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Invasive raccoon dogs harbour parasites that can infect people

Raccoon dogs harbour high levels of parasites that can infect people, some lethally

Pictures of a cute pet raccoon dog called Tanu went viral on Twitter last week. Meanwhile, its wild relatives have been "going viral" in a more destructive way among Europe's wildlife. And worryingly, they harbour high levels of parasites that can infect people, some lethally. Raccoon dogs (*Nyctereutes procyonoides)*, with their luxurious fur and pointy faces, resemble raccoons, but are in fact distant relatives of foxes in the canid family.

Mark Sisson/FLPA

These animals are native to East Asia. However, about 9,000 were released by Soviet biologists 80 years ago into western parts of the former Soviet Union to be hunted for their fur, says PA Åhlén of the Swedish Association for Hunting and Wildlife Management, who leads the effort to eradicate them in Sweden.

Raccoon dogs have since spread west as far as Germany and have been sighted in France and Italy. They move rapidly and reproduce prolifically. In Finland, a million cubs are born each year, says Åhlén.

And they pose a big threat to amphibian populations. There is now "not a single toad or frog in southernmost Finland", says Åhlén. Ground-nesting birds are also at risk.

Reservoir for infection

Now it seems that raccoon dogs may also be an overlooked wild reservoir for parasites that affect humans. The diseases they carry present a "considerable public health risk", say scientists led by Urmas Saarma at the University of Tartu in Estonia. Saarma's team found nine zoonotic parasites among the carcasses of 250 raccoon dogs they examined in Estonia, bringing the total number they have been found to harbour across Europe to 19.

In Estonia, the most common were the hookworm *Uncinaria stenocephala* and the flatworm *Alaria alata*. Of most concern, however, is that four carried the fox tapeworm *Echinococcus multilocularis*, which can be fatal if untreated in humans after a silent incubation period of up to 20 years. Estonia is the sixth country in Europe where this infection has been reported in raccoon dogs, says Saarma. He says however that the risk of them spreading it to humans is not very high because of the lack of direct contact.

But Heidi Enemark, a senior researcher at the Norwegian Veterinary Institute, says that hotspots have been found in Germany, where the animals have a much higher incidence of the tapeworm than in Estonia.

The fear is that an influx of raccoon dogs raises the general levels of the parasite in nature, says Åhlén, thus increasing the likelihood of humans catching it when picking fruit, taking their dogs out or hunting.

The raccoon dogs themselves seem to be trying to rid themselves of the parasites through self-medication. Saarma's team found that the more infected the animals they examined were, the more grass and other plant material they had ingested – which might have helped to dislodge the parasites.

Into the wild

Åhlén says that a fashion for owning raccoon dogs, fuelled by popular characters such as Tanu, will inevitably lead to more escapes into the wild. Facebook groups for owners of raccoon dogs in the UK number hundreds of members, says Åhlén.

In the UK, which is still believed to be free from wild raccoon dogs, the pet trade is considered the most likely route of entry. Indeed, an owner in Cornwall posted his raccoon dog as missing on a website for lost pets this week.

"There's a high risk that Great Britain already has an emerging population," says Åhlén. "And that, I can promise you, will not be good for its amphibian life."

Enemark agrees. "In an island country like the UK, you should do anything within your power to keep them out," he says.

Journal reference: *Veterinary Parasitology*, DOI: 10.1016/j.vetpar.2016.01.020

http://www.eurekalert.org/pub_releases/2016-02/wsu-its020816.php

Innate teaching skills 'part of human nature'

Take note, helicopter parents

VANCOUVER, Wash. - Some 40 years ago, Washington State University anthropologist Barry Hewlett noticed that when the Aka pygmies stopped to rest between hunts, parents would give their infants small axes, digging sticks and knives.

To parents living in the developed world, this could be seen as irresponsible. But in all the intervening years, Hewlett has never seen an infant cut him- or herself. He has, however, seen the exercise as part of the Aka way of teaching, an activity that most researchers - from anthropologists to psychologists to biologists - consider rare or non-existent in such small-scale cultures.

He has completed a small but novel study of the Aka, concluding that, "teaching is part of the human genome."

"It's part of our human nature," said Hewlett, a professor of anthropology at WSU Vancouver. "Obviously, teaching as it exists in formal education is way different than the way it exists in small-scale groups that I work with. The thing is, there does seem to be something going on there."

The Aka are among the last of the world's hunter-gatherers, but their way of life accounts for 99 percent of human history. That they teach, and how they teach, offers new insight into who we are as humans and how we might best learn.

Clearly, the Aka are not helicopter parents who would shudder at the thought of giving sharp objects to any children, let alone 1-year-olds. Rather, the Aka place a high value on individual autonomy, in addition to sharing and egalitarianism, so they're unlikely to intervene with one another's behavior.

"One does not coerce or tell others what to do, including children," Hewlett and co-author Casey Roulette write in Royal Society Open Science, an open-access journal by the world's oldest scientific publisher, The Royal Society of London.

After he saw the Aka teaching infants how to use various tools, he was told by social-cultural anthropologists that the activity was "just play." To their credit, said Hewlett, social-cultural anthropologists have recognized that teaching can be done outside a formal setting.

"The downside to that is they hadn't looked at teaching more broadly as part of human nature," he said.

But cognitive psychologists and evolutionary biologists suggested teaching is universal. Hewlett was particularly intrigued by the thinking of cognitive psychologists like Gyorgy Gergely of Central European University.

Gergely described an innate form of teaching called "natural pedagogy" in which a teacher directly demonstrates skills by, say, pointing, gazing or talking to a child. The learners in turn use the cues to imitate and learn about novel objects.

"It's important to remember that, cognitively, teaching occurs both in the teacher as well as in the child," said Hewlett. "The child needs to know that these particular cues mean something and the teacher knows how to use these particular cues to draw attention to knowledge that may not be clear to the learner. It's a co-evolution in the sense that it's happening both with the child and the so-called teacher."

