1vieZXk

Fungus Deadly to AIDS Patients Found to Literally Grow on Trees

Researchers have pinpointed the environmental source of fungal infections that have been sickening HIV/AIDS patients in Southern California for decades. It literally grows on trees.

The discovery is based on the science project of a 13-year-old girl, who spent the summer gathering soil and tree samples from areas around Los Angeles hardest hit by infections of the fungus named Cryptococcus gattii (CRIP-to-cock-us GAT-ee-eye).

Cryptococcus, which encompasses a number of species including C. gattii, causes life-threatening infections of the lungs and brain and is responsible for one third of all AIDS-related deaths.

The study, which appears Aug. 21 in PLOS Pathogens, found strong genetic evidence that three tree species - Canary Island pine, Pohutukawa and American sweetgum - can serve as environmental hosts and sources of these human infections.

“Just as people who travel to South America are told to be careful about drinking the water, people who visit other areas like California, the Pacific Northwest and Oregon need to be aware that they are at risk for developing a fungal infection, especially if their immune system is compromised,” said Deborah J. Springer, Ph.D., lead study author and postdoctoral fellow in the Center for Microbial Pathogenesis at Duke University School of Medicine.

A few years ago, Duke’s chairman of Molecular Genetics and Microbiology, Joseph Heitman M.D., was contacted by longtime collaborator and UCLA infectious disease specialist Scott Filler, M.D., whose daughter Elan was looking for a project to work on during her summer break. They decided it would be fun to send her out in search of fungi living in the greater Los Angeles area.

The student sampled 109 swabs of more than 30 tree species and 58 soil samples, grew and isolated the Cryptococcus fungus, and then sent those specimens to Springer at Duke. Springer DNA-sequenced the samples from California and compared the sequences to those obtained from HIV/AIDS patients with C. gattii infections.

She was surprised to find that specimens from three of the tree species were genetically almost indistinguishable from the patient specimens.

The researchers also found that the C. gattii isolated from the environment were fertile, reproducing either by sexual or asexual reproduction.

“That finding is important for long-term prevalence in the environment, because this fungal pathogen will be able to grow, reproduce, disperse spores, and serve as a source of ongoing infections,” Springer said.

http://bit.ly/1suVh5S

An African doctor who received the experimental anti-Ebola drug ZMapp has died

Despite having recently received a dose of the experimental anti-ebola drug ZMapp, a Liberian doctor died on Sunday, reports Front Page Africa and the BBC.

By Arielle Duhaime-Ross on August 25, 2014 10:12 am

Abraham Borbor was an internist and one of three African physicians who were injected with ZMapp in mid-August. The news casts a shadow over last week’s announcement that the two Americans who have been treated with the drug on US soil were released from the hospital last week.

""He was a classmate in high school, so this hits close to home.""

In reaction to Borbor’s death, the Liberian Information Minister Lewis Brown told Front Page Africa that Borbor "was walking around yesterday and the doctors were hopeful that he would make a full recovery," adding also that "he was a classmate in high school, so this hits close to home."

About 55 percent Ebola cases recorded in Guinea, Liberia, Nigeria, and Sierra Leone since March have resulted in death.

The extent of the outbreak has been called "unprecedented" by the World Health Organization, and although there’s some hope that ZMapp might help treat those infected with Ebola, the drug has never been tested on humans, so scientists still don’t know if it actually works. Moreover, quantities of the drug are extremely limited. According to the CDC, over 2,400 people have been infected with Ebola since this winter.

http://www.eurekalert.org/pub_releases/2014-08/uotw-stc082114.php

SA's Taung Child's skull and brain not human-like in expansion

CT scan disproves support for similar infant brain development to that of modern humans

The Taung Child, South Africa's premier hominin discovered 90 years ago by Wits University Professor Raymond Dart, never seizes to transform and evolve the search for our collective origins.

By subjecting the skull of the first australopith discovered to the latest technologies in the Wits University Microfocus X-ray Computed Tomography (CT) facility, researchers are now casting doubt on theories that Australopithecus africanus shows the same cranial adaptations found in modern human infants and

toddlers – in effect disproving current support for the idea that this early hominin shows infant brain development in the prefrontal region similar to that of modern humans.

The results have been published online in the prestigious journal Proceedings of the National Academy of Sciences (PNAS) on Monday, 25 August 2014 at 21:00 SAST (15:00 EST), in an article titled: New high resolution CT data of the Taung partial cranium and endocast and their bearing on metopism and hominin brain evolution.

The Taung Child has historical and scientific importance in the fossil record as the first and best example of early hominin brain evolution, and theories have been put forward that it exhibits key cranial adaptations found in modern human infants and toddlers.

This is the Taung Child fossil at the Evolutionary Studies Institute at Wits University.
WITS UNIVERSITY

To test the ancientness of this evolutionary adaptation, Dr Kristian J. Carlson, Senior Researcher from the Evolutionary Studies Institute at the University of the Witwatersrand, and colleagues, Professor Ralph L. Holloway from Columbia University and Douglas C. Broadfield from Florida Atlantic University, performed an in silico dissection of the Taung fossil using high-resolution computed tomography.

"A recent study has described the roughly 3 million-year-old fossil, thought to have belonged to a 3 to 4-year-old, as having a persistent metopic suture and open anterior fontanelle, two features that facilitate post-natal brain growth in human infants when their disappearance is delayed," said Carlson.

Comparisons with the existing hominin fossil record and chimpanzee variation do not support this evolutionary scenario.

Citing deficiencies in how the Taung fossil material has been recently assessed, the researchers suggest physical evidence does not incontrovertibly link features of the Taung skull, or its endocast, to early prefrontal lobe expansion, a brain region implicated in many human behaviors.

The authors also debate the previously offered theoretical basis for this adaptation in A. africanus. By refuting the presence of these features in the Taung Child, the researchers dispute whether these structures were selectively advantageous in hominin evolution, particularly in australopiths.

Thus, results of the new study show that there is still no evidence for this kind of skull adaptation that evolved before Homo, nor is there evidence for a link between such skull characteristics and the proposed accompanying early prefrontal lobe expansion, Carlson said.

http://www.eurekalert.org/pub_releases/2014-08/aaon-sdd082114.php

Sleep drunkenness disorder may affect 1 in 7

A study is shining new light on a sleep disorder called "sleep drunkenness."

MINNEAPOLIS – The disorder may be as prevalent as affecting one in every seven people. The research is published in the August 26, 2014, print issue of Neurology®, the medical journal of the American Academy of Neurology.

Sleep drunkenness disorder involves confusion or inappropriate behavior, such as answering the phone instead of turning off the alarm, during or following arousals from sleep, either during the first part of the night or in the morning. An episode, often triggered by a forced awakening, may even cause violent behavior during sleep or amnesia of the episode.

"These episodes of waking up confused have received considerably less attention than sleepwalking even though the consequences can be just as serious," said study author Maurice M. Ohayon, MD, DSc, PhD, with Stanford University School of Medicine in Palo Alto, CA.

For the study, 19,136 people age 18 and older from the general US population were interviewed about their sleep habits and whether they had experienced any symptoms of the disorder. Participants were also asked about mental illness diagnoses and any medications they took.

The study found that 15 percent of the group had experienced an episode in the last year, with more than half reporting more than one episode per week. In the majority of cases - 84 percent - people with sleep drunkenness also had a sleep disorder, a mental health disorder or were taking psychotropic drugs such as antidepressants. Less than 1 percent of the people with sleep drunkenness had no known cause or related condition.

Among those who had an episode, 37.4 percent also had a mental disorder. People with depression, bipolar disorder, alcoholism, panic or post-traumatic stress disorder and anxiety were more likely to experience sleep drunkenness.

The research also found that about 31 percent of people with sleep drunkenness were taking psychotropic medications such as antidepressants. Both long and short sleep times were associated with the sleep disorder. About 20 percent of those getting less than six hours of sleep per night and 15 percent of those getting at least nine hours experienced sleep drunkenness. People with sleep apnea also were more likely to have the disorder.

"These episodes of confused awakening have not gotten much attention, but given that they occur at a high rate in the general population, more research should be done on when they occur and whether they can be treated," said Ohayon. "People with sleep disorders or mental health issues should also be aware that they may be at greater risk of these episodes."

The study was supported by the Arrillaga Foundation.

Learn more about sleep disorders at AAN.com/patients.

http://www.eurekalert.org/pub_releases/2014-08/jhub-smm082114.php

State medical marijuana laws linked to lower prescription overdose deaths

Annual number of deaths from prescription drug overdose is 25 percent lower in states where it is legal to use medical marijuana to manage chronic pain

In states where it is legal to use medical marijuana to manage chronic pain and other conditions, the annual number of deaths from prescription drug overdose is 25 percent lower than in states where medical marijuana remains illegal, new research suggests.

The findings of the study, led by researchers from the Johns Hopkins Bloomberg School of Public Health and the Philadelphia Veterans Affairs Medical Center, suggest that while medical marijuana laws can be controversial and opponents have raised concerns that they may promote cannabis use among children, they may have unintended benefits as well. While more research is needed, these findings suggest that it is possible that the wider availability of medical marijuana for people in pain might help to reduce the growing number of overdose deaths attributed to prescription pain pills. A report on the research appears in the August 25 issue of JAMA Internal Medicine.

"Prescription drug abuse and deaths due to overdose have emerged as national public health crises," says Colleen L. Barry, PhD, an associate professor in the Department of Health Policy and Management at the Bloomberg School and senior author of the study. "As our awareness of the addiction and overdose risks associated with use of opioid painkillers such as Oxycontin and Vicodin grows, individuals with chronic pain and their medical providers may be opting to treat pain entirely or in part with medical marijuana, in states where this is legal."

Using death certificate data compiled by the Centers for Disease Control and Prevention, the researchers found that the rate of prescription painkiller overdose deaths increased in all states from 1999 to 2010. However, the yearly rate of opioid painkiller overdose deaths in states with medical marijuana laws was about 25 percent lower, on average, than the rate in states without these laws.

Three states – California, Oregon and Washington – legalized medical marijuana prior to 1999, with 10 more following between then and 2010, the time period of the analysis. As of June 2014, another 10 states and Washington, D.C. have adopted similar laws.

"In absolute terms, states with a medical marijuana law had about 1,700 fewer opioid painkiller overdose deaths in 2010 than would be expected based on trends before the laws were passed," says the study's lead author, Marcus Bachhuber, MD, of the Philadelphia Veterans Affairs Medical Center and the University of Pennsylvania. Bachhuber cautions that the exact mechanism underlying these results is unclear. It could be due, he says, to people with chronic pain choosing alternative treatments, or medical marijuana laws might also change the way people abuse or misuse prescription pain medications, or something else entirely.

Medical marijuana laws have been passed to give access to the drug to people with chronic or severe pain, sometimes due to conditions such as cancer or multiple sclerosis. Cannabis is believed to have painkilling properties and also to relieve nausea and improve appetite.

Brendan Saloner, PhD, an assistant professor in the Department of Health Policy and Management at the Bloomberg School and a co-author of the study, says the benefits and risks of using medical marijuana to treat chronic pain remain unclear. "Given the fast pace of policy change, more research is critical to understand how medical marijuana laws might be influencing both overdose deaths and the health trajectories of individuals suffering from chronic pain," he says.

The research was funded by grants from the National Institutes of Health's National Institute on Drug Abuse (R01 DA032110, R25 DA 023021); the Center for AIDS Research at the Albert Einstein College of Medicine and Montefiore Medical Center; the Robert Wood Johnson Foundation and the Philadelphia Veterans Affairs Medical Center.

"Medical Cannabis Laws and Opioid Analgesic Overdose Mortality in the United States, 1999-2010"was written by Marcus A. Bachhuber, MD; Brendan Saloner, PhD; Chinazo O. Cunningham, MD; and Colleen L. Barry PhD, MPP.

http://www.eurekalert.org/pub_releases/2014-08/nu-alc082214.php

A long childhood feeds the hungry human brain

Study of brain scans explains why children grow slowly and childhood lasts so long

EVANSTON, Ill. -- A five-year old's brain is an energy monster. It uses twice as much glucose (the energy that fuels the brain) as that of a full-grown adult, a new study led by Northwestern University anthropologists has found.

The study helps to solve the long-standing mystery of why human children grow so slowly compared with our closest animal relatives.

It shows that energy funneled to the brain dominates the human body's metabolism early in life and is likely the reason why humans grow at a pace more typical of a reptile than a mammal during childhood.

Results of the study will be published the week of Aug. 25 in the journal Proceedings of the National Academy of Sciences.

"Our findings suggest that our bodies can't afford to grow faster during the toddler and childhood years because a huge quantity of resources is required to fuel the developing human brain," said Christopher Kuzawa, first author of the study and a professor of anthropology at Northwestern's Weinberg College of Arts and Sciences. "As humans we have so much to learn, and that learning requires a complex and energy-hungry brain." Kuzawa also is a faculty fellow at the Institute for Policy Research at Northwestern.

The study is the first to pool existing PET and MRI brain scan data -- which measure glucose uptake and brain volume, respectively -- to show that the ages when the brain gobbles the most resources are also the ages when body growth is slowest. At 4 years of age, when this "brain drain" is at its peak and body growth slows to its minimum, the brain burns through resources at a rate equivalent to 66 percent of what the entire body uses at rest.

The findings support a long-standing hypothesis in anthropology that children grow so slowly, and are dependent for so long, because the human body needs to shunt a huge fraction of its resources to the brain during childhood, leaving little to be devoted to body growth. It also helps explain some common observations that many parents may have.

"After a certain age it becomes difficult to guess a toddler or young child's age by their size," Kuzawa said. "Instead you have to listen to their speech and watch their behavior. Our study suggests that this is no accident. Body growth grinds nearly to a halt at the ages when brain development is happening at a lightning pace, because the brain is sapping up the available resources."

It was previously believed that the brain's resource burden on the body was largest at birth, when the size of the brain relative to the body is greatest. The researchers found instead that the brain maxes out its glucose use at age 5. At age 4 the brain consumes glucose at a rate comparable to 66 percent of the body's resting metabolic rate (or more than 40 percent of the body's total energy expenditure).

"The mid-childhood peak in brain costs has to do with the fact that synapses, connections in the brain, max out at this age, when we learn so many of the things we need to know to be successful humans," Kuzawa said.

"At its peak in childhood, the brain burns through two-thirds of the calories the entire body uses at rest, much more than other primate species," said William Leonard, co-author of the study. "To compensate for these heavy energy demands of our big brains, children grow more slowly and are less physically active during this age range. Our findings strongly suggest that humans evolved to grow slowly during this time in order to free up fuel for our expensive, busy childhood brains."

Leonard is professor and chair of the department of anthropology at Northwestern's Weinberg College of Arts and Sciences.

This study was a collaboration between researchers at Northwestern University, Wayne State University, Children's Hospital of Michigan, Icahn School of Medicine at Mount Sinai, University of Illinois, George Washington University and Harvard Medical School.

The title of the paper, which is published in the Proceedings of the National Academy of Sciences, is "Energetic costs and evolutionary implications of human brain development."

Authors include Kuzawa and Leonard as well as Harry T. Chugani, Lawrence I. Grossman, Leonard Lipovich, Otto Muzik, Patrick R. Hof, Derek E. Wildman, Chet C. Sherwood and Nicholas Lange.

The study was funded by the U.S. National Science Foundation's Biological Anthropology Program.

http://www.eurekalert.org/pub_releases/2014-08/bcom-ssp082514.php

Study shows promise in automated reasoning, hypothesis generation over complete medical literature

Scientists cannot know about every relevant study when they are deciding where to take their research next

HOUSTON –With approximately 50 million scientific papers available in public databases– and a new one publishing nearly every 30 seconds – scientists cannot know about every relevant study when they are deciding where to take their research next.

A new tool in development by computational biologists at Baylor College of Medicine and analytics experts at IBM research and tested as a "proof-of-principle" may one day help researchers mine all public medical literature and formulate hypotheses that promise the greatest reward when pursuing new scientific studies.

Knowledge Integration Toolkit or KnIT

In a retrospective case study involving published data on p53, an important tumor suppressor protein, the team showed that this new resource called the Knowledge Integration Toolkit (KnIT) is an important first step in that direction, accurately predicting the existence of proteins that modify p53 – proteins that were subsequently found to do just that.

Details from the study published online today in the Association for Computing Machinery's digital library. Dr. Olivier Lichtarge, director of the Center of Computational and Integrative Biomedical Research at Baylor and the principle investigator on the study, will discuss details of the study in a presentation Aug. 27 at the 20th annual Association for Computing Machinery's Special Interest Group on Knowledge Discovery and Data Mining conference in New York City, the premier data mining conference.

"On average, a scientist might read between one and five research papers on a good day," said Lichtarge, also a professor of molecular and human genetics, biochemistry and molecular biology at Baylor. "But, to put this in perspective with p53, there are over 70,000 papers published on this protein.

Even if a scientist reads five papers a day, it could take nearly 38 years to completely understand all of the research already available today on this protein."

Scientists formulate hypotheses based on what they read and know, but because there is so little that they can actually read, hypotheses can be biased, Lichtarge said. "A computer certainly may not reason as well as a scientist but the little it can, logically and objectively, may contribute greatly when applied to our entire body of knowledge."

Collaboration with IBM

Together with colleagues at IBM led by Scott Spangler, principal data scientist at IBM, the team initiated a research project to develop a knowledge integration tool that took advantage of existing text mining capabilities, such as those used by IBM's Watson technology (cognitive technology that processes information more like a human than a computer.)

"Our hope is that scientists and researchers will be able to use Watson's cognitive capabilities to accelerate the understanding of biology underlying diseases," said Spangler. "Better understanding the biology of diseases can eventually lead to better treatments for some of the most complex and challenging diseases, like cancer."

They came up with KnIT, a system that aims to mine the information contained in the scientific literature, represents it explicitly in a network that can be queried, and then further attempts to use these data to generate new reasonable and testable hypotheses that can be used to help direct laboratory studies.

P53 kinases

In the first test using KnIT, the team sought to identify new protein kinases that phosphorylate (or turn on) the protein tumor suppressor p53. There are over 500 known human kinases and 10s of thousands of possible proteins they can target. Thirty-three are currently known to modify p53.

In the study, the team used KnIT to mine the medical literature up to 2003 when only half of the 33 phosphorylating protein kinases had been discovered.