Hewlett videotaped five male and five female 12- to 14-month-old infants for one hour each, usually in a naturalistic setting in or near their camp. He would have liked to videotape more but civil war in the Central African Republic made that impossible.

Later, Hewlett, Roulette and a person unfamiliar with the hypotheses coded the taped behavior of children and adults to identify moments when an adult modified his or her behavior to enhance learning, researchers' minimalist definition of teaching.

The researchers documented 169 discrete teaching events, like a caregiver demonstrating how to use a knife. Almost half lasted less than three seconds, with teachers giving positive and negative feedback, demonstrating activities, pointing, giving verbal instruction and "opportunity scaffolding"- providing an object like a digging stick and the chance to use it.

Hewlett said he was surprised to see how frequently the Aka teach their infants. More than 40 percent of the time, infants imitated skills to which they were exposed. On average, for less than four minutes average of teaching, they practiced skills for more than nine minutes.

The teaching interventions were brief and subtle, and Hewlett came to appreciate the value of letting the child learn as much as possible on his or her own.

"We know learning can be very rapid when it is self-motivated," he said. "When you take away the autonomy of the child, that impacts the self-motivation of the child."

The technique gives the child more choices and serves as an alternative to helicopter parents who hover over an infant and say, "go do this, go do that, you need to do this, you need to do that."

"This way steps backward in the other direction," he said, as in, "I need to provide advice here or there but I don't have all the right answers for my child."

http://www.eurekalert.org/pub_releases/2016-02/byu-wym020516.php

Why your muscles get less sore as you stick with your gym routine

BYU research shows unexpected immune system cells may help repair muscles

The first time back to the gym after a long break usually results in sore muscles. Fortunately, the return trip a few days later--if it happens--is generally less painful. Scientists have studied this reduced-soreness phenomenon for decades and even have a name for it--the repeated bout effect.

Despite all those years of research, they still can't figure out exactly why people feel less sore the second time around.

What they do know is the immune system plays some role in how the muscle repairs itself and protects against additional damage. But now exercise science researchers at BYU have produced evidence that shows for the first time the surprising presence of very specific immune workers: T-cells.

"You think of T-cells as responding to infections, not repairing muscles--but we found a significant accumulation of T-cells infiltrating damaged muscle fibers," said Robert Hyldahl, assistant professor of exercise science at BYU.

"Our study is the first to show T-cells present in human muscle in response to exercise-induced damage."

The research appears this month in Frontiers in Physiology and builds off past studies that implicate immune cells in muscle healing. One such study was a 2013 paper out of Harvard showing T-cells active in the skeletal muscles of mice (but not yet humans) after injury.

For the study, researchers, put 14 men and women through two vigorous rounds of exercise on an isokinetic dynamometer machine, 28 days apart. ("All of them got really sore," Hyldahl said.)

Before and after each bout of exercise, the team took muscle biopsies from the subjects and then used immunohistochemistry and microscopy to analyze the muscle tissue.

The BYU group found an expected increase in certain white blood cells after the second bout of exercise, but only identified the T-cells after it was suggested by Amanda Gier, one of two undergraduate coauthors on the paper, who was enrolled in an immunology course at the time.

"T-cells, up until recently, were not thought to enter healthy skeletal muscle," said lead author and grad student Michael Deyhle. "We hadn't planned on measuring them because there's no evidence that T-cells play a role in infiltrating damaged muscle tissue. It's very exciting."

The presence of the T-cells suggests that muscles become more effective at recruiting immune cells following a second bout of exercise and that these cells may facilitate accelerated repair.

In other words, the muscle seems to remember the damaging insult and reacts similarly to when the immune system responds to antigens--toxins, bacteria or viruses.

The group was also surprised to find inflammation actually increased after the second round of exercise. Hyldahl, his students and many physiologists have long thought inflammation goes down after the second bout of exercise, contributing to that "less sore" effect.

Instead, the slightly enhanced inflammatory response suggests inflammation itself probably does not worsen exercise-induced muscle damage.

"Many people think inflammation is a bad thing," Deyhle said. "But our data suggest when inflammation is properly regulated it is a normal and healthy process the body uses to heal itself."

Adds Hyldahl: "Some people take anti-inflammatory drugs such as Ibuprofen and Aspirin after a workout, but our study shows it may not actually be effective. The inflammation may not be directly causing the pain, since we see that muscle soreness is reduced concurrent with increases in inflammation."

http://www.eurekalert.org/pub_releases/2016-02/jhub-euo020416.php

Expanding use of vaccines could save up to $44 for every dollar spent, study suggests

Across 94 countries, benefits far exceed the costs, researchers find

Johns Hopkins University Bloomberg School of Public Health

Vaccinations, long recognized as an excellent investment that saves lives and prevents illness, could have significant economic value that far exceeds their original cost, a new study from researchers at the Johns Hopkins Bloomberg School of Public Health has found.

In what is believed to be among the first studies to examine the potential return on investment of vaccinations, the researchers assessed the economic benefits of vaccines in 94 low- and middle-income countries using projected vaccination rates from 2011 to 2020. When looking only at costs associated with illness, such as treatment costs and productivity losses, the return was $16 for every dollar spent on vaccines. In a separate analysis taking into account the broader economic impact of illness, vaccinations save $44 for every dollar spent.

The study will appear in the February issue of Health Affairs.

"Vaccines are an excellent investment," says lead author Sachiko Ozawa, PhD, MHS, an assistant scientist in the Department of International Health at the Bloomberg School. "But to reap the potential economic rewards, governments and donors must continue their investments in expanding access to vaccines."

Without vaccination, millions of children would die from preventable illnesses and diseases across the decade. While billions of dollars will be spent to try and vaccinate more children, the goal of full coverage -- that is, getting every child vaccinated -- has not yet been met.

To measure the potential investment returns, researchers used two approaches. The first, known as the "cost-of-illness" approach, measures averted treatment costs, transportation costs, lost caretaker wages and productivity losses. The second, known as the "full-income approach," estimates the broader economic and social benefits of vaccination and quantifies the value that people place on living longer and healthier lives. With both approaches, the costs of immunization programs were separately modeled to include supply chain, service delivery and vaccine costs.

Between 2011 and 2020, the estimated total cost of immunization programs in the 94 countries studied was $34 billion. Through these programs, an estimated $586 billion would be averted in cost of illness associated with vaccine-preventable diseases. Using the full-income approach, the benefit was estimated at $1.53 trillion dollars.

The study assessed 10 vaccine-preventable infections: Haemophilus influenzae type b, hepatitis B, human papillomavirus, Japanese encephalitis, measles, Neisseria meningitis serogroup A, rotavirus, rubella, Streptococcus pneumoniae and yellow fever.

"Our findings should encourage donors and governments to continue their financial investments in immunization programs. But we must keep in mind that these are estimates that assume immunization coverage continues to expand and improve," Ozawa says.

"Return On Investment From Childhood Immunization In Low- And Middle-Income Countries, 2011-2020" was written by Sachiko Ozawa, Samantha Clark, Allison Portnoy, Simrun Grewal, Logan Brenzel and Damian Walker.

This study was performed with financial support from the Bill & Melinda Gates Foundation (Contract No. 23120).

http://www.eurekalert.org/pub_releases/2016-02/uoo-tit020416.php

Timebomb in the testicles investigated by Oxford University researchers

Oxford researchers take a closer look at the paternal age effect that increases older fathers' chances of having a child with a rare disease

Oxford scientists have for the first time been able to identify the origins of some severe disease-causing mutations within the testicles of healthy men. This discovery will help our understanding of how certain serious genetic disorders can occur in the offspring of healthy parents, who do not themselves have the genetic defect. The research is published in the journal PNAS.

For the Oxford team, it is just the latest phase in a research programme that has been running for over 20 years. In the 1990s Professor Andrew Wilkie and colleagues were investigating a condition called Apert syndrome that affects the development of the skull and limbs. Most children with Apert syndrome are born to unaffected parents and Professor Wilkie's team showed that these cases are caused by new mutations (in a gene called FGFR2) that spontaneously arose as the father's testes produced new sperm. Based on the prevailing knowledge of how spontaneous mutations arise, we would expect Apert syndrome to be extremely rare, but surprisingly cases occur up to 1,000 times more frequently than this.

To find out why this disease is more common than expected, Professor Anne Goriely compared sperm from fathers of children with and without Apert syndrome, and found that both groups had rare sperms with the mutation. She explained 'the process that gives rise to Apert syndrome happens in every man, meaning any couple could have a child with Apert syndrome, regardless of the health of the parents. I also found that older men tended to produce more of these Apert mutations'. Professor Goriely also showed that normal men produce sperm with other mutations that cause lethal forms of dwarfism and other severe syndromes.

Sperm are formed when cells called spermatogonia divide into two - one of the new cells gets committed to making sperm, whereas the other stays as a spermatogonium so it can repeat the cycle. With millions of sperm and new spermatogonia being produced every day, some disease-causing mutations inevitably occur because of random errors in the complex DNA copying process. However, the team predicted that particular mutations in FGFR2 and a few other disease genes enabled the mutated spermatogonia to produce not just sperm but extra copies of themselves, reproducing and spreading faster than the surrounding normal spermatogonia. This tumour-like growth means that over time, a greater proportion of sperm being produced carry disease-causing mutations, increasing the risk of fathering a child with a serious condition. These mutations are termed 'selfish' because they lead to preferential growth of the mutant cells, with the associated negative effect of producing disease-causing mutations.

The current study aimed to identify these growths of mutant cells within the testicles of normal men (that were removed for surgical reasons and had been donated for research purposes). Professor Wilkie explains: 'The testis is similar to a massive tangle of spaghetti: in fact each testis contains up to 400 metres of interwoven tubes in which sperm are made. We developed techniques to pinpoint the abnormal regions of these tubes, and using a laser powered microscope, we could isolate these regions. This allowed us to perform detailed genetic analysis and we were able to identify mutations associated with severe diseases in 13 of the 14 testicles analysed.'

In essence, all men will develop these mutant growths within their testicles as they age, and with the trend for delayed parenthood, it is important that we understand the potential risks associated. Identifying these selfish growths will enable us to identify how they grow and the range of diseases that they cause in the next generation - in addition to the diseases studied, older paternal age is also associated with some cancers, autism and schizophrenia. In the clinic, non-invasive tests using blood samples from pregnant women are currently being used to screen for mutations that might be present in their babies. This work greatly adds to knowledge of which mutations are most likely to turn up - especially when the father is older.

The paper, Visualizing the origins of selfish de novo mutations in individual seminiferous tubules of human testes, is published in the journal PNAS in the week beginning 8 February (DOI: 10.1073/ pnas.1521325113).

http://www.eurekalert.org/pub_releases/2016-02/lu-soe020816.php

Signs of early settlement in the Nordic region date back to the cradle of civilization

The discovery of the world's oldest storage of fermented fish in southern Sweden could rewrite the Nordic prehistory with findings indicating a far more complex society than previously thought.

The unique discovery by osteologist Adam Boethius from Lund University was made when excavating a 9,200 year-old settlement at what was once a lake in Blekinge, Sweden. "Our findings of large-scale fish fermentation, a traditional way of preserving fish, indicate that not only was this area in Sweden settled at that time, it was also able to support a large community", says Adam Boethius, whose findings are now being published in the Journal of Archaeological Science.

The discovery is also an indication that Nordic societies were far more developed 9,200 years ago than what was previously believed. The findings are important as it is usually argued that people in the north lived relatively mobile lives, while people in the Levant -- a large area in the Middle East -- became settled and began to farm and raise cattle much earlier.

"These findings indicate a different time line, with Nordic foragers settling much earlier and starting to take advantage of the lakes and sea to harvest and process fish. From a global perspective, the development in the Nordic region could correspond to that of the Middle East at the time," says Adam Boethius.

"The discovery is quite unique as a find like this has never been made before. That is partly because fish bones are so fragile and disappear more easily than, for example, bones of land animals. In this case, the conditions were quite favourable, which helped preserve the remains", says Adam Boethius.