Using KnIT, 74 kinases were extracted as potential modifiers. Of these, prior to 2003, 10 were known to phosphorylate p53, nine were discovered at a later date. Of the 10 already known, KnIT accounted for them in reasoning as well as ranking the likelihood that the other 64 kinases targeted p53. Of the nine found nearly a decade later, KnIT accurately predicted seven.

"This study showed that in a very narrow field of study regarding p53, we can, in fact, suggest new relationships and new functions associated with p53, which can later be directly validated in the laboratory," said Lichtarge, who holds The Cullen Foundation Endowed Chair at Baylor.

The remaining kinases identified in the case study, but not previously identified in real time, may be further studied in the laboratory, he said.

Long-term goals

"Our long-term hope is to systematically extract knowledge directly from the totality of the public medical literature. For this we need technological advances to read text, extract facts from every sentence and to integrate this information into a network that describes the relationship between all of the objects and entities discussed in the literature," said Lichtarge. "This first study is promising, because it suggests a proof of principle for a small step towards this type of knowledge discovery. With more research, we hope to get closer to clinical and therapeutic applications."

A majority of the funding for this work was provided by the McNair Medical Institute of the Robert and Janice McNair Foundation and the Defense Advanced Research Projects Agency (N66001-14-1-4027). Additional funding provided by the National Science Foundation (NSF CCF-0905536, NSF DBI-1062455), National Institutes of Health (NIH-GM079656), and was supported in part by the IBM Accelerated Discovery Lab.

Co-authors on the report include Angela D. Wilkins, Benjamin J. Bachman, Tajhal Dayaram, Sam Regenbogen, Neha Parikh, Andreas Martin Lisewski and Lawrence Donehower, all of Baylor; Meena Nagarajan, Peter Haas, Ioana Stanoi, Linda Kato, Ana Lelescu, Jacques J. Labrie and Ying Chen, all of IBM; and Curtis R. Pickering, Austin Comer and Jeffrey N. Myers of the University of Texas M.D. Anderson Cancer Center.

http://www.eurekalert.org/pub_releases/2014-08/ru-bp082514.php

Biomimetic photodetector 'sees' in color

Rice lab uses CMOS-compatible aluminum for on-chip color detection

Rice University researchers have created a CMOS-compatible, biomimetic color photodetector that directly responds to red, green and blue light in much the same way the human eye does.

The new device was created by researchers at Rice's Laboratory for Nanophotonics (LANP) and is described online in a new study in the journal Advanced Materials. It uses an aluminum grating that can be added to silicon photodetectors with the silicon microchip industry's mainstay technology, "complementary metal-oxide semiconductor," or CMOS.

Conventional photodetectors convert light into electrical signals but have no inherent color-sensitivity. To capture color images, photodetector makers must add color filters that can separate a scene into red, green and blue color components. This color filtering is commonly done using off-chip dielectric or

dye color filters, which degrade under exposure to sunlight and can also be difficult to align with imaging sensors.

"Today's color filtering mechanisms often involve materials that are not CMOS-compatible, but this new approach has advantages beyond on-chip integration," said LANP Director Naomi Halas, the lead scientist on the study. "It's also more compact and simple and more closely mimics the way living organisms 'see' colors.

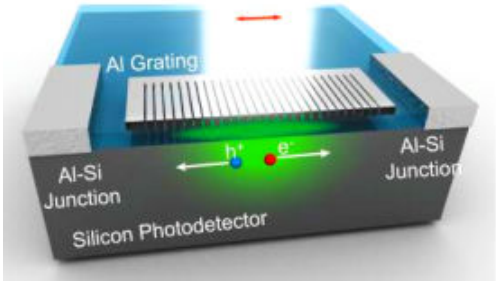
Biomimicry was no accident. The color photodetector resulted from a $6 million research program funded by the Office of Naval Research that aimed to mimic cephalopod skin using "metamaterials," compounds that blur the line between material and machine.

Cephalopods like octopus and squid are masters of camouflage, but they are also color-blind. Halas said the "squid skin" research team, which includes marine biologists Roger Hanlon of the Marine Biological Laboratory in Woods Hole, Mass., and Thomas Cronin of the University of Maryland, Baltimore County, suspect that cephalopods may detect color directly through their skin.

Based on that hypothesis, LANP graduate student Bob Zheng, the lead author of the new Advanced Materials study, set out to design a photonic system that could detect colored light.

"Bob has created a biomimetic detector that emulates what we are hypothesizing the squid skin 'sees,'" Halas said. "This is a great example of the serendipity that can occur in the lab. In searching for an answer to a specific research question, Bob has created a device that is far more practical and generally applicable."

Zheng's color photodetector uses a combination of band engineering and plasmonic gratings, comb-like aluminum structures with rows of parallel slits. Using electron-beam evaporation, which is a common technique in CMOS processing, Zheng deposited a thin layer of aluminum onto a silicon photodetector topped with an ultrathin oxide coating.



Researchers at Rice University's Laboratory for Nanophotonics have demonstrated a method for designing imaging sensors by integrating light amplifiers and color filters directly into pixels. **Bob Zheng/Rice University**

Color selection is performed by utilizing interference effects between the plasmonic grating and the photodetector's surface. By carefully tuning the oxide thickness and the width and spacing of the slits, Zheng was able to preferentially direct different colors into the silicon photodetector or reflect it back into free space. The metallic nanostructures use surface plasmons -- waves of electrons that flow like a fluid across metal surfaces. Light of a specific wavelength can excite a plasmon, and LANP researchers often create devices where plasmons interact, sometimes with dramatic effects.

"With plasmonic gratings, not only do you get color tunability, you can also enhance near fields," Zheng said. "The near-field interaction increases the absorption cross section, which means that the grating sort of acts as its own lens. You get this funneling of light into a concentrated area.

"Not only are we using the photodetector as an amplifier, we're also using the plasmonic color filter as a way to increase the amount of light that goes into the detector," he said.

Co-authors include Rice graduate student Yumin Wang and Peter Nordlander, professor of physics and astronomy at Rice.

http://www.eurekalert.org/pub_releases/2014-08/du-cdm082514.php

Cancer-fighting drugs might also stop malaria early

Scientists searching for new drugs to fight malaria have identified a number of compounds -- some of which are currently in clinical trials to treat cancer -- that could add to the anti-malarial arsenal.

DURHAM, N.C. -- Duke University assistant professor Emily Derbyshire and colleagues identified more than 30 enzyme-blocking molecules, called protein kinase inhibitors, that curb malaria before symptoms start.

By focusing on treatments that act early, before a person is infected and feels sick, the researchers hope to give malaria –- especially drug-resistant strains –- less time to spread. The findings appear online and are scheduled to appear in a forthcoming issue of the journal ChemBioChem.

Malaria is caused by a single-celled parasite called Plasmodium that spreads from person to person through mosquito bites. When an infected mosquito bites, parasites in the mosquito's saliva first make their way to the victim's liver, where they silently grow and multiply into thousands of new parasites before invading red blood cells -- the stage of the disease that triggers malaria's characteristic fevers, headaches, chills and sweats.

Most efforts to find safe, effective, low-cost drugs for malaria have focused on the later stage of the infection when symptoms are the worst. But Derbyshire and her team are testing chemical compounds in the lab to see if they can identify ones that inhibit malaria during the short window when the parasite is still restricted to the liver, before symptoms start.

One of the advantages of her team's approach is that focusing on the liver stage of the malaria lifecycle -- before it has a chance to multiply -- means there are fewer parasites to kill.

Using a strain of malaria that primarily infects rodents, Derbyshire and Jon Clardy of Harvard Medical School tested 1,358 compounds for their ability to keep parasites in the liver in check, both in test tubes and in mice.

"It used to be that researchers were lucky if they could identify one or two promising compounds at a time; now with advances in high-throughput screening technology we can explore thousands at once and identify many more," said Derbyshire, an assistant professor in the Departments of Chemistry and Molecular Genetics and Microbiology at Duke.

Focusing on a particular group of enzyme-blocking compounds called protein kinase inhibitors, they identified 31 compounds that inhibit malaria growth without harming the host. Several of the compounds are currently in clinical trials to treat cancers like leukemia and myeloma.

The same compounds that stopped the stage of malaria that lurks in the liver also worked against the stage that lives in the blood.

Malaria-free mice that received a single dose before being bitten by infected mosquitoes were able to avoid developing the disease altogether.

Medicines for malaria have been around for hundreds of years, yet the disease still afflicts more than 200 million people and claims hundreds of thousands of lives each year, particularly in Asia and Africa. Part of the reason is malaria's ability to evade attack. One of the most deadly forms of the parasite, Plasmodium falciparum, has already started to outsmart the world's most effective antimalarial drug, artemisinin, in much of southeast Asia. Infections that used to clear up in a single day of treatment now take several days.

Diversifying the antimalarial arsenal could also extend the lifespan of existing drugs, since relying less heavily on our most commonly used weapons gives the parasite fewer opportunities to develop resistance, Derbyshire said.

Another advantage is that the compounds they tested suppress multiple malaria proteins at once, which makes it harder for the parasites to develop ways around them.

"That makes them like a magic bullet," she said.

The research was supported by Duke University, Harvard Medical School and the National Institutes of Health (Grant Number: GM099796)

CITATION: "Chemical interrogation of the malaria kinome," Derbyshire, E. and Clardy, J., et al. ChemBioChem, 2014. http://dx.doi.org/10.1002/cbic.201400025

http://bit.ly/1wB0Y8K

Area of Brain Responsible for Exercise Motivation Discovered, May Help Improve Treatments for Depression

Researchers Discover Area of Brain Responsible for Exercise Motivation

Scientists at Seattle Children's Research Institute have discovered that the dorsal medial habenula region in the brain controls the desire to exercise in mice, possibly helping researchers develop more targeted and effective treatments for depression.

Scientists at Seattle Children's Research Institute have discovered an area of the brain that could control a person's motivation to exercise and participate in other rewarding activities – potentially leading to improved treatments for depression.

Dr. Eric Turner, a principal investigator in Seattle Children's Research Institute's Center for Integrative Brain Research, together with lead author Dr. Yun-Wei (Toni) Hsu, have discovered that a tiny region of the brain – the dorsal medial habenula – controls the desire to exercise in mice. The structure of the habenula is similar in humans and rodents and these basic functions in mood regulation and motivation are likely to be the same across species.

Exercise is one of the most effective non-pharmacological therapies for depression. Determining that such a specific area of the brain may be responsible for motivation to exercise could help researchers develop more targeted, effective treatments for depression.

"Changes in physical activity and the inability to enjoy rewarding or pleasurable experiences are two hallmarks of major depression," Turner said. "But the brain pathways responsible for exercise motivation have not been well understood. Now, we can seek ways to manipulate activity within this specific area of the brain without impacting the rest of the brain's activity."

Dr. Turner's study, titled "Role of the Dorsal Medial Habenula in the Regulation of Voluntary Activity, Motor Function, Hedonic State, and Primary Reinforcement," was published today by the Journal of Neuroscience and funded by the National Institute of Mental Health and National Institute on Drug Abuse.

The study used mouse models that were genetically engineered to block signals from the dorsal medial habenula. In the first part of the study, Dr. Turner's team collaborated with Dr. Horacio de la Iglesia, a professor in University of Washington's Department of Biology, to show that compared to typical mice, who love to run in their exercise wheels, the genetically engineered mice were lethargic and ran far less. Turner's genetically engineered mice also lost their preference for sweetened drinking water.

"Without a functioning dorsal medial habenula, the mice became couch potatoes," Turner said. "They were physically capable of running but appeared unmotivated to do it."

In a second group of mice, Dr. Turner's team activated the dorsal medial habenula using optogenetics – a precise laser technology developed in collaboration with the Allen Institute for Brain Science. The mice could "choose" to activate this area of the brain by turning one of two response wheels with their paws. The mice strongly preferred turning the wheel that stimulated the dorsal medial habenula, demonstrating that this area of the brain is tied to rewarding behavior.

Past studies have attributed many different functions to the habenula, but technology was not advanced enough to determine roles of the various subsections of this area of the brain, including the dorsal medial habenula.

"Traditional methods of stimulation could not isolate this part of the brain," Turner said. "But cutting-edge technology at Seattle Children's Research Institute makes discoveries like this possible."

As a professor in the University of Washington Department of Psychiatry and Behavioral Sciences, Dr. Turner treats depression and hopes this research will make a difference in the lives of future patients.

"Working in mental health can be frustrating," Turner said. "We have not made a lot of progress in developing new treatments. I hope the more we can learn about how the brain functions the more we can help people with all kinds of mental illness."

Publication: Yun-Wei A. Hsu, et al., "Role of the Dorsal Medial Habenula in the Regulation of Voluntary Activity, Motor Function, Hedonic State, and Primary Reinforcement," The Journal of Neuroscience, 20 August 2014, 34(34): 11366-11384; doi: 10.1523/JNEUROSCI.1861-14.2014

http://www.eurekalert.org/pub_releases/2014-08/acop-nfa082514.php

Personal protective equipment is critical but not enough to shield health care workers from Ebola

Annals of Internal Medicine tip sheet

Personal protective equipment is critical but not enough to shield health care workers from Ebola*

Personal protective equipment designed to shield health care workers from contaminated body fluids of Ebola patients is not enough to prevent transmission, according to a commentary being published early online today in Annals of Internal Medicine. Despite the known effectiveness of barrier protection in blocking Ebola transmission, infections among health care workers have played a major role in outbreaks. William A. Fischer II, MD from the University of North Carolina at Chapel Hill School of Medicine and co-authors write that there are two factors contributing to the high rate of Ebola infection among health care workers: insufficient supply of personal protective equipment and lack of emphasis on the process of donning and doffing it. Ebola is transmitted through direct or indirect contact between bodily fluids from an infected patient and breaks in the skin or exposed mucous membranes of an uninfected person. Even with personal protective gear, a health care worker is at risk for infection if removal of contaminated protective clothing is not done carefully. To prevent unwitting transmission from contaminated body fluids on personal protective equipment, the authors suggest a structure and systematic process be strictly followed for gear removal.

**Annals of Internal Medicine is part of the Emergency Access Initiative (EAI), a partnership of the National Library of Medicine, the National Network of Libraries of Medicine, and the Professional/Scholarly Publishing Division of the Association of American Publishers and other publishers. EAI provides temporary free access to full text articles from major biomedicine titles to health care professionals, librarians, and the public affected by disasters. As such, Annals content will be free to site visitors from the West African countries affected by the Ebola virus outbreak.*

http://www.eurekalert.org/pub_releases/2014-08/uoc-aff082614.php

Animals first flex their muscles

An unusual new fossil discovery of one of the earliest animals on earth may also provide the oldest evidence of muscle tissue – the bundles of cells that make movement in animals possible.

The fossil, dating from 560 million years ago, was discovered in Newfoundland, Canada. On the basis of its four-fold symmetry, morphological characteristics, and what appear to be some of the earliest impressions of muscular tissue, researchers from the University of Cambridge, in collaboration with the University of Oxford and the Memorial University of Newfoundland, have interpreted it as a cnidarian: the group which contains modern animals such as corals, sea anemones and jellyfish. The results are published today (27 August) in the journal Proceedings of the Royal Society B.

This is an artist's reconstruction of H. quadriformis. **Martin Brasier**

Historically, the origin, evolution and spread of animals has been viewed as having begun during the Cambrian Explosion, a period of rapid evolutionary

development starting 541 million years ago when most major animal groups first appear in the fossil record.

"However, in recent decades, discoveries of preserved trackways and chemical evidence in older rocks, as well as molecular comparisons, have indirectly suggested that animals may have a much earlier origin than previously thought," said Dr Alex Liu of Cambridge's Department of Earth Sciences, lead author of the paper.

"The problem is that although animals are now widely expected to have been present before the Cambrian Explosion, very few of the fossils found in older rocks possess features that can be used to convincingly identify them as animals," said Liu. "Instead, we study aspects of their ecology, feeding or reproduction, in order to understand what they might have been."

The new fossil, named Haootia quadriformis, dates from the Ediacaran Period, an interval spanning 635 to 541 million years ago. It differs from any previously described Ediacaran fossil, as it comprises of bundles of fibres in a broadly four-fold symmetrical arrangement: a body plan that is similar to that seen in modern cnidarians.

The researchers determined that the similarities between Haootia quadriformis and both living and fossil cnidarians suggest that the organism was probably a cnidarian, and that the bundles represent muscular tissue. This would make it not only a rare example of an Ediacaran animal, but also one of the oldest fossils to show evidence of muscle anywhere in the world.

"The evolution of muscular animals, in possession of muscle tissues that enabled them to precisely control their movements, paved the way for the exploration of a vast range of feeding strategies, environments, and ecological niches, allowing animals to become the dominant force in global ecosystems," said Liu.

The research was funded by the Natural Environment Research Council, the Natural Sciences and Engineering Research Council of Canada, the Burdett Coutts Fund of the University of Oxford, and the National Geographic Global Exploration Fund Northern Europe.

http://www.eurekalert.org/pub_releases/2014-08/nerc-sus082214.php

Sheepdogs use simple rules to herd sheep

Sheepdogs use just two simple rules to round up large herds of sheep, scientists have discovered.

The findings could lead to the development of robots that can gather and herd livestock, crowd control techniques, or new methods to clean up the environment. For the first time scientists used GPS technology to understand how sheepdogs do their jobs so well. Until now, they had no idea how the dogs manage to get so many unwilling sheep to move in the same direction.

NERC fellow, Dr Andrew King of Swansea University, fitted a flock of sheep and a sheepdog with backpacks containing extremely accurate GPS devices designed by colleagues at the Royal Veterinary College, London.

Daniel Strömbom of Uppsala University and colleagues then used data from these devices, together with computer simulations, to develop a mathematical shepherding model.

The team found that sheepdogs likely use just two simple rulesl: to collect the sheep when they're dispersed and drive them forward when they're aggregated. In the model, a single shepherd could herd a flock of more than 100 individuals using these two simple rules.

The research is published in the *Journal of the Royal Society Interface*.

'If you watch sheepdogs rounding up sheep, the dog weaves back and forth behind the flock in exactly the way that we see in the model,' says King.

'We had to think about what the dog could see to develop our model. It basically sees white, fluffy things in front of it. If the dog sees gaps between the sheep, or the gaps are getting bigger, the dog needs to bring them together,' he explains.

'At every time step in the model, the dog decides if the herd is cohesive enough or not. If not cohesive, it will make it cohesive, but if it's already cohesive the dog will push the herd towards the target,' says Strömbom.

'Other models don't appear to be able to herd really big groups – as soon as the number of individuals gets above 50 you start needing multiple shepherds or sheepdogs,' he says.