The fermentation process is also complex in itself. Because people did not have access to salt or the ability to make ceramic containers, they acidified the fish using, for example, pine bark and seal fat, and then wrapped the entire content in seal and wild boar skins and buried it in a pit covered with muddy soil. This type of fermentation requires a cold climate.

Download article: Something Rotten in Scandinavia: The World's Earliest Evidence of Fermentation (2016). By Boethius, Adam, published in the Journal of Archaeological Science. http://www.sciencedirect.com/science/article/pii/S0305440316000170

http://www.eurekalert.org/pub_releases/2016-02/mali-iip020816.php

Is it possible for humans to regenerate limbs?

An exploration of the ambitious goal of epimorphic regeneration in humans

New Rochelle, NY, - Unlocking the complex biological and regenerative processes that would enable humans to regrow digits and limbs "would radically change the prognosis and quality of life for amputees," state the authors of "Looking Ahead to Engineering Epimorphic Regeneration of a Human Digit or Limb," a Review article published in Tissue Engineering, Part B, Reviews, a peer-reviewed journal from Mary Ann Liebert, Inc., publishers. The article is available free to download on the Tissue Engineering website until March 8, 2016.

Lina M. Quijano, Kristen M. Lynch, Tabassum Ahsan, Tulane University (New Orleans, LA), Christopher H. Allan, University of Washington (Seattle), and Stephen F. Badylak, University of Pittsburgh (PA), explore the highly ambitious goal of epimorphic regeneration in humans, which would require the regrowth of multiple tissues that would then need to be assembled in the proper conformation and patterns to create a fully functional limb. The authors approach this fascinating subject--a combination of the latest advances in tissue engineering and regenerative medicine--by examining the process of human digit healing and published reports of regenerative potential. They provide a comprehensive look at the processes of epimorphic regeneration in non-mammalian systems and describe some mammalian models of regeneration, including the digit tip of the mouse. This model can serve as a comparison of regeneration-competent and regeneration-incompetent tissue in the same animal.

"There is a critical need to develop engineered tissues with complex physiologies, such as a complete limb, and the paper by Quijano and colleagues identifies some of the key components required for these developments," says Reviews Co-Editor-in-Chief John P. Fisher, PhD, Professor and Associate Chair, Fischell Department of Bioengineering, University of Maryland, College Park, MD.

Research reported in this publication was supported by the National Institutes of Health under Award Number P20 GM103629.

http://bit.ly/1O6ezHx

125-year mini ice age linked to the plague and fall of empires

Empires caught a chill

Winter was coming. In AD 536, the first of three massive volcanic eruptions ushered in a mini ice age. It coincided with an epidemic of the plague, the decline of the eastern Roman Empire, and sweeping upheavals across Eurasia.

Now we have the first evidence that the disruption to climate continued a lot longer than a decade, as was previously thought. The extended cold period lasted until around 660, affecting Europe and Central Asia, and perhaps the rest of the world too.

The work builds on research that used ice cores to identify three significant volcanic eruptions in the years 536, 540 and 547. Now Ulf Büntgen at the Swiss Federal Research Institute in Birmensdorf and his colleagues have used tree ring data from Europe and Central Asia to show that decades of cooler summers – in some cases 4 °C cooler – ensued, probably caused by volcanic particulates in the

atmosphere. Over this time, average summer temperatures would have been roughly 2 °C below those from 1961 to 1990, the standard reference period for studies of this kind. This long cold spell coincided with a period of widespread social turmoil across Eurasia, including the plague sweeping across Eastern Europe, Chinese dynasties changing, the Slavs expanding across Europe, and the transformation of the eastern Roman empire into the Byzantine empire.

"There was dramatic social, cultural, and political change in this period," says Shaun Tougher, a historian at Cardiff University, UK, who was not involved in the research. "Perhaps aspects of the changes were exacerbated by a colder period."

Stress on societies

"Suggesting climate caused complex events in human history like the fall of empires is controversial," says geographer Francis Ludlow of Trinity College Dublin in Ireland. "Ultimately [though], there can be very little doubt that these sorts of abrupt climatic events place great stress on societies, and can sometimes tip them over the edge."

This could have helped speed the demise of what remained of the Roman empire, by then restricted to the Mediterranean, which lost land and power during the mini ice age. The shorter growing season would have affected crops, and this could have led to famine and made people more vulnerable to disease.

"Such climatic disruption could have contributed to the movement of plague-bearing rodents into the empire," says historian Doug Lee of the University of Nottingham, UK. It wasn't just the Romans who suffered – the eastern Türk empire around modern-day Mongolia and the Northern Wei and Sui dynasties in China also fell during this time.

Weather winners

This period is what historians refer to as Late Antiquity, and so Büntgen's team named the cooling event the Late Antique Little Ice Age. It could have been more severe than the later, better-known Little Ice Age. "Based on this study, we would say this episode was the coolest over the last 2000 years," says Büntgen.

The period had its share of winners too. "In any period of changing climate, there will be some regions and societies that are better able to adapt," says Ludlow.

The Arabian peninsula may have been one area that benefited, perhaps becoming less dry during this time, says Büntgen. "We argue that this was a time when increased vegetation in this area could have been useful for nomadic people or for feeding camels." This could helped Arab peoples move into Europe and take land from the Romans. Other winners during this period include the Lombards, who invaded Italy, and the early Slavic languages, which seemed to have spread across most of continental Europe at this time from an unknown homeland.

Nature Geosciences, DOI: 10.1038/NGEO2652

http://bit.ly/20s2Aez

Ask Smithsonian: Why Do We Kiss?

According to philematology, or the science for the study of kissing, romance has little to do with it

By Alicia Ault

Love snuggling up to a sweetie and smooching? That's romantic, but—spoiler alert—kissing can be a disgusting and dangerous activity.

While kissing, couples exchange 9 milliliters of water, 0.7 milligrams of protein, 0.18 mg of organic compounds, 0.71 mg of fats, and 0.45 mg of sodium chloride, along with 10 million to 1 billion bacteria, according to one accounting. Many pathological organisms can be transmitted through mouth-to-mouth contact, including those that cause colds and other respiratory viruses, herpes simplex, tuberculosis, syphilis and strep.

That last part doesn't sound too romantic, but romance has very little to do with why we, as a species, are drawn to this very intimate contact. Humans are biologically driven to push their faces together and rub noses or touch lips or tongues.

At its most basic, kissing is a mating behavior, encoded in our genes. We share the vast majority of those genes with the mammalian species, but only humans (and occasionally our close primate relatives like chimps and bonobos) kiss.

But the reason for kissing is still mostly a mystery, even to scientists who have spent decades studying the behavior. It's not possible to say which is the overriding factor: that people kiss because of a psychological attraction, or because of a subconscious urge to mate with the chosen kiss-ee. Most likely, it's a combination of the two. "You can't have psychology without a biological brain," says Rafael Wlodarski, who has devoted much of his career to philematology—the science of kissing.

Wlodarski, a postdoctoral researcher with Oxford University's social and evolutionary neuroscience research group, has found that kissing helps heterosexuals select a mate. Women in particular value kissing early on. Saliva is full of hormones and other compounds that may provide a way of chemically assessing mate suitability—that's the biological brain stepping in.

Women are also more likely to say that a first kiss could be the decider for selecting a mate. Can the biological drive overcome the perception that your chosen one is a bad kisser? Wlodarski says it's hard to separate the two, but that "I would hazard a guess that if someone thinks someone is a bad kisser it's because their smell wasn't right," he says. Women have to be more selective because they face greater consequences when they make a poor mating decision—like having to carry a baby for nine months, says Wlodarski.

Kissing in heterosexual relationships—for both men and women, but particularly women—also cements the intimacy bond over the length of a relationship, says Wlodarski. Interestingly, Wlodarski and his Oxford colleagues have found that people who kiss more frequently seemed to be happier and more satisfied in their relationships, whereas intercourse frequency did not make a difference.

Wlodarski says he's hoping to determine why kissing makes people feel more bonded. That is one of many unanswered questions about kissing—and that's only for heterosexuals. Researchers are just scratching the surface in understanding kissing behavior in homosexuals, he says. "It's an extra level of complexity."

And what about non-sexual kissing? Even though it may not be a mating device, it still probably arose out of that biological imperative, says Wlodarski. A kiss on the cheek is an evolutionary modification that's shown up in larger, more complex societies where it's a sign of respect or admiration.

Not every culture is down with the full-on mouth kissing enlivened by a wandering tongue. That seems to be a modern, and Western, convention, perhaps from the last 2,000 years, says Wlodarski. A study published in 2015 found that less than half of the cultures surveyed engage in romantic, sexual kissing.

There's evidence—at least from written history—that in the past, kissing was primarily mutual face or nose rubbing, or even sniffing in close proximity. In Hindu Vedic Sanskrit texts, kissing was described as inhaling each other's soul.

Now that does sound romantic.

http://bit.ly/1SLkmL1

Sleep deprivation linked to false confession in milestone study

Damon Thibodeaux spent 15 years in prison on the basis of a false confession he gave while sleep deprived

The body of 14-year-old Crystal Champagne was found underneath a bridge in Louisiana in 1996, an electrical cord wrapped around her neck and her clothes in disarray. It didn't take long to find the man who did it: within a couple of days, her cousin Damon Thibodeaux confessed to police on tape that he had raped and murdered her. In fact, Thibodeaux had nothing to do with the crime, as DNA evidence would later confirm. But he paid a heavy price for his false statement, spending 15 years in solitary confinement on death row before being released.

Although hard to fathom, false confessions happen surprisingly often; they are thought to play a role in up to a quarter of wrongful convictions in the US, according to the campaign group the Innocence Project. In many cases, as in Thibodeaux's, the suspect was profoundly sleep deprived during their police interviews.

Now a study has shed more light on how easily severe exhaustion can lead to this type of false confession. Legal experts are predicting it will be cited in future court cases. "It's a milestone," says Lawrence Sherman, head of the Institute of Criminology at the University of Cambridge.

Questionable tactics

It might seem obvious that people who are dead tired can make stupid decisions – but there is a long history of police and army interrogators using sleep deprivation as an interview technique.

In the UK some notorious 1970s miscarriages of justice involving suspected IRA bombers hinged on false confessions made after profound sleep deprivation. It is now illegal for police in the UK to interview people who haven't had 8 hours' sleep in the past 24, unless in an emergency. The entire interview process must also be filmed.

But many other countries including the US have no such rules. Thibodeaux's confession came after an all-night interrogation, and he had been up the previous night helping the family search for Champagne.

It's not the only high-profile miscarriage of justice involving sleep deprivation. Amanda Knox falsely confessed to murdering Meredith Kercher in Italy, after being interrogated from 10pm to 6am.

Misguided gamble

"To the average person it's inconceivable how a false confession can happen," says Saul Kassin of the John Jay College of Criminal Justice in New York, who has been an expert witness in dozens of wrongful conviction cases. He says the suspect usually sees it as a short-term measure, thinking that when all the evidence is in, their innocence will become obvious. "They believe that in the end they won't have to pay for the confession."

Such a gamble is hard for juries to understand, he says, but the latest study might help. In this, 88 people did various computer tasks as part of a fake experiment. A week later they returned for more tasks, then either slept for 8 hours or had to stay awake all night. The next morning they were accused of losing all the study data from the previous week by pressing the "Escape" key, something they had been repeatedly warned against.

"It's not as awful as confessing to murder but some of these people feel really bad – they think the experiment is ruined," says Elizabeth Loftus of the University of California, Irvine, who took part in the work.

When asked to sign a statement admitting their guilt, half of those who were sleep deprived complied, compared with only 18 per cent of those who got a night's rest.