'There are numerous applications for this knowledge, such as crowd control, cleaning up the environment, herding of livestock, keeping animals away from sensitive areas, and collecting or guiding groups of exploring robots,' says King.

http://www.eurekalert.org/pub_releases/2014-08/ssm-wcf082614.php

What can 14th century Venice teach us about Ebola and other emerging threats?

Venice's response to the plague an 'example of resilience management,' say experts

The way in which the Italian city of Venice dealt with the outbreak of the plague in the fourteenth century holds lessons on how to even mitigate the consequences of today's emerging threats, like climate change, terrorism, and highly infectious or drug-resistant diseases. So says Dr. Igor Linkov of the US Army Engineer Research and Development Center, and a visiting professor of the Ca Foscari University in Italy. Linkov led an article on resilience management appearing in Springer's journal Environment Systems and Decisions.

Venice was the hub of many trade routes into central Europe, and in 1347 became the epicenter of a plague epidemic. While Venetians initially attempted to mitigate what they believed to be the threat - God, vampires, etc. - by enacting traditional risk management like prayer and rituals, they eventually began to utilize what we would now call resilience management.

Instead of trying to target a poorly understood risk, state authorities focused on managing physical movement, social interactions, and data collection for the city as a system. This included a system of inspection, lazaretto (quarantine stations) on nearby islands, quarantine periods, and wearing protective clothing. Although these actions were too late to stop the disease's initial devastation, thanks to the cumulative efforts over several hundred years. Venice continued to flourish, experiencing only sporadic episodes of plague thereafter, while in Greece and southern Europe, similar epidemics raged for centuries.

As the world grapples with the current outbreak of Ebola in West Africa, Linkov and his colleagues see opportunities to learn from the Venetians in resilience management. In the case of Ebola, economic and cultural factors make risk management difficult. While it will take time to transform deeply rooted traditions that contribute the spread of the Ebola virus, health experts and national leaders may be able to realize improvements by bolstering the ability of other parts of the system to respond to re-emergence of the disease. Resilience management addresses the ability of a complex system - such as a city or community - to prepare, absorb, recover, and adapt to unexpected threats.

"Resilience management can be a guide to dealing with the current Ebola outbreak in Africa, and others like it, as well as other issues like population growth and the impacts of global climate change," believes Linkov. "Similar to what the officials of Venice did centuries ago, approaching resilience at the system level provides a way to deal with the unknown and unquantifiable threats we are facing at an increasing frequency."

Linkov, I. et al (2014). Risk and Resilience Lessons from Venice. Environment Systems and Decisions. DOI 10.1007/s10669-014-9511-8.

http://www.eurekalert.org/pub_releases/2014-08/scp-csu082614.php

Chinese scientists use laser-induced breakdown spectroscopy to identify toxic cooking 'gutter oil'

The illegal use of waste cooking oil in parts of the nationwide food system is threatening the public's health in China.

Now scientists led by Professor Ding Hongbin at the Dalian University of Technology, in northeastern China, present a new means to confront this problem. In a study published in the Chinese Science Bulletin, Ding and fellow researchers at the university's School of Physics and Optoelectronic Engineering outline the potential use of laser-induced breakdown spectroscopy (LIBS) to rapidly distinguish between "gutter oil" and safe, edible oil.

Laser-induced breakdown spectroscopy is used to obtain spectral features of oil samples, which are subjected to principal component analysis (PCA). The researchers used an Artificial Neural Network (ANN) model during the analysis. This provides a new approach to detecting gutter oil efficiently and quickly.

Gutter oil is made from restaurant leftover oil, and circulates widely in China. Investigations of this toxic concoction have detected samples including harmful substances like bacteria, heavy metals, fatty acids, and even strong carcinogens like flavacol.

Long-term consumption of gutter oil can lead to liver ailments and cancer, as well as to developmental disabilities in newborns and children. Yet due to a lucrative trade in this toxic substance, producing and selling gutter oil persists despite the threat of severe punishment by the Chinese government.

This situation has grown in severity because of a longstanding difficulty in differentiating gutter oil from legitimate oil. Bleach is used to transform gutter oil's dark color into a more natural one and alkali additives are used to neutralize the abnormal pH caused by containing high rates of animal fats. Reports in the Chinese press have indicated that one in ten visits to a restaurant is likely to lead to the unwitting consumption of gutter oil.

Laser-induced breakdown spectroscopy can be used in the quantitative and qualitative analysis of solids, liquids and gases. In LIBS, a high-energy focused laser pulse is utilized as a vaporization and excitation source to create a plasma in front of a target surface. The laser-induced plasma generates a spectrum of ionic and atomic characteristic emission lines, which are used to identify the composition of each element in the sample.

LIBS has been regarded as a future superstar in terms of chemical analysis due to its unique features, such as requiring little or no sample preparation, remote sensing, and fast analysis of multiple elements.

The laser-induced breakdown spectroscopy instrument installed on NASA's Curiosity rover has successfully analyzed rock samples from up to 7 m away. Back on Earth, Ding Hongbin and his research group have used LIBS technology to monitor fuel retention and the deposit of impurities on the first wall of fusion devices. LIBS has been used in extreme environments such as strong magnetic or electric fields and a strong radiation background.

In the new study, researchers stated that they used LIBS techniques to detect gutter oil for the very first time. Analysis software developed by the group automatically collects useful line signals from a single-shot LIBS spectrum (Fig.1). A data processing algorithm based on PCA is likewise used to detect

gutter oil. The resulting scores for the first two principal components are shown in Fig. 2, and predicted results are shown in table 1.

This research received funding from the National Natural Science Foundation of China (No. 11175035), the Fundamental Research Funds for Central Universities (No. DUT12ZD(G)01) and the mmlab research project (DP1051208).

See the article: Wu D, Hai R, Liu P, et al. A. Exploring the use of laser-induced breakdown spectroscopy to identify toxic "gutter oil" (in Chinese). Chin Sci Bull (Chin Ver), 2014, 59(21):2071-2076. http://csb.scichina.com:8080/kxtb/CN/Y2014/V59/I21/2071

http://bit.ly/1qKx09Q

Researchers Identify Gut Bacteria That Protect Against Food Allergies

A newly published study from the University of Chicago reveals that the common gut bacteria Clostridia prevent sensitization to allergens in a mouse model, paving the way for probiotic therapies to treat food allergies.

The presence of Clostridia, a common class of gut bacteria, protects against food allergies, a new study in mice finds. By inducing immune responses that prevent food allergens from entering the bloodstream, Clostridia minimize allergen exposure and prevent sensitization - a key step in the development of food allergies. The discovery points toward probiotic therapies for this so-far untreatable condition, report scientists from the University of Chicago, August 25 in the Proceedings of the National Academy of Sciences.

Although the causes of food allergy - a sometimes deadly immune response to certain foods - are unknown, studies have hinted that modern hygienic or dietary practices may play a role by disturbing the body's natural bacterial composition. In recent years, food allergy rates among children have risen sharply – increasing approximately 50 percent between 1997 and 2011 - and studies have shown a correlation to antibiotic and antimicrobial use.

"Environmental stimuli such as antibiotic overuse, high fat diets, caesarean birth, removal of common pathogens and even formula feeding have affected the microbiota with which we've co-evolved," said study senior author Cathryn Nagler, PhD, Bunning Food Allergy Professor at the University of Chicago. "Our results suggest this could contribute to the increasing susceptibility to food allergies."

To test how gut bacteria affect food allergies, Nagler and her team investigated the response to food allergens in mice. They exposed germ-free mice (born and raised in sterile conditions to have no resident microorganisms) and mice treated with antibiotics as newborns (which significantly reduces gut bacteria) to peanut allergens. Both groups of mice displayed a strong immunological response, producing significantly higher levels of antibodies against peanut allergens than mice with normal gut bacteria.

This sensitization to food allergens could be reversed, however, by reintroducing a mix of Clostridia bacteria back into the mice. Reintroduction of another major group of intestinal bacteria, Bacteroides, failed to alleviate sensitization, indicating that Clostridia have a unique, protective role against food allergens.

Closing the door

To identify this protective mechanism, Nagler and her team studied cellular and molecular immune responses to bacteria in the gut. Genetic analysis revealed that Clostridia caused innate immune cells to produce high levels of interleukin-22 (IL-22), a signaling molecule known to decrease the permeability of the intestinal lining.

Antibiotic-treated mice were either given IL-22 or were colonized with Clostridia. When exposed to peanut allergens, mice in both conditions showed reduced allergen levels in their blood, compared to controls. Allergen levels significantly increased, however, after the mice were given antibodies that neutralized IL-22, indicating that Clostridia-induced IL-22 prevents allergens from entering the bloodstream.

"We've identified a bacterial population that protects against food allergen sensitization," Nagler said. "The first step in getting sensitized to a food allergen is for it to get into your blood and be presented to your immune system. The presence of these bacteria regulates that process." She cautions, however, that these findings likely apply at a population level, and that the cause-and-effect relationship in individuals requires further study.

While complex and largely undetermined factors such as genetics greatly affect whether individuals develop food allergies and how they manifest, the identification of a bacteria-induced barrier-protective response represents a new paradigm for preventing sensitization to food. Clostridia bacteria are common in humans and represent a clear target for potential therapeutics that prevent or treat food allergies. Nagler and her team are working to develop and test compositions that could be used for probiotic therapy and have filed a provisional patent.

"It's exciting because we know what the bacteria are; we have a way to intervene," Nagler said. "There are of course no guarantees, but this is absolutely testable as a therapeutic against a disease for which there's nothing. As a mom, I can imagine how frightening it must be to worry every time your child takes a bite of food."

"Food allergies affect 15 million Americans, including one in 13 children, who live with this potentially life-threatening disease that currently has no cure," said Mary Jane Marchisotto, senior vice president of research at Food Allergy

Research & Education. "We have been pleased to support the research that has been conducted by Dr. Nagler and her colleagues at the University of Chicago."

The study, "Commensal bacteria protect against food allergen sensitization," was supported by Food Allergy Research & Education (FARE) and the University of Chicago Digestive Diseases Research Core Center. Gene sequencing was conducted at the Next-Generation Sequencing Core at Argonne National Laboratory. Additional authors include Andrew T. Stefka, Taylor Feehley, Prabhanshu Tripathi, Ju Qiu, Kathy D. McCoy, Sarkis K. Mazmanian, Melissa Y. Tjota, Goo-Young Seo, Severine Cao, Betty R. Theriault, Dionysios A. Antonopoulos, Liang Zhou, Eugene B. Chang and Yang-Xin Fu.

Publication: Andrew T. Stefka, et al., "Commensal bacteria protect against food allergen sensitization," PNAS, 2014; doi: 10.1073/pnas.1412008111

http://scitechdaily.com/new-acoustic-device-separates-tumor-cells-blood-cells/

New Acoustic Device Separates Tumor Cells from Blood Cells

Researchers Develop New Way to Separate Cells by Exposing Them to Sound Waves

A team of engineers has developed a new acoustic device that separates tumor cells from blood cells, helping doctors predict whether a tumor is going to spread.

Researchers from MIT, Pennsylvania State University, and Carnegie Mellon University have devised a new way to separate cells by exposing them to sound waves as they flow through a tiny channel. Their device, about the size of a dime, could be used to detect the extremely rare tumor cells that circulate in cancer patients' blood, helping doctors predict whether a tumor is going to spread.

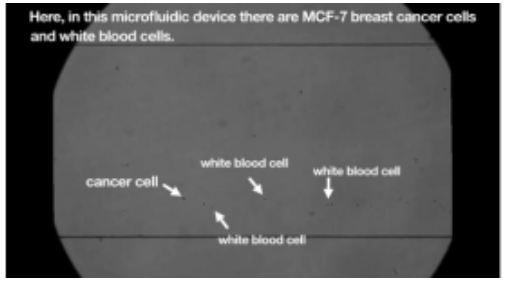
Separating cells with sound offers a gentler alternative to existing cell-sorting technologies, which require tagging the cells with chemicals or exposing them to stronger mechanical forces that may damage them.

"Acoustic pressure is very mild and much smaller in terms of forces and disturbance to the cell. This is a most gentle way to separate cells, and there's no artificial labeling necessary," says Ming Dao, a principal research scientist in MIT's Department of Materials Science and Engineering and one of the senior authors of the paper, which appears this week in the Proceedings of the National Academy of Sciences.

Subra Suresh, president of Carnegie Mellon, the Vannevar Bush Professor of Engineering Emeritus, and a former dean of engineering at MIT, and Tony Jun Huang, a professor of engineering science and mechanics at Penn State, are also senior authors of the paper. Lead authors are MIT postdoc Xiaoyun Ding and Zhangli Peng, a former MIT postdoc who is now an assistant professor at the University of Notre Dame.

The researchers have filed for a patent on the device, the technology of which they have demonstrated can be used to separate rare circulating cancer cells from white blood cells.

To sort cells using sound waves, scientists have previously built microfluidic devices with two acoustic transducers, which produce sound waves on either side of a microchannel. When the two waves meet, they combine to form a standing wave (a wave that remains in constant position). This wave produces a pressure node, or line of low pressure, running parallel to the direction of cell flow. Cells that encounter this node are pushed to the side of the channel; the distance of cell movement depends on their size and other properties such as compressibility. However, these existing devices are inefficient: Because there is only one pressure node, cells can be pushed aside only short distances.



Researchers from MIT, Penn State, and Carnegie Mellon University show how they separate cells and particles using sound waves. **Video: Melanie Gonick/MIT**

The new device overcomes that obstacle by tilting the sound waves so they run across the microchannel at an angle - meaning that each cell encounters several pressure nodes as it flows through the channel. Each time it encounters a node, the pressure guides the cell a little further off center, making it easier to capture cells of different sizes by the time they reach the end of the channel.

This simple modification dramatically boosts the efficiency of such devices, says Taher Saif, a professor of mechanical science and engineering at the University of Illinois at Urbana-Champaign. "That is just enough to make cells of different sizes and properties separate from each other without causing any damage or harm to them," says Saif, who was not involved in this work.

In this study, the researchers first tested the system with plastic beads, finding that it could separate beads with diameters of 9.9 and 7.3 microns (thousandths of a millimeter) with about 97 percent accuracy. They also devised a computer simulation that can predict a cell's trajectory through the channel based on its size, density, and compressibility, as well as the angle of the sound waves, allowing them to customize the device to separate different types of cells.

To test whether the device could be useful for detecting circulating tumor cells, the researchers tried to separate breast cancer cells known as MCF-7 cells from white blood cells. These two cell types differ in size (20 microns in diameter for MCF-7 and 12 microns for white blood cells), as well as density and

compressibility. The device successfully recovered about 71 percent of the cancer cells; the researchers plan to test it with blood samples from cancer patients to see how well it can detect circulating tumor cells in clinical settings. Such cells are very rare: A 1-milliliter sample of blood may contain only a few tumor cells.

"If you can detect these rare circulating tumor cells, it's a good way to study cancer biology and diagnose whether the primary cancer has moved to a new site to generate metastatic tumors," Dao says. "This method is a step forward for detection of circulating tumor cells in the body. It has the potential to offer a safe and effective new tool for cancer researchers, clinicians and patients," Suresh says.

The research was funded by the National Institutes of Health and the National Science Foundation.

Publication: Xiaoyun Ding, et al., "Cell separation using tilted-angle standing surface acoustic waves, PNAS, 2014; doi: 10.1073/pnas.1413325111

http://phys.org/news/2014-08-japan-lab-unable-replicate-stem.html

Japan lab unable to replicate 'stem cell' findings (Update)

Researchers in Japan said Wednesday they have been unable to replicate experiments that were hailed earlier this year as a "game-changer" in the quest to grow transplant tissue, amid claims evidence was faked.

In a scandal that rocked Japan's scientific establishment, Riken - the research institute that sponsored the study - launched an independent experiment in April to verify research published by scientist Haruko Obokata and her colleagues earlier this year. But the failure to replicate the experiment casts further doubt on the existence of stem cell-like cells, what the researchers called Stimulus-Triggered Acquisition of Pluripotency (STAP) cells.

"Researchers have conducted 22 experiments thus far, but we could not confirm the emergence of cells in the conditions described in (Obokata's) papers," Riken said in an interim report issued Wednesday.

Obokata since July has been trying in tandem with independent teams to reproduce her own results.

The researchers will continue their experiments under more diverse conditions while also considering data obtained by Obokata herself, Shinichi Aizawa, a special adviser at Riken, told a lengthy press conference.

Obokata was feted after unveiling findings that appeared to show a straightforward way to re-programme adult cells to become stem cells - precursors that are capable of developing into any other cell in the human body.

Identifying a readily manufacturable supply of stem cells could one day help meet a need for transplant tissues, or even whole organs, meaning that any advance in the field is met with excitement in the scientific community.

But suspicions began to emerge in the weeks and months after the research was published, building into one of the biggest controversies in scientific publishing for a decade.

Leading science journal Nature withdrew the flawed stem-cell study after Obokata agreed in June to retract the papers. Nature said it would tighten procedures to vet future studies submitted for publication.

It said the decision was taken after mistakes were discovered in some data published in two papers, photograph captions were found to be misleading, and the work itself could not be repeated by other scientists.

Earlier this month Obokata's co-author, stem cell scientist Yoshiki Sasai, hanged himself, further shaking Japan's scientific establishment.

Researchers have been trying to replicate results appearing to show that exposing ordinary cells to various stresses had made them pluripotent, or able to develop into any type of tissue.

Riken had planned to implant these cells into mouse embryos to test whether they really were pluripotent. But the experiments have been fraught with difficulty from the outset, with researchers unable to reproduce such cells.

On Wednesday Riken also announced a shake-up of the Center for Developmental Biology where the scandal took place, adding it planned to cut about half of its 40 laboratories. CDB currently has around 400 researchers.

http://www.eurekalert.org/pub_releases/2014-08/uoc--isa082614.php

In sync and in control?

UCLA social scientists find that marching in unison makes men feel more formidable

In the aftermath of the Aug. 9 shooting of an 18-year-old African American man by a white police officer in Ferguson, Missouri, much of the nation's attention has been focused on how law enforcement's use of military gear might have inflamed tensions. But what if the simple act of marching in unison - as riot police routinely do - increases the likelihood that law enforcement will use excessive force in policing protests?

That's the suggestion of a new study by a pair of UCLA social scientists.