Shaky defence

Peter Neyroud of the University of Cambridge says the study would be more relevant if it had used prisoners instead of university students, because students

could in theory be more suggestible. “They may be bright but they aren’t necessarily savvy.”

But it still fills a gap in the research, says Kassin; while other studies have shown sleep deprivation can impair people in various ways, this is the first to show it can lead to false admissions of guilt. “In court there’s nothing more persuasive than a study that goes right to the point.”

Kassin says that people typically retract false confessions as soon as they have been allowed to sleep – but it still derails the police investigation and, if the case goes to court, it undermines the defence.

For instance, witnesses to the suspect’s alibi, if they have any, may become less confident or even back out when they learn of the false confession. This was shown by another study published this month involving a fake theft. Subjects spent some time doing tasks with a partner and were then told some money had gone missing from a room next door.

When asked if their partner had ever left the room, at first 95 per cent of them said no; this dropped to 45 per cent when told their partner had confessed to the theft.

Kassin wants the US to adopt similar rules to the UK, with time limits and mandatory taping of interviews. Breaking the rules is always possible, he says, but once you impose limits, this would require more than just a single police officer, it would have to involve the entire department.

Journal reference: *PNAS*, DOI: 10.1073/pnas.1521518113

Article amended on 10 February 2016

Clarification: *Since this article was first published, the details of the fake experiment have been tweaked to make it clearer how it worked.*

http://www.eurekalert.org/pub_releases/2016-02/e-scs020716.php

Slime can see

Scientists discover that slime-forming bacteria act as optical objects

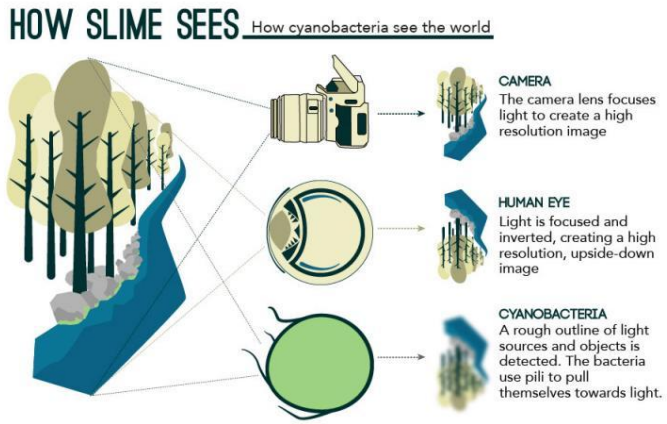
After more than 300 years of looking, scientists have figured out how bacteria "see" their world. And they do it in a remarkably similar way to us.

A team of British and German researchers reveal in the journal *eLife* how bacterial cells act as the equivalent of a microscopic eyeball or the world's oldest and smallest camera eye.

"The idea that bacteria can see their world in basically the same way that we do is pretty exciting," says lead researcher Conrad Mullineaux, Professor of Microbiology from QMUL's School of Biological and Chemical Sciences from Queen Mary University of London (QMUL).

Cyanobacteria are found in huge numbers in water bodies or can form a slippery green film on rocks and pebbles. The species used in the study, Synechocystis, is found naturally in freshwater lakes and rivers. Cyanobacteria evolved around 2.7 billion years ago and the fact that they are able to produce oxygen and fix carbon dioxide using energy from the sun - photosynthesis - is thought to have caused mass extinctions and the oldest known ice age.

As photosynthesis is crucial to the survival of these bacteria, scientists have sought to understand how they sense light. Previous studies have shown that they contain photosensors and that they are able to perceive the position of a light source and move towards it, a phenomenon called phototaxis.



Bacteria are optical objects, each cell acting like a microscopic eyeball or the world's oldest and smallest camera eye. **eLife**

The current study reveals that they are able to do this because the cell body acts like a lens. As light hits the spherical surface, it refracts into a point on the other side of the cell. This triggers movement by the cell away from the focused spot.

Within minutes, the bacteria grow tiny tentacle-like structures called pili that reach out towards the light source. As they attach to the surface that they're on, they retract and pull the bacteria along.

"The fact that bacteria respond to light is one of the oldest scientific observations of their behaviour," says Mullineaux.

"Our observation that bacteria are optical objects is pretty obvious with hindsight, but we never thought of it until we saw it. And no-one else noticed it before either, despite the fact that scientists have been looking at bacteria under microscopes for the last 340 years," he says.

Synechocystis serves as a spherical lens but the team think that rod-shaped bacteria can also trap light and sense the direction it is coming from using refraction, acting like an optical fibre.

The findings are most likely an example of convergent evolution between bacteria and more complex multi-cellular organisms including animals and humans.

"The physical principles for the sensing of light by bacteria and the far more complex vision in animals are similar, but the biological structures are different," says co-author Annegret Wilde from the University of Freiburg.

A Synechocystis cell is about half a billion times smaller than the human eye. As with the retina in the human eye, the image on the rear of the cell will be upside

down. But its resolution will be much lower, so only a blurred outline of any object can be perceived. The ability of optical objects to distinguish fine detail is determined by "angular resolution". In the human eye this is an impressive 0.02 degrees. The team estimate that in Synechocystis it is about 21 degrees.

Reference

The paper 'Cyanobacteria use micro-optics to sense light direction' can be freely accessed online at http://dx.doi.org/10.7554/eLife.12620. Contents, including text, figures, and data, are free to re¬use under a CC BY 4.0 license.

http://bit.ly/1O6fhVq

Inside the cloning factory that creates 500 new animals a day

A controversial Korean lab led by Woosuk Hwang is moving from cloning pets to endangered animals. But will cloning help or hurt these species?

A dog lies unconscious on the operating table, as Woosuk Hwang gently lifts the puppy from its womb. While I watch, one of his researchers, David Kim, tells me about the original – the source of this puppy's DNA.

He calls it the original, because the nearly born puppy is a clone.

Hwang snips open the amniotic sac and the little fur ball slips out into the world. It's black, wet – and motionless. An assistant wraps it in a towel, massages it gently – and it starts to yelp. Success!