"We have found that when men are walking in step with other men, they think that a potential foe is smaller and less physically formidable and less intimidating than when they're just walking in no particularly coordinated manner with other men," said lead author Daniel Fessler, a professor of anthropology in the UCLA College. "That calculation appears to make men who march with other men feel less vulnerable and more powerful and their potential foe more easily vanquished. We theorize that it also makes them more likely to use violence than they otherwise would be."

Study co-author Colin Holbrook said media coverage of Ferguson frequently showed police slowly advancing in lockstep on protesters who were standing with their hands up. "Not only can it be quite intimidating to see a group marching in unison, but we've also found - and past research supports - that the mere act of moving in sync also makes those in formation feel more formidable and therefore potentially more likely to be aggressive."

Fessler's and Holbrook's findings are published online today by Biology Letters, a scholarly journal published by the British Royal Society, the world's oldest scientific academy in continuous existence.

For the strikingly simple experiment, Fessler and Holbrook recruited 96 undergraduate men, pairing each with an experimenter who posed as a fellow recruit. Half the participants were instructed to walk in unison with their partners. The other half were asked just to accompany their partners, but without walking in lockstep. Participants were not allowed to talk to each other, and all followed the same 800-foot route, outside of UCLA's Pauley Pavilion.

Afterward, each participant was given a range of tests, most of them to disguise the real purpose of the study. Ultimately, each study subject was shown a photograph showing a man's face with an angry expression. Based on that information alone, subjects were asked to estimate the man's height in feet and inches and then asked to guess his size by choosing images from two different charts, each showing six silhouettes. On one chart, each image was progressively taller and bigger; on the other, each appeared progressively more muscular.

Even though each participant was accompanied only by a single companion, those who walked in unison with their partners judged the angry man as significantly less physically imposing than did the study subjects who had not walked in unison with their confederate: On average, they estimated that the man in the photo was about an inch shorter than the other participants did. Although the researchers noted the difference was relatively small, they said the strength of the finding was so strong that the chance of it being a fluke was 1 in 100.

The researchers said the effect would likely have been even stronger had the study more closely approximated the conditions of police and military training.

"If we had more people marching together, and if they had marched together repeatedly like police and the military do in drills, we would have expected a stronger effect," said Holbrook, a postdoctoral fellow at UCLA's Center for Behavior, Evolution and Culture.

The researchers theorize that humans have evolved to view the act of moving in unison as a marker of a group's strength. Further, the perception pertains to both observers, especially potential adversaries, and to those moving together in formation.

"The ability to move in unison indicates that one is part of an effective fighting alliance," said Fessler, who also is director of the Center for Behavior, Evolution and Culture. "That's no accident. In order for individuals to be synchronized, they have to be motivated to coordinate their behavior - they have to be paying attention to what one another are doing, and they have to be skilled and competent. A deep part of our brain registers this connection."

The connection may help explain the continued use of military parades and drills at a time when armed forces increasingly rely on air strikes, the researchers contend. Marching band performances at sporting events and fans spontaneously breaking into the "wave" at stadiums also communicate - albeit unconsciously - that the participants are part of a powerful and intimidating coalition.

Research has found that marching in unison might actually make people more likely to be aggressive. In a 2012 study conducted by a University of Southern California professor, subjects who had walked in sync with another person were more likely to take actions that they thought would result in the death of sow bugs than those who walked together in no particular pattern.

In many species, natural selection appears to favor animals most skilled at moving in unison. In research published this year, for example, researchers at Florida Atlantic University found that dolphins traveling in tightly coordinated groups are more likely to win fights with other dolphins than those in groups that swim and breach in unison less often.

Fessler's and Holbrook's latest findings build on more than 30 studies they have conducted into unconscious assumptions people make when they assess the risk posed by another in a potentially dangerous situation. With funding from the Air Force Office of Scientific Research, the researchers have found that people appear to compute the risk posed by a potential adversary by arriving at a quick mental picture of the size of the potential assailant, regardless of whether the foe's size is germane to the risk.

For instance, Fessler and Holbrook have found that a foe's envisioned size and muscularity is influenced by his access to weapons, propensity to take risks and - in a study conducted immediately following the death of Osama Bin Laden - the success or failure of his leader. They've also found that when men are in groups they tend to reduce the envisioned size and strength of a potential foe.

"Experiencing moving in unison with another person appears to make us paint a less threatening picture of a potential assailant," Fessler said. "They loom less large and formidable in the mind's eye. Simply walking in sync may make men more likely to think, 'Yeah, we could take that guy!'"

http://phys.org/news/2014-08-godzilla-stomps-ultra-hd-wires.html

Godzilla stomps back in ultra HD, wires intact

At a humble Tokyo laboratory, Godzilla, including the 1954 black-and-white original, is stomping back with a digital makeover that delivers four times the image quality of high definition.

The effort with "4K" technology is carefully removing scratches and discoloration from the films and also unearthing hidden information on the reel-to-reel. Experts say the chemical reactions used to make old movies stored far greater detail than was visible with the limited projection technology of the era, as well as with subsequent digital updates. If all the hidden information of a reel-to-reel is ever brought out, quality would approximate 8K, they say.

In this April 28, 2014 file photo, a large size figure of Godzilla in a diorama is on display at Cheepa's gallery in Tokyo. At a humble Tokyo laboratory, Godzilla, including the 1954 black-and-white original, is stomping back with a digital makeover that delivers four times the image quality of high definition. Experts say the chemical reactions used to make old movies stored far greater detail than was visible with the limited projection technology of the era, as well as with subsequent digital updates. **(AP Photo/Junji Kurokawa, File)**

Only one minute from the original film and from each of the sequels has been turned into 4K so far but the results are stunning enough. Faded, blurry, yellowing footage of the radiation-breathing creature that emerged from the Pacific after atomic-bomb testing turns sharp, clear and vivid. It almost looks like state-of-the-art animation.

It's better than the original, said Toshifumi Shimizu of Tokyo Laboratory Co., the studio that undertook the painstaking effort. "You can feel the impact of the bodies banging into each other under the suits," he said in an interview Wednesday with The Associated Press. He said many scenes are more real and emotionally moving than what is achieved by today's computer-graphics manipulation, widespread in Hollywood blockbusters. The details of the cityscape models, the bumpy skin of Godzilla and the metallic shine of the robots are revealed as they once were.

The craftsmen at the lab made a point to keep visible the wires from which the flying monsters hung. The goal was to stay true to the intention of the original.

In turning Godzilla films into 4K, each frame of the reel-to-reel is scanned by a special machine. Each frame is then examined for blotches and other damage that has crept in over the last 60 years. Any problems with a frame are fixed on a computer, one by one, by a film-processing specialist.

Shoko Ideriha, one of the specialists, said the team pieced together the best segments, working with the only three copies left of the 1954 Godzilla. She compared fixing film to being a doctor treating a patient.

The big catch is that 4K, also known as ultra-high definition, or Ultra HD, can't be seen in most homes or theaters yet. For one, you would need a 4K TV, which is not cheap. Sony's 85-inch model sells for $25,000, although prices are gradually coming down overall. More crucial still, 4K broadcasting is virtually non-existent. In Japan, it's available only in limited test programming.

But believers swear that it will become the standard of the not-so-distant future. Other movie classics, such as "Lawrence of Arabia" and "Gone With the Wind," have turned 4K.

What 4K promises for movie classics is astounding, said Takashi Sawa, of Nihon Eiga Satellite Broadcasting Corp., which aired all 28 Toho Godzilla classics for the 60th anniversary of Godzilla's birth, which fell this year and marked the debut of Gareth Edwards' Hollywood Godzilla.

Nihon Eiga also aired a special program on the 4K Godzilla project on its cable network, which broadcasts to 7.5 million households in Japan.

Restoring movie classics into 4K might do wonders for the chicken-and-egg dilemma for new technology, which generally won't take off until there is content people want to watch. "TV drama shows shot in digital cannot be restored as 4K," he said. "But Godzilla can become 4K."

http://bit.ly/1ppVx8B

Water clouds tentatively detected just 7 light-years from Earth

Astronomers have found signs of water ice clouds on an object just 7.3 light-years from Earth - less than twice the distance of Alpha Centauri, the nearest star system to the sun.

Ken Croswell

If confirmed, the discovery is the first sighting of water clouds beyond our solar system. The clouds shroud a Jupiter-sized object known as a brown dwarf and should yield insight into the nature of cool giant planets orbiting other suns.

Kevin Luhman, an astronomer at Pennsylvania State University, University Park, recently discovered the nearby object by using images from NASA's WISE infrared space telescope, which scanned the sky from 2010 to 2011. A brown

dwarf is a failed star and has so little mass that it can't sustain nuclear reactions, so after its birth it fades and cools. This brown dwarf, named WISE J0855-0714, is the coldest known. Its temperature is slightly below the freezing point of water, so it's colder than Earth's mean temperature but warmer than Jupiter's.

"I've been obsessed with this object since its discovery," says astronomer Jacqueline Faherty of the Carnegie Institution for Science in Washington, D.C. The new neighbor resembles a giant planet - it's as large as Jupiter and three to 10 times as massive - but is solitary, which means it has no sun whose glare interferes with our view of it. Moreover, it's nearby: the fourth closest system to the sun, after Alpha Centauri, Barnard's star, and Luhman 16.

Still, because the object is small and cold, it's so dim that no ground-based observatory had seen it. "I went to battle at the telescope to try and get this detection," Faherty says. "I wanted to put war paint under my eyes and wear a bandanna, because I knew this was not going to be an easy thing to do. At the telescope, I've never been so nervous. I've never wanted clear conditions so badly."

For 3 nights in May, Faherty used the 6.5-meter Magellan Baade telescope in Chile to acquire 151 near-infrared images that she later combined to yield a detection. "I'm absolutely elated," she says. Moreover, as her team will report in The Astrophysical Journal Letters, the observed colors match models of a brown dwarf with clouds of water ice and clouds of sodium sulfide.

"It's incredibly interesting," says Jonathan Fortney of the University of California, Santa Cruz, an astronomer who helped develop those models but was not involved in the discovery. "It's tentative," he says, but "it's the first evidence for water clouds" outside our solar system. Even within the solar system, observers can see water clouds on only Earth and Mars; the giant planets are so cold that ammonia ice clouds cover the water clouds on Jupiter and Saturn while the atmospheres of Uranus and Neptune block the view there.

Observers have previously discerned water vapor in the atmospheres of extrasolar planets, but Fortney says water clouds are a new phenomenon. "One of the things we don't really know is how common partly cloudiness is," he says. Venus, whose clouds consist of sulfuric acid, is totally cloudy, whereas Earth is partly cloudy. Faherty says the brown dwarf is also partly cloudy: About half is obscured by clouds.

Verifying the discovery will require spectra. Because the object is so dim, this will likely await the James Webb Space Telescope, which will be launched later this decade.

http://www.eurekalert.org/pub_releases/2014-08/uoe-sid082614.php

Self-deceived individuals deceive others better

Over confident people can fool others into believing they are more talented than they actually are, a study has found.

These 'self-deceived' individuals could be more likely to get promotions and reach influential positions in banks and other organisations. And these people are more likely to overestimate other people's abilities and take greater risks, possibly creating problems for their organisations.

The study by researchers from Newcastle University and the University of Exeter, has also found that those who are under confident in their own abilities are viewed as less able by their colleagues. The findings, which will be published in the journal PLOS ONE today, are the first time a link has been found between a person's view of their own ability and how others see their abilities, and could partially explain financial collapses and other disasters.

As part of the research the team asked 72 students to rate their own ability and the ability of their peers after the first day of their course. Of those, 32 students (about 45%) were under confident in their ability as compared to their final mark, 29 students (40%) were overconfident and 11 students (15%) were accurate in their assessments of their own ability. There was a positive correlation between the grades students predicted for themselves and the grades others predicted for them. In other words, students who predicted higher grades for themselves were predicted to have higher grades by others, irrespective of their actual final score. The same applied to those who were under confident.

The task was repeated after six weeks of the course when the students knew each other better and the findings remained the same. Those who were over confident were over rated by others. Study author Dr Vivek Nityananda, research associate at Newcastle University explains: "These findings suggest that people don't always reward the most accomplished individual but rather the most self-deceived. "We think this supports an evolutionary theory of self-deception. It can be beneficial to have others believe you are better than you are and the best way to do this is to deceive yourself – which might be what we have evolved to do. "This can cause problems as over confident people may also be more likely to take risks. So if too many people overrate themselves and deceive others about their abilities within organisations then this could lead to disastrous consequences such as airplane crashes or financial collapses."

Joint lead author, Dr Shakti Lamba, of The University of Exeter added: "If over confident people are more likely to be risk prone then by promoting them we may be creating institutions, such as banks and armies, that are more vulnerable to risk."

http://www.eurekalert.org/pub_releases/2014-08/uow-ats082714.php

A touching story: The ancient conversation between plants, fungi and bacteria

The mechanical force that a single fungal cell or bacterial colony exerts on a plant cell may seem vanishingly small, but it plays a heavy role in setting up some of the most fundamental symbiotic relationships in biology.

MADISON, Wis. - In fact, it may not be too much of a stretch to say that plants may have never moved onto land without the ability to respond to the touch of beneficial fungi, according to a new study led by Jean-Michel Ané, a professor of agronomy at the University of Wisconsin-Madison.

"Many people have studied how roots progress through the soil, when fairly strong stimuli are applied to the entire growing root," says Ané, who just published a review of touch in the interaction between plants and microbes in the journal Current Opinion in Plant Biology. "We are looking at much more localized, tiny stimuli on a single cell that is applied by microbes."

Specifically, Ané, Dhileepkumar Jayaraman, a postdoctoral researcher in agronomy, and Simon Gilroy, a professor of botany, studied how such a slight mechanical stimulus starts round one of a symbiotic relationship - that is, a win-win relationship between two organisms.

It's known that disease-causing fungi build a structure to break through the plant cell wall, "but there is growing evidence that fungi and also bacteria in symbiotic associations use a mechanical stimulation to indicate their presence," says Ané. "They are knocking on the door, but not breaking it down."

After the fungus announces its arrival, the plant builds a tube in which the fungus can grow. "There is clearly a mutual exchange of signals between the plant and the fungus," says Ané. "It's only when the path is completed that the fungus starts to penetrate."

Mycorrhizae are the beneficial fungi that help virtually all land plants absorb the essential nutrients - phosphorus and nitrogen - from the soil. Biologists believe this ubiquitous mechanism began about 450 million years ago, when plants first moved onto land.

Mechanical signaling is only part of the story - microbes and plants also communicate with chemicals, says Ané. "So this is comparable not to breaking the door or even just knocking on the door, but to knocking on the door while wearing cologne. Clearly the plant is much more active than we thought; it can process signals, prepare the path and accept the symbiont."

Beyond fungi, some plants engage in symbiosis with bacteria called rhizobia that "fix" nitrogen from the atmosphere, making it available to the plant. Rhizobia enable legumes like soybeans and alfalfa to grow without nitrogen fertilizer.

When Ané and his colleagues looked closer, they found that rhizobium symbiosis also employs mechanical stimulation. When the bacterium first contacts a root hair, the hair curls around the bacterium, trapping it.

The phenomenon of curling has been known for almost 100 years. "But why would nature develop such a complicated mechanism to entrap a bacterial colony?" Ané asks. "We propose the purpose is to apply mechanical stimulation" so the plant will start building a home for the rhizobium - for mutual benefit. "We have preliminary evidence that when the entrapment is not complete, the process of colonization does not happen," he says.

Again, the two-step communication system is at work, Ané adds. "The curling process itself can only begin when the plant gets a chemical signal from the bacterium - but the growing tube inside the root hair that accepts the bacteria requires something else, and nobody knew what. We propose it's a mechanical stimulation created by entrapping, which gives the bacterial colony a way to push against the root."

In many respects, this symbiosis parallels the older one between plants and beneficial fungi, Ané says. Indeed, he says legumes have "hijacked" the mycorrhizae system. "Plants used the symbiosis toolkit to develop this relationship with mycorrhizae, and then used it again for bacteria. This dual requirement for chemical and mechanical signals is present in both associations, even though the association between rhizobia and legumes is only 60 million years old."

http://www.eurekalert.org/pub_releases/2014-08/uosf-mcm082714.php

Marijuana compound may offer treatment for Alzheimer's disease

New preclinical study indicates THC may slow or halt progression of memory-robbing disease

Tampa, FL - Extremely low levels of the compound in marijuana known as delta-9-tetrahydrocannabinol, or THC, may slow or halt the progression of Alzheimer's disease, a recent study from neuroscientists at the University of South Florida shows.

Findings from the experiments, using a cellular model of Alzheimer's disease, were reported online in the Journal of Alzheimer's Disease.

Researchers from the USF Health Byrd Alzheimer's Institute showed that extremely low doses of THC reduce the production of amyloid beta, found in a soluble form in most aging brains, and prevent abnormal accumulation of this

protein -- a process considered one of the pathological hallmarks evident early in the memory-robbing disease. These low concentrations of THC also selectively enhanced mitochondrial function, which is needed to help supply energy, transmit signals, and maintain a healthy brain.

"THC is known to be a potent antioxidant with neuroprotective properties, but this is the first report that the compound directly affects Alzheimer's pathology by decreasing amyloid beta levels, inhibiting its aggregation, and enhancing mitochondrial function," said study lead author Chuanhai Cao, PhD and a neuroscientist at the Byrd Alzheimer's Institute and the USF College of Pharmacy.

"Decreased levels of amyloid beta means less aggregation, which may protect against the progression of Alzheimer's disease. Since THC is a natural and relatively safe amyloid inhibitor, THC or its analogs may help us develop an effective treatment in the future."

The researchers point out that at the low doses studied, the therapeutic benefits of THC appear to prevail over the associated risks of THC toxicity and memory impairment.

Neel Nabar, a study co-author and MD/PhD candidate, recognized the rapidly changing political climate surrounding the debate over medical marijuana.

"While we are still far from a consensus, this study indicates that THC and THC-related compounds may be of therapeutic value in Alzheimer's disease," Nabar said. "Are we advocating that people use illicit drugs to prevent the disease? No. It's important to keep in mind that just because a drug may be effective doesn't mean it can be safely used by anyone. However, these findings may lead to the development of related compounds that are safe, legal, and useful in the treatment of Alzheimer's disease."

The body's own system of cannabinoid receptors interacts with naturally-occurring cannabinoid molecules, and these molecules function similarly to the THC isolated from the cannabis (marijuana) plant.

Dr. Cao's laboratory at the Byrd Alzheimer's Institute is currently investigating the effects of a drug cocktail that includes THC, caffeine as well as other natural compounds in a cellular model of Alzheimer's disease, and will advance to a genetically-engineered mouse model of Alzheimer's shortly.

"The dose and target population are critically important for any drug, so careful monitoring and control of drug levels in the blood and system are very important for therapeutic use, especially for a compound such as THC," Dr. Cao said.

Chuanhai Cao, Yaqiong Li, Hui Liu, Ge Bai, Jonathan May, Xiaoyang Lin, Kyle Sutherland, Neel Nabar and Jianfeng Cai; "The Potential Therapeutic Effects of THC on Alzheimer's Disease," Journal of Alzheimer's Disease, DOI: 10.3233/JAD-140093.

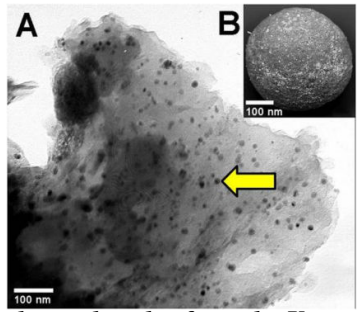
http://bit.ly/1tiY8CZ

Study examines 13,000-year-old nanodiamonds from multiple locations across three continents

The cause of a massive extinction has long been debated by scientists who, until recently, could only speculate as to why.

Most of North America's megafauna - mastodons, short-faced bears, giant ground sloths, saber-toothed cats and American camels and horses - disappeared close to 13,000 years ago at the end of the Pleistocene period. The cause of this massive extinction has long been debated by scientists who, until recently, could only speculate as to why.

A group of scientists, including UC Santa Barbara's James Kennett, professor emeritus in the Department of Earth Science, posited that a comet collision with Earth played a major role in the extinction. Their hypothesis suggests that a cosmic-impact event precipitated the Younger Dryas period of global cooling close to 12,800 years ago. This cosmic impact caused abrupt environmental stress and degradation that contributed to the extinction of most large animal species then inhabiting the Americas. According to Kennett, the catastrophic impact and the subsequent climate change also led to the disappearance of the prehistoric Clovis culture, known for its big game hunting, and to human population decline.

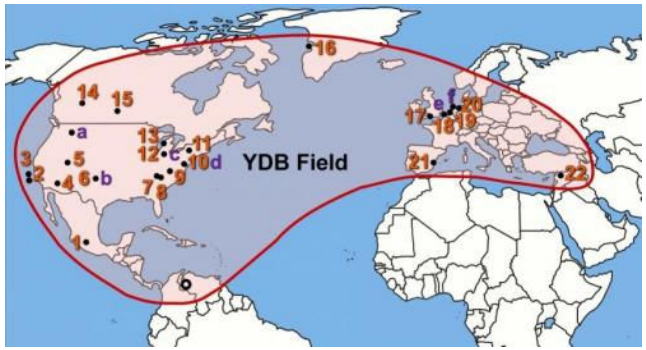


A transmission electron microscopy image of carbon spherules from the Younger Dryas Boundary 30 cm below the surface in Gainey, Michigan. **Credit: UCSB**

In a new study published this week in the *Journal of Geology*, Kennett and an international group of scientists have focused on the character and distribution of nanodiamonds, one type of material produced during such an extraterrestrial collision. The researchers found an abundance of these tiny diamonds distributed over 50 million square kilometers across the Northern Hemisphere at the Younger Dryas boundary (YDB). This thin, carbon-rich layer is often visible as a thin black line a few meters below the surface.

Kennett and investigators from 21 universities in six countries investigated nanodiamonds at 32 sites in 11 countries across North America, Europe and the Middle East. Two of the sites are just across the Santa Barbara Channel from UCSB: one at Arlington Canyon on Santa Rosa Island, the other at Daisy Cave on San Miguel Island.

"We conclusively have identified a thin layer over three continents, particularly in North America and Western Europe, that contain a rich assemblage of nanodiamonds, the production of which can be explained only by cosmic impact," Kennett said. "We have also found YDB glassy and metallic materials formed at temperatures in excess of 2200 degrees Celsius, which could not have resulted from wildfires, volcanism or meteoritic flux, but only from cosmic impact."



The solid line defines the current known limits of the Younger Dryas Boundary field of cosmic-impact proxies, spanning 50 million square kilometers. **Credit: UCSB**

The team found that the YDB layer also contained larger than normal amounts of cosmic impact spherules, high-temperature melt-glass, grapelike soot clusters, charcoal, carbon spherules, osmium, platinum and other materials. But in this paper the researchers focused their multi-analytical approach exclusively on nanodiamonds, which were found in several forms, including cubic (the form of diamonds used in jewelry) and hexagonal crystals.

"Different types of diamonds are found in the YDB assemblages because they are produced as a result of large variations in temperature, pressure and oxygen levels associated with the chaos of an impact," Kennett explained. "These are exotic conditions that came together to produce the diamonds from terrestrial carbon; the diamonds did not arrive with the incoming meteorite or comet."

Based on multiple analytical procedures, the researchers determined that the majority of the materials in the YDB samples are nanodiamonds and not some other kinds of minerals. The analysis showed that the nanodiamonds consistently occur in the YDB layer over broad areas.

"There is no known limit to the YDB strewnfield which currently covers more than 10 percent of the planet, indicating that the YDB event was a major cosmic impact," Kennett said. "The nanodiamond datum recognized in this study gives scientists a snapshot of a moment in time called an isochron."

To date, scientists know of only two layers in which more than one identification of nanodiamonds has been found: the YDB 12,800 years ago and the well-known Cretaceous-Tertiary boundary 65 million years ago, which is marked by the mass extinction of the dinosaurs, ammonites and many other groups.

"The evidence we present settles the debate about the existence of abundant YDB nanodiamonds," Kennett said. "Our hypothesis challenges some existing paradigms within several disciplines, including impact dynamics, archaeology, paleontology and paleoceanography/paleoclimatology, all affected by this relatively recent cosmic impact."

More information: *Journal of Geology*, www.jstor.org/stable/10.1086/677046

http://www.eurekalert.org/pub_releases/2014-08/uob-fnt082814.php

From nose to knee: Engineered cartilage regenerates joints

Human articular cartilage defects can be treated with nasal septum cells.

Researchers at the University and the University Hospital of Basel report that cells taken from the nasal septum are able to adapt to the environment of the knee joint and can thus repair articular cartilage defects. The nasal cartilage cells' ability to self-renew and adapt to the joint environment is associated with the expression of so-called HOX genes. The scientific journal Science Translational Medicine has published the research results together with the report of the first treated patients.

Cartilage lesions in joints often appear in older people as a result of degenerative processes. However, they also regularly affect younger people after injuries and accidents. Such defects are difficult to repair and often require complicated surgery and long rehabilitation times. A new treatment option has now been presented by a research team lead by Prof. Ivan Martin, professor for tissue engineering, and Prof. Marcel Jakob, Head of Traumatology, from the Department of Biomedicine at the University and the University Hospital of Basel: Nasal cartilage cells can replace cartilage cells in joints.

Cartilage cells from the nasal septum (nasal chondrocytes) have a distinct capacity to generate a new cartilage tissue after their expansion in culture. In an ongoing clinical study, the researchers have so far taken small biopsies (6 millimeters in diameter) from the nasal septum from seven out of 25 patients below the age of 55 years and then isolated the cartilage cells. They cultured and multiplied the cells and then applied them to a scaffold in order to engineer a cartilage graft the size of 30 x 40 millimeters. A few weeks later they removed the damaged cartilage tissue of the patients' knees and replaced it with the engineered and tailored tissue from the nose. In a previous clinical study conducted in cooperation with plastic surgeons and using the same method, the researchers from Basel recently already successfully reconstructed nasal wings affected by tumors.

Surprising Adaption

The scientists around first author Dr. Karoliina Pelttari were especially surprised by the fact that in the animal model with goats, the implanted nasal cartilage cells were compatible with the knee joint profile; even though, the two cell types have different origins. During the embryonic development, nasal septum cells develop

from the neuroectodermal germ layer, which also forms the nervous system; their self-renewal capacity is attributed to their lack of expression of some homeobox (HOX) genes. In contrast, these HOX genes are expressed in articular cartilage cells that are formed in the mesodermal germ layer of the embryo.

"The findings from the basic research and the preclinical studies on the properties of nasal cartilage cells and the resulting engineered transplants have opened up the possibility to investigate an innovative clinical treatment of cartilage damage", says Prof. Ivan Martin about the results. It has already previously been shown that the human nasal cells' capacity to grow and form new cartilage is conserved with age. Meaning, that also older people could benefit from this new method, as well as patients with large cartilage defects. While the primary target of the ongoing clinical study at the University Hospital of Basel is to confirm the safety and feasibility of cartilage grafts engineered from nasal cells when transplanted into joint, the clinical effectiveness assessed until now is highly promising.

Karoliina Pelttari, Benjamin Pippenger, Marcus Mumme, Sandra Feliciano, Celeste Scotti, Pierre Mainil-Varlet, Alfredo Procino, Brigitte von Rechenberg, Thomas Schwamborn, Marcel Jakob, Clemente Cillo, Andrea Barbero, Ivan Martin

Adult human neural crest-derived cells for articular cartilage repair

Science Translational Medicine, 6, 251ra120 (2014) | doi: 10.1126/scitranslmed.3009688

http://phys.org/news/2014-08-didnt-arachnids.html

Three things you didn't know about the arachnids that live on your face

You are not alone. Your body is a collection of microbes, fungi, viruses… and even other animals.

In fact, you aren't even the only animal using your face. Right now, in the general vicinity of your nose, there are at least two species of microscopic mites living in your pores. You would expect scientists to know quite a lot about these animals (given that we share our faces with them), but we don't.

Here is what we do know: Demodex mites are microscopic arachnids (relatives of spiders and ticks) that live in and on the skin of mammals – including humans. They have been found on every mammal species where we've looked for them, except the platypus and their odd egg-laying relatives.

Often mammals appear to host more than one species, with some poor field mouse species housing four mite species on its face alone. Generally, these mites live out a benign coexistence with their hosts. But if that fine balance is disrupted, they are known to cause mange amongst our furry friends, and skin ailments like rosacea and blepharitis in humans. Most of us are simply content – if unaware – carriers of these spindly, eight-legged pore-dwellers.

Scientists from NC State, the North Carolina Museum of Natural Sciences, and the California Academy of Sciences have just published a study that uncovers some previously unknown truths regarding these little-known mites – all the while providing a glimpse into even bigger mysteries that have yet to be solved.

1. Everyone has mites.

One of our most exciting discoveries is that these mites are living on everyone. Yes everyone (even you). This hasn't always been obvious because it can be hard to find a microscopic mite living on one's face. Traditional sampling methods (including scraping or pulling a piece of tape off your face) only return mites on 10-25 percent of adults. The fact that mites are found at a much higher rate on cadavers (likely because the dead are easier to sample more extensively and intrusively) was a hint that they might be much more ubiquitous.

As it turns out, you don't have to actually see a mite to detect its presence. Dan Fergus, a mite molecular biologist at the North Carolina Museum of Natural Sciences, discovered that mite DNA could be sequenced from face scrapings regardless of whether a mite could be found under the microscope. And mite DNA was sequenced from every adult we sampled. Meaning that if you let us scrape your face, we'd find mite DNA on you as well. And where mite DNA is found, you'll find mites.

2. Humans host two mite species that aren't closely related to each other.

One of the most intriguing (and unsolved) face mite mysteries is how humans acquired these beasties. Perhaps these mites are a model system of co-evolution. It's possible that as every species of mammal evolved, so did their mites – each one particularly adapted to its changed environs. In such a case, we would expect that we acquired our mites from our ape ancestors, and that the two species of human mites would be more closely related to each other than to any other mite species.

However, we've learned that the two mite species on our faces Demodex folliculorum (the long skinny one, pictured at the top of this post) and Demodex brevis (the short, chubby one, photo to the right) are actually not very close relatives to each other at all. Our analyses actually show that brevis is more closely related to dog mites than to folliculorum, the other human mite. This is interesting because it shows us that humans have acquired each of these mite species in different ways, and that there are two separate histories of how each of these mite species came to be on our face.

Though we don't have enough evidence to say that we got one of our mites from man's best friend, it does seem possible that one of the domestic animal species that we've long shared our lives with (be it dogs, goats or otherwise) may have gifted us their mites.

3. Mites can tell us about the historical divergence of human populations

How we acquired our mites is just one part of the story. We are also curious about how our mite species have evolved since they became our constant companions. Demodex have likely been living with us for a long, long time; as early humans walked out of Africa and found their way around the globe, they probably carried their mites with them. So we want to know if Demodex DNA can provide a reflection of our own evolutionary history by allowing us to retrace those ancient paths of human migration.

So far, our analyses look promising. When looking at the DNA from one of our mite species, D. brevis, we found that mites from China are genetically distinct from mites from the Americas. East Asians and European populations diverged over 40,000 years ago and so far it looks like their mites did as well. On the other hand, D. folliculorum from China is indistinguishable from that of the Americas. Of the two Demodex species associated with humans, D. brevis lives deeper in your pores than folliculorum and is probably shared between people less readily, whereas D. folliculorum appears to enjoy global domination.

But as exciting as these results are, China and the US are just a small piece of the picture. We can't wait to see what happens when we sample D. brevis from people all over the world! The ancient journey of Homo sapiens as retold by mites.

If reading this made your face a little itchy, rest easy. In an evolutionary perspective, humans and Demodex are old, old friends. You are in good company. And so are your mites.

More information: Thoemmes MS, Fergus DJ, Urban J, Trautwein M, Dunn RR (2014) "Ubiquity and Diversity of Human-Associated Demodex Mites." PLoS ONE 9(8): e106265. DOI: 10.1371/journal.pone.0106265

http://nyti.ms/1wR80X1

Ebola Could Strike 20,000, World Health Agency Says

The World Health Organization said on Thursday that the Ebola epidemic was still accelerating and could afflict more than 20,000 people - almost seven times the current number of reported cases - before it could be brought under control.

By Nick Cumming-Bruce and Alan Cowell

GENEVA - The dire forecast was made as the health organization reported that the number of known cases and fatalities had risen once again. The organization also acknowledged that in areas of intense transmission "the actual number of cases may be two to four times higher than that currently reported."

The outbreak "continues to accelerate," the organization said.

According to the latest figures released by the health organization on Thursday, the total cases had risen to 3,069, with 1,552 deaths, in four West African countries: Guinea, Liberia, Sierra Leone and Nigeria.

Though the disease was identified in March, "more than 40 percent of the total number of cases have occurred within the past 21 days," the organization said. "However, most cases are concentrated in only a few localities."

The assessment came as the organization presented what it called a road map for stopping the transmission of Ebola within nine months. The plans are likely to cost nearly half a billion dollars over the next six months.

Though the road map aims to stop the epidemic in that time frame, "We have to be realistic that there is uncertainty" about such targets, Bruce Aylward, an assistant director general of the health organization, told reporters in Geneva.

With many centers for treating the disease now too full to take new patients, it was necessary to find and expand other approaches to contain the spread of the disease, the organization said.

The road map assumes that a number of countries that are not now affected by the epidemic could become so, but also asserts that the procedures it sets out could stop any new transmissions within eight weeks of the first case being identified.

"That's extremely aggressive," Mr. Aylward said, acknowledging such speedy containment had been achieved only in remote locations, not in the crowded urban centers now affected.

The road map came as Dr. Thomas R. Frieden, director of the United States Centers for Disease Control and Prevention, warned that the epidemic could get worse before it gets better. Dr. Frieden called for quicker international help and cooperation to control its spread.

Doctors Without Borders, which is battling the disease in the region, welcomed the road map but cautioned against taking a "false sense of hope" from it.

In a sign of the difficulties facing governments seeking to contain the disease, the health authorities in Nigeria reported on Thursday for the first time that the disease had spread beyond Lagos, its commercial capital, to claim another death.

In its statement on Thursday, the World Health Organization said the countries hit hardest by the epidemic - Guinea, Liberia and Sierra Leone - were "struggling to control the escalating outbreak against a backdrop of severely compromised health systems, significant deficits in capacity, and rampant fear."

Mr. Aylward, picking out details of the road map, said it would take at least 750 international and 12,000 local health workers.

"That is very difficult in the current environment," he added, alluding to fears arising from the high number of medical workers - 250 as of Monday - who had contracted the disease. Recruiting international staff may be harder than finding local personnel, he added, debunking the notion that locals were running away from the crisis. Health workers were getting infected because they were exhausted from working extraordinary hours, Mr. Aylward said.

The road map emphasized the need to halt transmission of the disease in major cities and ports, and underscored the importance of keeping air and shipping links operating to deliver medical supplies, personal protection equipment, food and other goods to fight the outbreak.

Guinea, Liberia and Sierra Leone are facing severe economic downturns as they struggle to cope with the Ebola outbreak, the African Development Bank reported on Thursday. On Wednesday, British Airways said it was suspending flights to Liberia and Sierra Leone because of Ebola concerns. Air France followed suit on Thursday.

Nick Cumming-Bruce reported from Geneva, and Alan Cowell from London.

http://phys.org/news/2014-08-marvellous-isnt-awesome.html

Why marvellous isn't awesome any more

Shedding light on the way our spoken language changes over time

Using the Spoken British National Corpus 2014, a very large collection of recordings of real-life, informal, spoken interactions between speakers of British English from across the United Kingdom, Cambridge University Press and Lancaster University are shedding light on the way our spoken language changes over time.

The digital revolution and America's growing influence on our culture have dramatically changed the way British people speak over the past two decades, new research has revealed.

'Marvellous' has been consigned to the dustbin of vocabulary – replaced by the American 'awesome', according to the study by Lancaster University's Faculty of Arts and Social Sciences (FASS) and Cambridge University Press.

The changes also reflect the nation's eating habits – with 'marmalade' also falling out of favour as one of the country's most used words.

Using the 'Spoken British National Corpus 2014', the team at Lancaster University and Cambridge University Press are shedding light on the way our spoken language changes over time.

The study looks at the most characteristic words of today's Britain. Not surprisingly the internet age has had a massive influence on the words we use. While in the 1990s we were captivated by 'Walkmans', today it has been replaced by the likes of 'online' and 'smartphone'. 'Awesome' has rapidly overtaken 'marvellous' as the most characteristic emotive word in today's speech.

The research shows that in 2014 the word 'awesome' appears 72 times per million words compared to 'marvellous', which has fallen in use from 155 times per million 20 years ago to only two times per million today.