This puppy is a sign of things to come for Hwang and his lab. For the past few years, the lab has worked on cloning domestic dogs. Now the researchers plan move on to saving their wild relatives. They want to rescue some of the world's most endangered canids, including the Ethiopian wolf and the dhole, or Asiatic wild dog.

This has raised concerns among conservationists, not least because they fear cloning will be little more than a shiny distraction from wider efforts to preserve habitats and biodiversity.

From hero to disgrace to hero again

In 2005, Hwang became a national hero. In the space of three months, he made international headlines twice: first, with the creation of 11 stem cell lines cloned from human embryos that could be used to study the diseased cells of individual patients, and then with the unveiling the world's first cloned dog.

But a year later, he had been unmasked as a fraud. Seoul National University found he had faked the human stem cell lines and expelled him, and a national bioethics commission found he had forced some junior members of his lab to donate their eggs for research. He was sentenced to two years in prison, but this was suspended.

Although an international pariah, he still had supporters in South Korea, who funded the creation of a private lab, Sooam Biotech, in Seoul. There he turned to cloning canines – a verified accomplishment – charging bereaved dog owners to clone their recently deceased companions to the tune of $100,000 a pup.

Hwang's team extracts the nucleus of skin cells from the animal you wish to clone, and then inserts them into an egg with its nucleus removed. The technique is called somatic cell nuclear transfer (SCNT), and they have now refined and extended it to coyotes and grey wolves, using dogs as egg donors and surrogates. Soon they hope to be producing clones of endangered species. "It is the most meaningful way that we can use the SCNT technology to contribute to society," says Sooam's research director Yeonwoo Jeong.

Cloning the Ethiopian wolf

First up is the Ethiopian wolf, of which fewer than 500 remain, living in Ethiopia's high-altitude alpine meadows. The degradation of the highlands because of human expansion has shrunk their range to six enclaves on different mountains, all isolated from each other. Such low numbers of individuals creates low genetic diversity that can reduce their ability to reproduce and survive.

Sooam hopes to preserve these gene pools by cryogenically banking the cells of as many individual wolves as possible. If an animal dies in the wild, Sooam could thaw its stored cells, create clones using domestic dog surrogates, and introduce them into the wild.

Since no Ethiopian wolves are held in captivity they will first need to be captured. In January, Sooam inked an agreement to collaborate with Arsi University in central Ethiopia through which it hopes to receive permission from the Ethiopian government to collect tissue samples. If they succeed, they hope to be providing cloned pups for repopulation efforts within a year.

Only a few hundred Ethiopian wolves remain, in populations scattered across the country's highlands **FLPA/REX/Shutterstock**

Because Ethiopian wolves are very closely related to dogs, the team expects the actual cloning to go smoothly. "I don't think there will be too much of a complication," says Kim.

Sooam also hopes to start work later this year on the dhole. This canid's range once included nearly all of east Asia, but now has fragmented into groups scattered across the mountain forests of India and south-east Asia. They also suffer from direct conflict with humans. If they kill livestock, herders sometimes

retaliate by poisoning the carcasses, which can wipe out an entire pack. Estimates suggest fewer than 2500 dholes remain in the wild.

Asiatic wild dogs, and more

The dhole will test Sooam's cloning expertise: it's more distantly related to the domestic dog and classified in a separate genus. In principle, domestic dogs can become surrogates to any canid, but in reality the success rate will vary. "It depends, species by species, on how closely related they are to the dog," says Kim. Hwang's team has attempted to clone the African wild dog, which is also in its own genus. These tests resulted in successful impregnations, but no successful births, so how easy it will be to clone the dhole remains to be seen.

Sooam's researchers are also starting work on cloning the Siberian musk deer, a fanged deer that has been nearly wiped off the Korean peninsula. They already have technical expertise beyond dogs. They routinely clone pigs with genes susceptible to disease to be used for drug tests. They also clone breeds of cows prized for their high-quality meat, and have worked on genetically modifying cows to produce therapeutic proteins in their milk. In total, they produce about 500 cloned embryos every day across all species.

Is cloning just a high-tech distraction?

So can work like Hwang's actually help conserve endangered species? Many researchers are far from convinced. Some feel the lab is operating in a vacuum and its work could even hurt existing conservation efforts.

One such sceptic is conservation biologist Claudio Sillero, who founded the Ethiopian Wolf Conservation Programme at the University of Oxford. "They are the last man standing in terms of representing the wilderness of those African meadows," he says of the Ethiopian wolves.

Three years ago, Sooam proposed a collaboration to help conserve the wolves, he says. But he turned them down, saying cloning wouldn't be worth their time.

The most pressing problem for Ethiopian wolves is not genetic diversity or any difficulty in reproducing, he says. It's that they're losing their habitat and prey, and are susceptible to diseases spread by local domestic dogs. Genetic diversity could be preserved simply by moving animals between packs, he says. And he worries that politicians presented with what looks like a simple solution will choose cloning over the kinds of wide-reaching and long-term conservation programmes that are really needed.

Luigi Boitani, a conservation biologist at the University of Rome, also thinks cloning is a "waste of resources" that should be reserved for extreme, near-extinction situations. "I do not see any canid species in this desperate situation yet," he says.

Face to face with cloned puppies

On the third-floor kennel room of the Sooam Biotech cloning facility in Seoul, I get to meet some of the cloned puppies. The first are two 9-month-old German shepherds, cloned for the national police. Their original was a working dog deemed particularly capable and well-disposed. They are endlessly friendly - eagerly jumping up to get attention.

But it's also incredibly eerie: not only are their coats identical, so are their mannerisms. When they hop down, they twist their bodies to the left - every time, sometimes in unison. The only detail I can use to tell them apart is that one of them has a left ear that points upwards.

Further down is another pair of puppies cloned from the same donor; these ones are just 2 months old. They leap at me with the same unbridled enthusiasm, and one of them also has a perky left ear. I do a double take - a quadruple take, really - glancing back down the row of kennels at their older clone siblings. It's like looking at a living growth chart.

http://bit.ly/1Qb3xSD

Mind-reading tech helps beginners quickly learn to play Bach

Every potential virtuoso needs a mentor. It just so happens that this one is a computer.