Language expert Professor Tony McEnery, from the ESRC Centre for Corpus Approaches to Social Science (CASS) at Lancaster University, said: "These very early findings suggest the things that are most important to British society are indeed reflected in the amount we talk about them. "New technologies like Facebook have really captured our attention, to the extent that, if we're not using it, we're probably talking about it. "The rise of 'awesome' seems to provide evidence of American English's influence on British speakers."

These are only the initial findings from a small pilot of the project, named the 'Spoken British National Corpus 2014', which is now underway.

Prof McEnery said: "We need to gather hundreds, if not thousands, of conversations to create a spoken corpus so we can continue to analyse the way language has changed over the last 20 years. "We are calling for people to send us MP3 files of their everyday, informal conversations in exchange for a small payment to help me and my team to delve deeper into spoken language."

It is an ambitious project. Prof McEnery said: "It has not been completed to this scale in the UK since the early 1990s.

"That data, which is now out of date, is still used by researchers from around the world today, so we know there is a real appetite for research of this kind. "It is of great importance to collect new recordings from the 2010s in order to understand the nature of British English speech as it is today and not how it was more than two decades ago."

The research also allows analysis into language used in different regions, between genders and across different age groups. People who wish to submit recordings to the research team should email corpus@cambridge.org.

http://bit.ly/1zW24Iq

Next-generation nuclear reactors that use radioactive waste materials as fuel

Hitachi announced today that they have begun joint research with three American universities aimed at using Transuranium Elements (TRUs) as fuel

Hitachi announced today that they have begun joint research with three American universities aimed at using Transuranium Elements (TRUs) as fuel, and the development of Resource-renewable Boiling Water Reactors (RBWRs) that enable the effective use of uranium resources. Through this joint research, Hitachi plans to evaluate the performance and safety of RBWRs, which is being developed by Hitachi and Hitachi GE Nuclear Energy Ltd., and to study plans for testing with a view toward practical applications with each university.

The uranium fuel used in nuclear power plants contains TRUs, which are harmful to humans, and it is estimated that it takes about 100,000 years for the radioactive properties of these materials to decay to the level of uranium ore in its natural state. If TRUs could be effectively removed from these spent fuels, then the

period of decay for the remaining radioactive waste materials could be reduced to just a few hundred years. For this reason, research and development is being conducted throughout the world targeting nuclear reactors that can achieve nuclear fission in transuranic waste.

As one solution to this challenge, Hitachi has undertaken the development of RBWRs based on Boiling Water Reactor technologies, which already have an extensive track record of applications in commercial nuclear reactors. RBWRs could potentially use TRUs separated and refined from spent fuel as fuel along with uranium. Although RBWRs use new core fuel concepts to burn TRUs, they use the same non-core components as current Boiling Water Reactors (BWRs), including safety systems and turbines. As such, RBWRs are unique in that extensive experience accumulated through the application of BWRs can be leveraged to achieve efficient nuclear fission in TRUs.

Hitachi conducted joint research targeting RBWRs with MIT, U-M, and UCB from 2007 to 2011, evaluating safety and performance in the burning of TRUs, as described above. In this next stage of joint research, utilizing the knowledge and insights acquired through the previous stage, and applying the more accurate analysis methods developed by MIT, U-M, and UCB, Hitachi will continue to evaluate the safety and performance of the new reactors, and will study plans for tests with a view toward practical applications.

Hitachi will continue to apply highly reliable Monozukuri technologies to provide support for the stable supply of low-carbon energy with minimal environmental impact, while at the same time striving to further improve safety and reduce the burden of radioactive waste processing. In this way, they will contribute to the resolution of the medium- to long-term issues facing the nuclear power industry.

http://www.eurekalert.org/pub_releases/2014-08/uoc--tu082814.php

The universal 'anger face'

Researchers at UCSB and Griffith University in Australia identify origin and purpose of the facial expression for anger

The next time you get really mad, take a look in the mirror. See the lowered brow, the thinned lips and the flared nostrils? That's what social scientists call the "anger face," and it appears to be part of our basic biology as humans.

Now, researchers at UC Santa Barbara and at Griffith University in Australia have identified the functional advantages that caused the specific appearance of the anger face to evolve. Their findings appear in the current online edition of the journal Evolution and Human Behavior.

"The expression is cross-culturally universal, and even congenitally blind children make this same face without ever having seen one," said lead author Aaron Sell, a lecturer at the School of Criminology at Griffith University in Australia. Sell was formerly a postdoctoral scholar at UCSB's Center for Evolutionary Psychology.

The anger expression employs seven distinct muscle groups that contract in a highly stereotyped manner. The researchers sought to understand why evolution chose those particular muscle contractions to signal the emotional state of anger.

The current research is part of a larger set of studies that examine the evolutionary function of anger. "Our earlier research showed that anger evolved to motivate effective bargaining behavior during conflicts of interest," said Sell.

The greater the harm an individual can inflict, noted Leda Cosmides, the more bargaining power he or she wields. Cosmides, professor of psychology at UCSB, is a co-author on the study along with John Tooby, UCSB professor of anthropology. Cosmides and Tooby are co-directors of the campus's Center for Evolutionary Psychology.

"This general bargaining-through-menace principle applies to humans as well," said Tooby. "In earlier work we were able to confirm the predictions that stronger men anger more easily, fight more often, feel entitled to more unequal treatment, resolve conflicts more in their own favor and are even more in favor of military solutions than are physically weak men."

Starting from the hypothesis that anger is a bargaining emotion, the researchers reasoned that the first step is communicating to the other party that the anger-triggering event is not acceptable, and the conflict will not end until an implicit agreement is reached. This, they say, is why the emotion of anger has a facial expression associated with it. "But the anger face not only signals the onset of a conflict," said Sell. "Any distinctive facial display could do that. We hypothesized that the anger face evolved its specific form because it delivers something more for the expresser: Each element is designed to help intimidate others by making the angry individual appear more capable of delivering harm if not appeased."

For our ancestors, Cosmides noted, greater upper body strength led to a greater ability to inflict harm; so the hypothesis was that the anger face should make a person appear stronger.

Using computer-generated faces, the researchers demonstrated that each of the individual components of the anger face made those computer-generated people appear physically stronger. For example, the most common feature of the anger face is the lowered brow. Researchers took a computerized image of an average human face and then digitally morphed it in two ways: One photo showed a lowered brow, and the other a raised brow. "With just this one difference, neither face appeared 'angry,' " said Sell. "But when these two faces were shown to subjects, they reported the lowered brow face as looking like it belonged to a physically stronger man."

The experiment was repeated one-by-one with each of the other major components of the classic anger face - raised cheekbones (as in a snarl), lips thinned and pushed out, the mouth raised (as in defiance), the nose flared and the chin pushed out and up. As predicted, the presence by itself of any one of these muscle contractions led observers to judge that the person making the face was physically stronger.

"Our previous research showed that humans are exceptionally good at assessing fighting ability just by looking at someone's face," said Sell. "Since people who are judged to be stronger tend to get their way more often, other things being equal, the researchers concluded that the explanation for evolution of the form of the human anger face is surprisingly simple - it is a threat display."

These threat displays - like those of other animals - consist of exaggerations of cues of fighting ability, Sell continued. "So a man will puff up his chest, stand tall and morph his face to make himself appear stronger.

"The function of the anger face is intimidation," added Cosmides, "just like a frog will puff itself up or a baboon will display its canines."

As Tooby explained, "This makes sense of why evolution selected this particular facial display to co-occur with the onset of anger. Anger is triggered by the refusal to accept the situation, and the face immediately organizes itself to advertise to the other party the costs of not making the situation more acceptable. What is most pleasing about these results is that no feature of the anger face appears to be arbitrary; they all deliver the same message." According to Sell, the researchers know this to be true because each of the seven components has the same effect. "In the final analysis, you can think of the anger face as a constellation of features, each of which makes you appear physically more formidable."

http://www.eurekalert.org/pub_releases/2014-08/afot-amw082814.php

Ancient metal workers were not slaves but highly regarded craftsmen

Iron Age copper smelters were respected leaders with sophisticated skills, say Tel Aviv University archaeologists

In 1934, American archaeologist Nelson Glueck named one of the largest known copper production sites of the Levant "Slaves' Hill." This hilltop station, located deep in Israel's Arava Valley, seemed to bear all the marks of an Iron Age slave camp – fiery furnaces, harsh desert conditions, and a massive barrier preventing escape. New evidence uncovered by Tel Aviv University archaeologists, however, overturns this entire narrative.

In the course of ongoing excavations at Timna Valley, Dr. Erez Ben-Yosef and Dr. Lidar Sapir-Hen of TAU's Department of Archaeology and Near Eastern Cultures analyzed remnants of food eaten by copper smelters 3,000 years ago. The result of this analysis, published in the journal Antiquity, indicates that the laborers operating the furnaces were in fact skilled craftsmen who enjoyed high social status and adulation.

They believe their discovery may have ramifications for similar sites across the region. "What we found represents a general trend or reality related to metal workers in antiquity," said Dr. Ben-Yosef. "They had a very unique role in society, and we can demonstrate this by looking at Timna."

Examining ancient leftovers

The rare arid conditions of Timna have resulted in unparalleled preservation of organic materials usually destroyed by the march of time: bones, seeds, fruits, and even fabric dating back to the 10th century B.C.E. Using a technique called "wet sieving," the archaeologists found miniscule animal and fish bones, evidence of a rich and diverse diet.

"The copper smelters were given the better cuts of meat – the meatiest parts of the animals," said Dr. Sapir-Hen. "Someone took great care to give the people working in the furnaces the best of everything. They also enjoyed fish, which must have been brought from the Mediterranean hundreds of kilometers away. This was not the diet of slaves but of highly-regarded, maybe even worshipped, craftsmen."

Copper, used at the time to produce tools and weapons, was the most valuable resource in ancient societies. According to Dr. Ben-Yosef, the smelters needed to be well-versed in the sophisticated technology required to turn stone into usable copper. This knowledge was so advanced for the time it may have been considered magical or supernatural.

"Like oil today, copper was a source of great power," said Dr. Ben-Yosef. "If a person had the exceptional knowledge to 'create copper,' it is not surprising he would have been treated well. In comparing our findings to current ethnographic accounts from Africa, we see smelters worshipped and even honored with animal sacrifices."

Copper production is a complex operation requiring many levels of expertise. Ancient mine workers at Timna may have indeed been slaves or prisoners, because theirs was a simple task performed under severe conditions. However, the act of smelting, turning stone into metal, required an enormous amount of skill and leadership. The smelter had to build a furnace out of clay in precise dimensions, provide the right amount of oxygen and charcoal, maintain a 1,200 degree (Celsius) heat, connect bellow pipes, blow a fixed amount of air, and add an exact mixture of minerals. All told, the smelter had to manage some 30-40 variables in order to produce the coveted copper ingots.

Reconstructing social diversity

According to Dr. Sapir-Hen, an expert on early complex societies, the food remains reflect the social stratification of different laborers at the site. "By studying the remains of domesticated food animals, we reveal differential access to meat that may indicate different levels of specialization among workers at the same site. This allowed us to reconstruct social diversity at the site," said Dr. Sapir-Hen.

The remains of the wall found at the Timna site, once considered a barrier used to contain slave laborers, apparently played a different role as well. "We now know it was a wall used to defend the sophisticated technology and its most precious product – the ingot, the result of the complex copper smelting process," said Dr. Ben-Yosef. The research on the ancient societies of Timna continues as part of the Central Timna Valley (CTV) Project of Tel Aviv University.

http://www.eurekalert.org/pub_releases/2014-08/tl-tlr082814.php

The Lancet: Respiratory infection controls being used for ebola patients are unnecessary and may contribute to public panic

Infection control measures are unnecessary and may heighten panic and fear among the public

Respiratory infection control measures – which have been adopted by most health agencies to deal with the Ebola epidemic in west Africa – are unnecessary, and may heighten panic and fear among the public, according to the authors of a new letter, published in The Lancet, and written by Professor Jose M. Martin-Moreno from the University of Valencia in Spain, and colleagues.

Ebola virus is primarily transmitted through contact with infected patients' blood, vomit, faeces and other secretions, both direct and indirect, from contaminated needles and other materials. This usually occurs via close family contact or in healthcare settings, and the virus is rarely transmissible via airborne routes. However, according to the authors, "Although these routes of transmission are well known, most agencies, including governmental agencies responsible for repatriating western patients, apply infection control measures appropriate for airborne diseases."

"Excessive precautions could offer reassurance to those responding to Ebola, yet complete respiratory protection is expensive, uncomfortable, and unaffordable for countries that are the most affected. Worse, such an approach suggests that the only defence is individual protective equipment, which is inaccessible to the general population. Moreover, the image of workers with spectacular protective clothing might contribute to the panic in some communities. If this leads people to flee affected areas it could increase the spread of infection. It also reinforces the view that some lives are more valuable than others, already engendered by decisions about the use of experimental Ebola drug ZMapp."

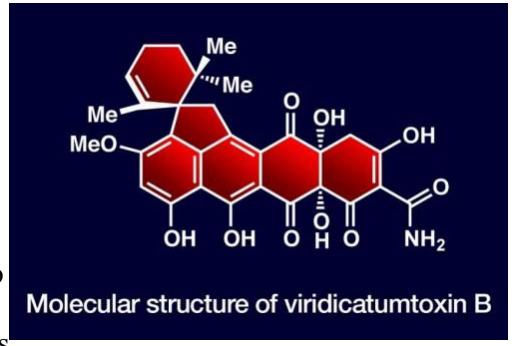
The letters concludes, "In western Africa now there is a need for rational and efficient use of protective equipment. This can only be achieved by communicating a consistent message that the disease is essentially transmitted through direct contact. In control of infectious diseases, more is not necessarily better and, very often, the simplest answer is the best."

http://bit.ly/1qdtRD2

Synthesis produces new antibiotic: Scientists confirm potent synthesis of natural tetracycline

A fortuitous collaboration at Rice University has led to the total synthesis of a recently discovered natural antibiotic.

The laboratory recreation of a fungus-derived antibiotic, viridicatumtoxin B, may someday help bolster the fight against bacteria that evolve resistance to treatments in hospitals and clinics around the world. As part of the process, Rice organic chemist K.C. Nicolaou and structural biologist Yousif Shamoo and their colleagues created and tested a number of variants of viridicatumtoxin B that could lead to the simplified synthesis of a new generation of more effective antibiotics.



Molecular structure of viridicatumtoxin B

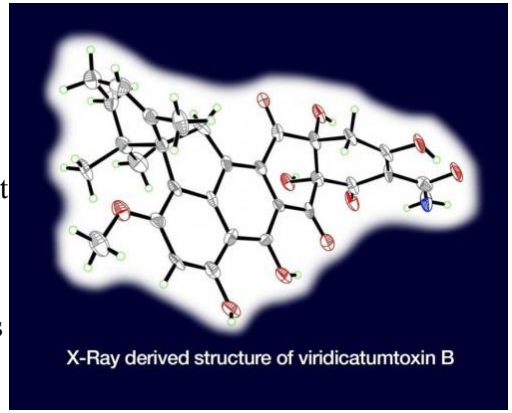
The molecular structure of viridicatumtoxin B, which has been synthesized and tested by scientists at Rice University. The natural antibiotic and its synthetic variants have potential to help wage the fight against resistant superbugs. **Credit: Nicolaou Group/Rice University**

The work reported this month in the *Journal of the American Chemical Society* (*JACS*) focused on a tetracycline discovered in 2008 by scientists who isolated small amounts from penicillium fungi. The yield wasn't nearly enough for extensive testing, but it provided a basis for the discoverers to analyze its structure through magnetic resonance imaging, Nicolaou said. "We're inspired by molecules that are biologically active and have the potential to become medicines one day," he said.

The new discovery belongs to a class of antibiotics known as tetracyclines for their distinctive molecular structure. They proved potent in initial tests on Gram-positive bacteria, so named for a staining technique to mark bacteria that are more susceptible to antibiotics than their Gram-negative counterparts.

The first tetracyclines, discovered in the late 1940s, ushered in a new class of powerful antibacterial agents to treat high-mortality diseases, among them anthrax and plague as well as such bacterial infections as chlamydia, syphilis and Lyme disease.

To find new weapons, especially against "superbugs" that resist nearly all antibiotics, synthetic chemists pursue the complex process of mimicking the structures of effective natural molecules as they build drug candidates atom by atom.



The Rice University lab of synthetic chemist K.C. Nicolaou determined the structure of viridicatumtoxin B, a natural antibiotic, on the way to total synthesis of the compound.
Credit: Nicolaou Group/Rice University

"Tetracyclines are widespread antibiotics today, but bacteria are building resistance to a lot of them," Nicolaou said. "This new tetracycline is not plentiful in nature, so the only way we can make it available to study by biologists for its potential in medicine is to synthesize it in the laboratory."

Three years of effort led the chemists working at Rice's BioScience Research Collaborative to find a structure that not only matches that of natural viridicatumtoxin B, but also allows the possibility of synthetic variants that could match or surpass its antibiotic potency. Nicolaou, who is best known for synthesizing the widely used anticancer drug taxol and the chemotherapy agent calicheamicin, said the complicated new molecule offered a challenge he couldn't resist. "The structure (the discoverers) assigned to this molecule was suspicious to us. We didn't actually believe that it was correct," he said.

"Given this, we initiated a research program to synthesize this compound for three purposes," he said. "One was to develop new synthetic chemistry, which is always the case in these kinds of endeavors. Two was to synthesize the molecule itself and confirm its structure. Three was to use the technology we've developed to make analogs of it in the hope that we could find something simpler and yet better in terms of its biological and pharmacological properties." Nicolaou's team met all of those goals and did indeed revise the structure of the molecule. The lab turned synthetic samples over to biologist Shamoo and his group for testing against a number of bacterial strains and comparison with natural viridicatumtoxin B.

"This was very exciting for us," said Nicolaou, who moved his lab from the Scripps Research Institute and the University of California at San Diego last year to form these kinds of collaborations. "In order to investigate the biological properties of our synthesized compounds, we turned to the Shamoo laboratory for its expertise in the area of antibiotics and drug-resistant bacteria."

The biologists reported that the synthetic version performed as well as the natural, and analogs lacking a hydroxyl group were even more effective against the same Gram-positive bacteria. The results also suggested the possibility of making variants by modifying certain domains of the molecule to improve its overall pharmacological properties.

"The most important finding was that simpler variations that are easier to make are showing equal if not better activity than the natural substance," Nicolaou said.

"My lab was really excited about working with K.C.'s group," Shamoo said. "Our expertise in antibiotic resistance and his synthesis of viridicatumtoxin B and analogs were a perfect opportunity for us to work together on an important problem."

Nicolaou acknowledged it could be years – even decades – before an antibiotic derived from viridicatumtoxin B is available to patients. But, he said, careful research from the start pays dividends in the long term, and the tools developed through the process should prove valuable in the synthesis of other fungal tetracyclines.

"Even though you find something that looks good, you shouldn't take the first substance from the shelf and run to develop it into a drug," he said. "We have to worry about solubility, biodegradation, availability and so many different things before we can get on the path of clinical development, because that part of the process is very expensive. We want to be sure at the research stage that we're doing everything we can to ensure the success of our chosen drug candidate."

The subject is very much on his mind these days. In this month's print edition of the journal *Angewandte Chemie*, Nicolaou laid out strategies for drug development to make what he called "one of the most challenging and difficult human endeavors" more efficient. "It's said that for a drug to be discovered, a chemist has to make 10,000 compounds on average," he said. "It also means that it takes 12 to 15 years to develop a drug from the beginning to the end, and costs between $1.5 billion to $2 billion.

"Often, these things are not predictable, so experimentation is usually the final proof of what we're trying to do. That's what makes our collaborations at Rice so welcome and fruitful. The interface between chemistry and biology is the key to success in discovering drugs."

More information: Journal of the American Chemical Society, pubs.acs.org/doi/abs/10.1021/ja506472u

http://www.eurekalert.org/pub_releases/2014-08/uoc-nds082814.php

New DNA study unravels the settlement history of the New World Arctic

We know people have lived in the New World Arctic for about 5,000 years.

Prehistoric migrations

Archaeological evidence clearly shows that a variety of cultures survived the harsh climate in Alaska, Canada and Greenland for thousands of years. Despite this, there are several unanswered questions about these people: Where did they come from? Did they come in several waves? When did they arrive? Who are their descendants? And who can call themselves the indigenous peoples of the Arctic?

We can now answer some of these questions, thanks to a comprehensive DNA study of current and former inhabitants of Greenland, Arctic Canada, Alaska, the Aleutian Islands and Siberia, conducted by an international team headed by the Centre for GeoGenetics at the Natural History Museum of Denmark, University of Copenhagen. The results have just been published in the leading scientific journal Science.

Looking for ancient human remains in northern Greenland.

The North American Arctic was one of the last major regions to be settled by modern humans. This happened when people crossed the Bering Strait from Siberia and wandered into a new world. While the area has long been well researched by archaeologists, little is known of its genetic prehistory. In this study, researchers show that the Paleo-Eskimo, who lived in the Arctic from about 5,000 years ago until about 700 years ago, represented a distinct wave of migration, separate from both Native Americans – who crossed the Bering Strait much earlier – and the Inuit, who came from Siberia to the Arctic several thousand years after the Paleo-Eskimos.

- Our genetic studies show that, in reality, the Paleo-Eskimos – representing one single group – were the first people in the Arctic, and they survived without outside contact for over 4,000 years, says Lundbeck Foundation Professor Eske Willerslev from Centre for GeoGenetics at the Natural History Museum, University of Copenhagen, who headed the study.

- Our study also shows that the Paleo-Eskimos, after surviving in near-isolation in the harsh Arctic environment for more than 4,000 years, disappeared around 700 years ago – about the same time when the ancestors of modern-day Inuit spread eastward from Alaska, adds Dr. Maanasa Raghavan of Centre for GeoGenetics and lead author of the article.

Migration pulses into the Americas

In the archaeological literature, distinctions are drawn between the different cultural units in the Arctic in the period up to the rise of the Thule culture, which replaced all previous Arctic cultures and is the source of today's Inuit in Alaska, Canada and Greenland. The earlier cultures included the Saqqaq or Pre-Dorset and Dorset, comprising the Paleo-Eskimo tradition, with the Dorset being further divided into three phases.

Greenlandic Inuit from the 1930s pictured in their traditional boats (umiaq), used for hunting and transportation.

All of these had distinctive cultural, lifestyle and subsistence traits as seen in the archaeological record. There were also several periods during which the Arctic was devoid of human settlement. These facts have further raised questions regarding the possibility of several waves of migration from Siberia to Alaska, or perhaps Native Americans migrating north during the first 4,000 years of the Arctic being inhabited.

- Our study shows that, genetically, all of the different Paleo-Eskimo cultures belonged to the same group of people. On the other hand, they are not closely related to the Thule culture, and we see no indication of assimilation between the two groups. We have also ascertained that the Paleo-Eskimos were not descendants of the Native Americans. The genetics reveals that there must have been at least three separate pulses of migration from Siberia into the Americas and the Arctic. First came the ancestors of today's Native Americans, then came the Paleo-Eskimos, and finally the ancestors of today's Inuit, says Eske Willerslev.

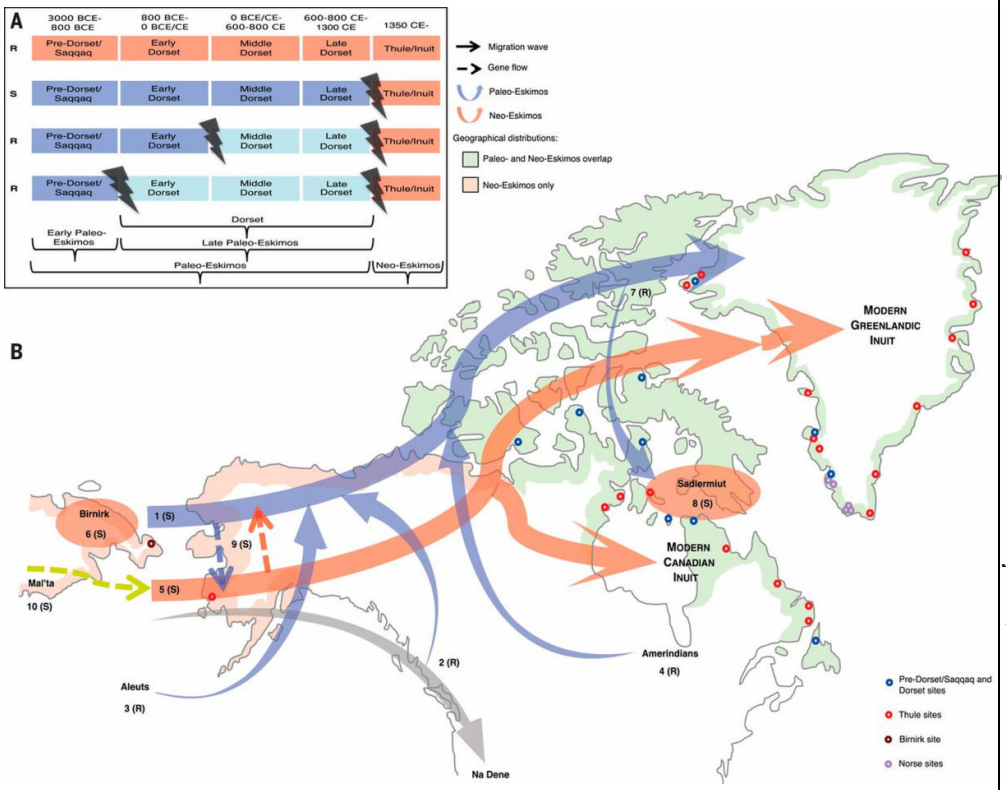
Genetics and archaeology

The genetic study underpins some archaeological findings, but not all of them. It rejects the speculation that the Paleo-Eskimos represented several different peoples, including Native Americans, or that they are direct ancestors of today's Inuit. Also rejected are the theories that the Greenlanders on the east coast or the Canadian Sadlermiut, from Southampton Island in Hudson Bay, who died out as late as 1902–03, were surviving groups of Dorset people. Genetics shows that these groups were Inuit who had developed Dorset-like cultural traits.

The study clearly shows that the diversity of tools and ways of life over time, which in archaeology is often interpreted as a result of migration, does not in fact necessarily reflect influx of new people. The Paleo-Eskimos lived in near-

isolation for more than 4,000 years, and during this time their culture developed in such diverse ways that it has led some to interpret them as different peoples.

Fig. 2 *Origins and continuity of Paleo-Eskimos and Neo-Eskimos. Support from genetic results presented in this study is indicated by "(S)" and rejection by "(R)". (A) A two-wave migration model into the New World Arctic, with continuity*



*throughout the Paleo-Eskimo tradition, followed by the Neo-Eskimo migration, is supported. Black thunderbolt symbols represent genetic discontinuity. (**B**) This schematic summarizes the origins of Paleo- and Neo-Eskimos in the archaeological and genetic literature, including the present study, and their relationships with other ancient populations in the North American Arctic. See main text for details on the different scenarios represented by numbers 1 to 10 in the figure. For reference, we show the maximal geographical distribution of the Paleo-Eskimos and Neo-Eskimos in the New World Arctic and far-east Siberia (9). Additionally, plotted are Paleo-Eskimo (Pre-Dorset, Saqqaq, Dorset), Thule, Birnirk, and Norse sites from which samples in this study derive; for further information, see fig. S1 and table S1.*

- Essentially, we have two consecutive waves of genetically distinct groups entering the New World Arctic and giving rise to three discrete cultural units. Through this study, we are able to address the question of cultural versus genetic continuity in one of the most challenging environments that modern humans have successfully settled, and present a comprehensive picture of how the Arctic was peopled, says Dr. Raghavan.

The first inhabitants

The study was unable to establish why the disappearance of the Paleo-Eskimos coincided with the ancestors of the Inuit beginning to colonise the Arctic. There is no doubt that the Inuit ancestors – who crossed the Bering Strait about 1,000 years ago and reached Greenland around 700 years ago – were technologically superior. The Inuit's own myths tell stories of a people before them, which in all likelihood refer to the Paleo-Eskimos. In the myths, they are referred to as the 'Tunit' or 'Sivullirmiut', which means "the first inhabitants". According to these myths they were giants, who were taller and stronger than the Inuit, but easily frightened from their settlements by the newcomers.

Co-author Dr. William Fitzhugh from the Arctic Studies Centre at the Smithsonian Institution says:

- Ever since the discovery of a Paleo-Eskimo culture in the North American Arctic in 1925, archaeologists have been mystified by their relationship with the Thule culture ancestors of the modern Inuit. Paleo-Eskimo culture was replaced rapidly around AD 1300-1400, their only traces being references to 'Tunit' in Inuit mythology and adoption of some elements of Dorset technology. This new genomic research settles outstanding issues in Arctic archaeology that have been debated for nearly a century, finding that Paleo-Eskimo and Neo-Eskimo people were genetically distinct, with separate origins in Eastern Siberia, and the Paleo-Eskimo remained isolated in the Eastern Arctic for thousands of years with no significant mixing with each other or with American Indians, Norse, or other Europeans.

http://www.eurekalert.org/pub_releases/2014-08/uotm-ler082914.php

Leading Ebola researcher at UTMB says there's an effective treatment for Ebola

Blend of three monoclonal antibodies can completely protect monkeys against a lethal dose of Ebola virus up to 5 days after infection

A leading U.S. Ebola researcher from the University of Texas Medical Branch at Galveston has gone on record stating that a blend of three monoclonal antibodies can completely protect monkeys against a lethal dose of Ebola virus up to 5 days after infection, at a time when the disease is severe. Thomas Geisbert, professor of microbiology and immunology, has written an editorial for Nature discussing advances in Ebola treatment research. The filoviruses known as Ebola virus and Marburg virus are among the most deadly of pathogens, with fatality rates of up to 90 percent.

Since the discovery of Ebola in 1976, researchers have been actively working on treatments to combat infection. Studies over the past decade have uncovered three treatments that offer partial protection for monkeys against Ebola when given within an hour of virus exposure. One of these treatments, a VSV-based vaccine was used in 2009 to treat a laboratory worker in Germany shortly after she was accidentally stuck with a needle possibly contaminated by an Ebola-infected animal.

Further advances have been made that can completely protect monkeys against Ebola using small 'interfering' RNAs and various combinations of antibodies. But these treatments need to be given within two days of Ebola exposure.

"So although these approaches are highly important and can be used to treat known exposures, the need for treatments that can protect at later times after infection was paramount," said Geisbert. Further research led to a cocktail of monoclonal antibodies that protected 43% of monkeys when given as late as five days after Ebola exposure, at a time when the clinical signs of the disease are showing.

The new study from Qui and colleagues at MAPP Biopharmaceutical Inc. used ZMAPP to treat monkeys given a lethal dose of Ebola. All of the animals survived and did not show any evidence of the virus in their systems 21 days after infection, even after receiving the treatment 5 days after infection. They also showed that ZMAPP inhibits replication of the Ebola virus in cell culture.

ZMAPP has been used to treat several patients on compassionate grounds. Of these, two US healthcare workers have recovered, although but whether ZMAPP had any effect is unknown, as 45% of patients in this outbreak survive without treatment. There were also two patients treated with ZMAPP who did not survive, but this may be because the treatment was started too late in the disease course.

"The diversity of strains and species of the Ebola and Marburg filoviruses is an obstacle for all candidate treatments," said Geisbert. "Treatments that may protect against one species of Ebola will probably not protect against a different species of the virus, and may not protect against a different strain within the species."

Although we certainly need treatments for filovirus infections, the most effective way to manage and control future outbreaks might be through vaccines, some of which have been designed to protect against multiple species and strains. During outbreaks, single-injection vaccines are needed to ensure rapid use and protection. At least five preventative vaccines have been reported to completely protect monkeys against Ebola and Marburg infection. But only the VSV-based vaccines have been shown to complete protect monkeys against Ebola after a single injection. "Antibody therapies and several other strategies should be included in the arsenal of interventions for controlling future Ebola outbreaks," said Geisbert.

"Although ZMAPP in particular has been administered for compassionate use, the next crucial step will be to formally assess its safety and effectiveness."

http://www.eurekalert.org/pub_releases/2014-08/uoaf-pcf082914.php

Preventing cancer from forming 'tentacles' stops dangerous spread

New research confirms role of key mechanism in metastasis and identified potential for therapy

EDMONTON, AB – A new study from the research group of Dr. John Lewis at the University of Alberta (Edmonton, AB) and the Lawson Health Research Institute (London, ON) has confirmed that "invadopodia" play a key role in the spread of cancer. The study, published in Cell Reports, shows preventing these tentacle-like structures from forming can stop the spread of cancer entirely.

Roughly 2 in 5 Canadians will develop cancer in their lifetime, and one in four of them will die of the disease. In 2014, it's estimated that nine Canadians will die of cancer every hour. Thanks to advances in medical research and care, cancer can often be treated with high success if detected early. However, after it spreads, cancer becomes much more difficult to treat.

To spread, or "metastasize," cancer cells must enter the blood stream or lymph system, travel through its channels, and then exit to another area or organ in the body. This final exit is the least understood part of the metastatic process.

Previous research has shown cancer cells are capable of producing "invadopodia," a type of extension that cells use to probe and change their environment. However, their significance in the escape of cancer cells from the bloodstream has been unclear.

In the study, the scientists injected fluorescent cancer cells into the bloodstream of test models, and then captured the fate of these cells using high-resolution time-lapse imaging. Results confirmed the cancer cells formed invadopodia to reach out of the bloodstream and into the tissue of the surrounding organs – they essentially formed "tentacles" that enabled the tumor cell to enter the organ.

However, through genetic modification or drug treatment, the scientists were able to block the factors needed for invadopodia to form. This effectively stopped all attempts for the cancer to spread. The study findings confirm invadopodia play a key role in the spread of cancer. Most importantly, they suggest an important new target for therapy. If a drug can be developed to prevent invadopodia from forming, it could potentially stop the spread of cancer.

"The spread of cancer works a lot like plane travel," says lead author Dr. Hon Leong, now a Scientist at Lawson Health Research Institute and Western University. "Just as a person boards an airplane and travels to their destination,

tumor cells enter the bloodstream and travel to distant organs like the liver, lungs, or brain. The hard part is getting past border control and airport security, or the vessels, when they arrive. We knew that cancer cells were somehow able to get past these barriers and spread into the organs. Now, for the first time, we know how."

"Metastasis is the deadliest aspect of cancer, responsible for some 90% of cancer deaths," says Dr. John Lewis, the Frank and Carla Sojonky Chair in Prostate Cancer Research at the University of Alberta. "These new insights give us both a new approach and a clinical window of opportunity to reduce or block the spread of cancer".

Funding for the study was provided by the Alberta Cancer Foundation, the Canadian Cancer Society, the Canadian Breast Cancer Foundation, the Natural Sciences and Engineering Research Council of Canada (NSERC), and Prostate Cancer Canada.

http://bit.ly/1peuibd

Use of 'language of deceit' betrays scientific fraud

Researchers say they can separate genuine research from the fictional with about 70 per cent accuracy

- 18:05 29 August 2014 by **Peter Aldhous**

Diederik Stapel, the infamous "lying Dutchman" who in 2011 admitted to inventing the data in dozens of psychology research papers, unwittingly signalled his deceit through the language he used. As well as inflating the certainty surrounding his results, Stapel included more science-related terms to describe his methods when writing up his fraudulent "findings" than when describing genuine results.

Researchers who have analysed Stapel's papers say they can separate his genuine research from the fictional with about 70 per cent accuracy. Now they are studying a larger sample of papers from many different scientific fraudsters, to see if the detection method works more generally.

Jeff Hancock's team at Cornell University in Ithaca, New York, has previously studied the language used by liars in situations including politics and online dating. When US presidents make false statements, for instance, they tend to use negative words such as "fear" or "doom" more frequently.

Leaking language

"Lying is a very stressful act," says David Markowitz, a member of the team. "This anxiety sometimes leaks through into people's language."

Context matters: when presidents lie on the subject of war, they use fewer personal pronouns like "I" and "me". But people who write deceitful online dating profiles actually use these pronouns more than those who tell the truth.

Markowitz and Hancock suspected that there may be specific linguistic tics that signal deceit in science. Stapel's outrageous fraud provided the ideal testing ground. "He produced a tremendous amount of writing," says Markowitz. "And the fact that he was investigated so closely provided us with a unique opportunity."

So the pair selected 24 of Stapel's papers now known to be fraudulent, and a further 25 that have withstood official scrutiny. They chose only papers of which Stapel was the first author listed – indicating that he actually wrote the paper.

Stapel, who worked at Tilburg University in the Netherlands, used more "amplifiers" – words like "profoundly" and "extreme" – in his fraudulent papers, and fewer "diminishers" – like "merely" and "somewhat".

"He tried to overvalue the fraudulent research," suggests Markowitz, who is now investigating whether this pattern holds true for other scientists who have been forced to retract fraudulent papers.

Screened by machine

If it does work more widely, it might be useful for policing the scientific literature. It couldn't provide firm evidence of fraud, but might help flag research labs turning out large numbers of suspicious papers, prompting closer investigation. Still, the current false-positive rate of about 30 per cent means that there would be many false leads.

"It's not really good enough as a screening tool," says Harold Garner of Virginia Tech in Blacksburg, who has developed software to screen published papers for examples of plagiarism.

However, Markowitz hopes that it will be possible to improve accuracy by employing machine learning – using examples of fraudulent and genuine scientific papers to train algorithms to detect subtle differences in the way that they are written.

Journal reference: PLoS ONE, DOI: 10.1371/journal.pone.0105937

http://bit.ly/1lnaSFP

Walking fish reveal how our ancestors evolved onto land

A living fish could help show what might have happened when fish first attempted to walk out of the water

About 400 million years ago a group of fish began exploring land and evolved into tetrapods – today's amphibians, reptiles, birds, and mammals. But just how these ancient fish used their fishy bodies and fins in a terrestrial environment and what evolutionary processes were at play remain scientific mysteries.

Researchers at McGill University published in the journal Nature, turned to a living fish, called Polypterus, to help show what might have happened when fish first attempted to walk out of the water.

Polypterus is an African fish that can breathe air, 'walk' on land, and looks much like those ancient fishes that evolved into tetrapods. The team of researchers raised juvenile Polypterus on land for nearly a year, with an aim to revealing how these 'terrestrialized' fish looked and moved differently.

"Stressful environmental conditions can often reveal otherwise cryptic anatomical and behavioural variation, a form of developmental plasticity", says Emily Standen, a former McGill post-doctoral student who led the project, now at the University of Ottawa. "We wanted to use this mechanism to see what new anatomies and behaviours we could trigger in these fish and see if they match what we know of the fossil record."

Polypterus Senegalus

Remarkable anatomical changes

The fish showed significant anatomical and behavioural changes. The terrestrialized fish walked more effectively by placing their fins closer to their bodies, lifted their heads higher, and kept their fins from slipping as much as fish that were raised in water.

"Anatomically, their pectoral skeleton changed to became more elongate with stronger attachments across their chest, possibly to increase support during walking, and a reduced contact with the skull to potentially allow greater head/neck motion," says Trina Du, a McGill Ph.D. student and study collaborator.

"Because many of the anatomical changes mirror the fossil record, we can hypothesize that the behavioural changes we see also reflect what may have occurred when fossil fish first walked with their fins on land", says Hans Larsson, Canada Research Chair in Macroevolution at McGill and an Associate Professor at the Redpath Museum.

Unique experiment

The terrestrialized Polypterus experiment is unique and provides new ideas for how fossil fishes may have used their fins in a terrestrial environment and what evolutionary processes were at play.

Larsson adds, "This is the first example we know of that demonstrates developmental plasticity may have facilitated a large-scale evolutionary transition, by first accessing new anatomies and behaviours that could later be genetically fixed by natural selection".

http://www.eurekalert.org/pub_releases/2014-08/esoc-wop082614.php

Wine only protects against CVD in people who exercise

Wine only protects against cardiovascular disease (CVD) in people who exercise

Barcelona, Spain - Wine only protects against cardiovascular disease (CVD) in people who exercise, according to results from the In Vino Veritas (IVV) study presented at ESC Congress today by Professor Milos Taborsky from the Czech Republic.

Professor Taborsky said: "This is the first randomised trial comparing the effects of red and white wine on markers of atherosclerosis (1) in people at mild to moderate risk of CVD. We found that moderate wine drinking was only protective in people who exercised. Red and white wine produced the same results."

Evidence suggesting that mild to moderate consumption of wine protects against cardiovascular disease has been accumulating since the early 1990s. In particular, retrospective studies have found that wine increases levels of HDL, the "good" cholesterol. But until now there has been no long-term, prospective, randomised study comparing the effects of red and white wine on HDL cholesterol and other markers of atherosclerosis.

The IVV study (2) is the first long-term, prospective randomised trial comparing the effect of red and white wine on markers of atherosclerosis. The study included 146 people with mild to moderate risk of cardiovascular disease according to the HeartScore (3). Participants were randomised to one year of moderate consumption of red wine (Pinot Noir) or white wine (Chardonnay-Pinot) from the same year and wine region of the Czech Republic. Moderate consumption was the World Health Organization definition of 0.2 L for women and 0.3 L for men, a maximum of five times a week. The primary endpoint was the level of HDL cholesterol at one year. Secondary endpoints were levels of other markers of atherosclerosis including LDL cholesterol. Participants consumed their usual diet. Participants kept a logbook on their consumption of wine and other alcoholic beverages, medication use, and amount and type of exercise. They were required to return the corks from the wine bottles to confirm that they had drank the wine rather than sold it. The researchers found that there was no difference between HDL cholesterol levels at the beginning of the study compared to one year in either the red or white wine groups. LDL cholesterol was lower in both groups at one year while total cholesterol was lower only in the red wine group.

Professor Taborsky said: "A rise in HDL cholesterol is the main indication of a protective effect against CVD, therefore we can conclude that neither red or white wine had any impact on study participants as a whole."

He added: "The only positive and continuous result was in the subgroup of patients who took more exercise, which means regular exercise at least twice a

week, plus the wine consumption. In this group HDL cholesterol increased and LDL and total cholesterol decreased in the
red and white wine groups. There may be some synergy between the low dose of ethyl alcohol in wine and exercise which is protective against CVD."
He continued: "In a future study we will compare the effects of red and white wine on markers of atherosclerosis in patients at high risk for CVD who take statins and do regular exercise. We hope to find that moderate wine consumption is safe in these patients."
Professor Taborsky concluded: "Our current study shows that the combination of moderate wine drinking plus regular exercise improves markers of atherosclerosis, suggesting that this combination is protective against cardiovascular disease."

(1) Atherosclerosis is a condition in which the arteries become clogged with fatty substances including cholesterol. Atherosclerosis is a major risk factor for cardiovascular disease.

(2) Taborsky M, Ostadal P, Petrek M. A pilot randomized trial comparing long-term effects of red and white wines on biomarkers of atherosclerosis (in vino veritas: IVV trial). Bratisl Lek Listy. 2012;113(3):156-158. (full paper available in the press kit)

http://phys.org/news/2014-08-fujifilm-ebola-japan-giants-medicine.html

Fujifilm vs Ebola: Japan giants turn hands to medicine

When Japan announced it was ready to supply a new drug to help combat the deadly Ebola virus, one unusual detail emerged - it would be made by Fujifilm.

The company synonymous with cameras and photobooths said it could start producing Avigan, which has been approved in Japan to treat the flu but which scientists think also could crimp the vicious illness.
Fujifilm's expansion from pictures to pills through its healthcare subsidiary, Toyama Chemical, is a business move being echoed by other giants of Japanese manufacturing, including Sony, Panasonic and Toshiba. Fierce competition from lower-cost rivals, a shrinking domestic market and products that no longer immediately dominate the world is nudging them into new spheres.
"We are currently developing our medical activity to create a comprehensive service that covers everything, from diagnostic prevention to treatment," said Shigetaka Komori, CEO of Fujifilm, in a presentation on the firm's website.
It's not all about fighting disease, however - Fujifilm also makes anti-ageing face creams under the brand Astalift, which is found alongside traditional names in the business. "We are adding a variety of medicines, dietary supplements and cosmetics to the radiography film and equipment and mammography apparatus already in our collection," said Komori.
Fellow high-tech titan Sony has also leveraged its expertise to meet demand in medical science, incorporating technology usually found in Blu-Ray disk readers into the design of a new cell analysis device used in cancer and stemcell research.
The switch in focus is part of an effort by company president, Kazuo Hirai, to "make medicine a central part of the group's development" as he looks to stem losses that have left Sony in the red for five of the last six years.
Rival Panasonic, whose profits are making a wobbly recovery from combined losses topping $15 billion in the previous two fiscal years, has also tried its hand at medical machinery. One of its brainchildren is a robot named "HOSPI" which transports medicine from one place to another at a hospital in Osaka.
Meanwhile, Toshiba has gone one step further by opening its own hospital in central Tokyo that is kitted out almost entirely with its own-brand machinery and equipment.

Cigarettes and alcohol

Japan's rapidly ageing population makes the sector a smart bet for companies in search of growth, said Hiroshi Nakamura, a professor at Keio Business School in Tokyo. "The pharmaceutical industry in Japan is one of the few industries in which its domestic market is expected to expand for years, despite the declining population in Japan," he said.
Barriers to entry that might stymie other players - such as technology and regulation - can often work in favour of electronics companies, which are accustomed to doing rigorous research, said Nakamura. And the fact that many of their original product lines are in trouble adds a certain sense of urgency.
"Fujifilm is one of the few companies which has managed to enter the market, thanks to, for example, technologies developed under its film business, a strong sense of crisis (because there is) no hope for the film business, and a clear policy for differentiation against the existing big pharmaceutical companies," he said.
But it is not only electronics companies who have decided to dabble in the medical market. The sector has also attracted companies more usually associated with products that are frowned upon by doctors. Beer maker Kirin produces a range of medicine used to treat cancer, kidney disease and high blood pressure through a sister company.
And while Japan Tobacco churns out millions of packets of Winston, Benson & Hedges and Camel cigarettes, it also runs a medical research laboratory, and is now marketing its own anti-HIV compounds and treatments for melanoma skin cancer. Although pharmaceutical pursuits only account for 2.7 percent of Japan Tobacco's revenue, it is keen to derive further healthy profits from its medical side-project.
"We strive to strengthen the profit base through value maximisation of each product and research and development promotion for the next generation of strategic compounds," Japan Tobacco's Associate General Manager Dmitry Krivtsov told AFP.

http://www.eurekalert.org/pub_releases/2014-08/ru-drh082714.php

Discovery reveals how bacteria distinguish harmful vs. helpful viruses

One variety of a bacterial immune system can distinguish viral foe from friend

When they are not busy attacking us, germs go after each other. But when viruses invade bacteria, it doesn't always spell disaster for the infected microbes: Sometimes viruses actually carry helpful genes that a bacterium can harness to, say, expand its diet or better attack its own hosts.

Scientists have assumed the bacterial version of an immune system would robotically destroy anything it recognized as invading viral genes.

However, new experiments at Rockefeller University have now revealed that one variety of the bacterial immune system known as the CRISPR-Cas system can distinguish viral foe from friend. And, the researchers report in a paper published August 31 in Nature, it does so by watching for one particular cue.

"Transcription — an initial step in the process that reads genes, including those of viruses — makes the difference," says researcher Luciano Marraffini, head of the Laboratory of Bacteriology. "The full genome of viruses in their lytic, or destructive phase, is transcribed. Meanwhile, a few of the genes from a virus are transcribed during its lysogenic, or dormant phase."

Viruses in their lytic phase make copies of themselves using a cell's machinery before destroying it to liberate these new viruses. Viruses in their lysogenic phase, meanwhile, quietly integrate into a host's genetic material.

And this is where they offer their potential benefit to the bacteria, which co-opt viral genes for their own ends. In fact, some disease-causing microbes, such as the bacterium responsible for diphtheria, must pick up the right virus in order to attack humans.

Scientists have only discovered this adaptive bacterial immune system relatively recently. Its function relies on CRISPRs, sections of DNA that contain repeating sequences interspersed with unique sequences called spacers. (CRISPR stands for clustered regularly interspaced short palindromic repeats.)

The spacer sequences match the sequences in the viral genetic code, making it possible for enzymes encoded by CRISPR-associated genes (Cas) to chop out single spacer sequences from the RNA transcribed from the CRISPR DNA. Other Cas enzymes then use these spacer sequences as guides to target invaders for destruction.

The system can adapt to new invaders by acquiring new spacer sequences to target them. Recently, CRISPR-Cas systems have attracted significant scientific attention because their ability to make precisely targeted cuts in DNA can be put to use to genetically engineer all types of cells.

"Our understanding of CRISPR-Cas systems remains in the early stages, but, so far, it has generally been thought they lack a sophisticated way of discriminating their targets. In other words, once they target something, it will be chopped up," says the study's lead author, graduate student Gregory Goldberg.

"For the first time, our work has shown that a CRISPR-Cas system, one found in Staphylococcus bacteria, can detect whether or not a virus is in its destructive phase and poses an immediate threat."

Most previous work has focused on lytic viruses. However, Staphylococci host many viruses capable of entering a lysogenic phase.

The researchers also uncovered a telling asymmetry in the Staphylococcal CRISPR system's ability to effectively target a sequence and its counterpart on two strands of complimentary DNA. They suspected this discrepancy arose because transcription proceeds in a single direction for most viral genes, meaning one of the two target strands is not transcribed.

"The big clue showed up when we isolated a mutant virus that managed to evade destruction. Sometimes viruses can do this through a mutation in a target sequence that prevents the system from identifying them. But when we sequenced the genome of this phage, we found a mutation in a region that promotes transcription instead," Goldberg says.

In a series of experiments, he and colleagues tested their hypothesis that the Staphylococcal CRISPR-Cas system, known as Type III-A, can tolerate an infection by a lysogenic virus, so long as the target sequences are not transcribed. They engineered a target sequence that would undergo transcription only in the presence of a specific chemical. As a result, the Type III-A CRISPR-Cas system only destroyed the target in the presence of this chemical.

"This discovery of a transcription requirement is likely to surprise many who work with these systems," Marraffini says.

"Although we do not yet understand the mechanism behind it, we can say that the Type -III-A system is quite different from other CRISPR-Cas systems, of which there is a mysteriously large variety. Our discovery hints at the possibility that each CRISPR type and subtype recognizes and destroys its targets in different ways, each in tune with a particular bacterium's needs. If these different targeting mechanisms do exist, they could have important implications for biotechnology."

http://www.bbc.com/news/science-environment-28970855

Wada brings in ban on xenon and argon, but has no test

Doping experts have yet to find an effective test for athletes using xenon and argon, despite introducing a ban on the gases' use by sports stars.

Matt McGrath By Matt McGrath Environment correspondent, BBC News

The new ban has been ordered by the World Anti-Doping Agency (Wada), which runs drug testing across many sports. It follows concerns that athletes were breathing these so-called noble gases to encourage the growth of red blood cells that boost stamina. But despite being piloted, a valid test is not yet ready, the agency says.

Ignoble prize

The idea of doping with gases more usually associated with arc welding, neon light bulbs and anaesthesia may seem bizarre, but Wada believes there is enough evidence of their enhancement potential to ban them.

Media reports earlier this year indicated that athletes in Russia have been using the gases for years as a means of boosting their stamina ahead of international competitions. Indeed the company that developed techniques to help athletes prepare using xenon, has a "badge of honour" on its website from the Russian Olympic Committee for "the organisation and conduct of inhalation remediation".

Earlier this year Wada's executive committee decided to ban these two named gases by adding them to the prohibited list from this month. "We had serious information that xenon was being used," Wada's science director Dr Olivier Rabin told BBC News. "We believe it has been used in the preparation for some major events."

Now that xenon and argon are banned, the agency needs to have an effective test for the gases. Developing one is not an easy task. As well as being present in the air we all breathe, albeit in minute quantities, xenon is also used in many countries as an anaesthetic.

Dr Rabin says that Wada scientists are close to developing a direct test for the gas.

"We had some preliminary pilot results that do indicate that detection is not too much of an issue but we just need to make it solid and robust in the anti-doping context and make sure that any result in the future will be accepted by a court."

Validating a test like this to the level that it can stand up in the Court of Arbitration for sport is not easy. When I asked Dr Rabin if the test would be in place by the end of the year, he was unable to give that reassurance.

"I cannot give you a specific date, we usually do not, what I can tell you is that the science is very solid and certainly we will do our best, now that the gases are on the prohibited lists to make sure there are detection methods available as soon as possible."

Other researchers though are not convinced that a reliable test will be quickly forthcoming'. They also question why Wada has banned the use of these gases but allows athletes to use oxygen tents or hypoxic chambers that mimic the effects of sleeping at altitude with the aim of producing a similar blood boosting effect as xenon.

"Their whole argument is based on false grounds," said Dr Ben Koh, a former athlete and an expert on sports medicine. "What is happening among elite athletes is a very artificial process, involving hypoxic chambers before competitions. This is artificial, and it is no different from the artificiality of xenon."

Secondary benefits

Wada says that there could be dangers to the health of the athletes if they use large amounts of xenon or argon and this another reason for the ban, as well as the performance enhancement.

Dr Koh rejects this argument.

"I would argue that xenon is actually safer than hypoxic tents, in terms of heart failure, trauma to the ear and to the lungs, the risks are very well documented from hypoxic tents, on the other hand, xenon gas from the published literature seems to be quite safe."

There is a possibility that Wada has information that xenon can have other sports enhancing effects in athletes that go beyond an increase in stamina.

"The concern would be that there's some secondary benefit not due to HIF1, and that seems to me entirely possible," said Dr Chris Cooper, from the University of Essex, who has researched the science of doping. "I'm surprised if the effect in these animal models is due to increased hematocrit, there is something else going on."

Wada say they have named xenon and argon for the sake of legal clarity.

How xenon gas may boost performance

Inhaling xenon, mixed with oxygen, is believed to improve stamina because it increases the body's production of a protein known as hypoxia inducible factor 1, or HIF1.

In turn this stimulates the production of natural erythropoietin (EPO) which regulates the number of red blood cells. The more of these cells, the more oxygen you can carry, and the greater your athletic stamina.

Doping with artificial EPO has been one of the biggest threats to the integrity of sport over the past 20 years. The clampdown on using the drug has seen sports scientists develop other methods including the use of xenon and argon.

Gas facts

Xenon and argon are called noble gases because they are inert and don't react with anything else

At less than 100 parts per billion, xenon is one of the rarest natural gas components in the atmosphere

Xenon has been used in flash bulbs, lamps and in medical imaging

In Russia, xenon has been used for decades as an anaesthetic because of its lack of side effects

I asked Dr Rabin what would happen if similar inert gases such as krypton, say, are shown to have a similar effect.
"Xenon and argon are only examples, it is not a closed list as we do have for narcotics - tomorrow any gas that has a HIF1 activation is de facto prohibited."
So no krypton-powered super athletes then?
"Absolutely not!"