Called BACh – for Brain Automated Chorales – the system helps beginners learn to play Bach chorales on piano by measuring how hard their brains are working. It only offers a new line of music to learn when the brain isn't working too hard, avoiding information overload.

Developed by Beste Yuksel and Robert Jacob of Tufts University in Massachusetts, BACh estimates the brain's workload using functional Near-Infrared Spectroscopy (fNIRS), a technique that measures oxygen levels in the brain – in this case in the prefrontal cortex. A brain that's working hard pulls in more oxygen. Sensors strapped to the player's forehead talk to a computer, which delivers the new music.

To test whether BACh works, Yuksel and Jacob got 16 inexperienced piano players to learn two chorales, one with the system's assistance, and one on their own. BACh first gave the musicians only the soprano line. When their cognitive load fell below a certain threshold, it added the bass part, then later the alto and tenor parts.

In 15 minutes of learning each piece, pianists played more accurately and faster with BACh than without. People who identified themselves as beginners benefited more than those who rated their skills as intermediate. Yuksel and Jacob will present BACh at a conference in San Jose, California, in May.

Sensing trend

The approach could help with learning any subject, Yuksel says – maths, engineering, programming, foreign languages or reading.

"I find it exciting," says Ton de Jong an educational psychologist at the University of Twente in the Netherlands. "It's individually based, and that's one of the big things we are searching for: to make learning more adapted to the individual."

Yuksel plans to add emotion sensing to the program. High cognitive load combined with positive emotions might indicate productive learning, while negative emotions could signal frustration. "When they're overloaded," Yuksel says, "to maybe remove some information might be even more effective for learning".

You wouldn't want to carry around Yuksel's fNIRS machine all day to help you learn – it's the size of a microwave oven – but more portable fNIRS technology is being developed. "The idea of wearing brain sensors is still not widely accepted," says Erin Solovey of Drexel University in Philadelphia, Pennsylvania. "However, people are starting to wear more sensors, so brain sensors are just going to follow along in that trend."

Journal reference: ACM CHI 2016, *DOI: 10.1145/2858036.2858388*

http://www.eurekalert.org/pub_releases/2016-02/bumc-nsr020916.php

New study reveals incidence of dementia may be declining

Despite the concern of an explosion of dementia cases in an aging population over the next few decades

Boston - Despite the concern of an explosion of dementia cases in an aging population over the next few decades, a new study, based on data from the Framingham Heart Study (FHS), suggests that the rate of new cases of dementia actually may be decreasing.

These findings, which appear in the *New England Journal of Medicine*, provide hope that some cases of dementia might be preventable or delayed and encourages funding agencies and the scientific community to further explore demographic, lifestyle and environmental factors underlying this positive trend.

It is believed that the number of Americans with Alzheimer's disease and other dementias will grow each year as the size and proportion of the U.S. population age 65 and older continues to increase. By 2025 the number of people age 65 and older with Alzheimer's disease is estimated to reach 7.1 million -- a 40 percent increase from the 5.1 million aged 65 and older affected in 2015. By 2050, the number of people in this age population with Alzheimer's disease may nearly triple, from 5.1 million to a projected 13.8 million, barring the development of medical breakthroughs to prevent or cure the disease.

Worldwide, the World Health Organization (WHO) estimates that 47.5 million people have dementia in the world and the total number of people with dementia is projected to reach 75.6 million in 2030 and almost triple by 2050 to 135.5 million.

FHS participants have been continuously monitored for the occurrence of cognitive decline and dementia since 1975. Thanks to a rigorous collection of information, FHS researchers have been able to diagnose Alzheimer's disease and other dementias using a consistent set of criteria over the last three decades. These sources of information include FHS exams, outside clinical records, interviews with family members, and the examination of participants suspected of having a neurological problem by neurologists and neuropsychologists.

Researchers looked at the rate of dementia at any given age and attempted to explain the reason for the decreasing risk of dementia over a period of almost 40 years by considering risk factors such as education, smoking, blood pressure and medical conditions including diabetes, high blood pressure or high cholesterol among many others.

Looking at four distinct periods in the late 1970s, late 1980s, 1990s and 2000s, the researchers found that there was a progressive decline in incidence of dementia at a given age, with an average reduction of 20 percent per decade since the 1970s, when data was first collected. The decline was more pronounced with a subtype of dementia caused by vascular diseases, such as stroke. There also was a decreasing impact of heart diseases, which suggests the importance of effective stroke treatment and prevention of heart disease. Interestingly, the decline in dementia incidence was observed only in persons with high school education and above.

"Currently, there are no effective treatments to prevent or cure dementia; however, our study offers hope that some of the dementia cases might be preventable -- or at least delayed -- through primary (keep the disease process from starting) or secondary (keep it from progressing to clinically obvious dementia) prevention," explained corresponding author Sudha Seshadri, MD, professor of neurology at Boston University School of Medicine and FHS senior investigator. "Effective prevention could diminish in some measure the projected explosion in the number of persons affected with the disease in the next few decades," she added.

The FHS consistently has been shown to be a reliable source of data. However the authors concede that the sample population is overwhelmingly of European ancestry and that further studies are needed to extend the findings to other populations. In addition, the authors also did not look at the effects of key variables such as changes in diet and exercise.

Despite these limitations, "it is very likely that primary and secondary prevention and better management of cardiovascular diseases and stroke, and their risk factors, might offer new opportunities to slow down the currently projected burden of dementia for the coming years " add Carole Dufouil, Inserm research

director in Bordeaux (France). Yet, the authors warn that this does not mean that the total number of persons with dementia will decrease anytime soon. Since baby boomers are aging and people are living longer, the burden of dementia will continue to grow.

This particular type of study requires an enormous amount of data collected over many years on the same persons, and the study was only possible thanks to the generosity and dedication of FHS participants, who contribute their time and data with a missionary zeal. There is a plaque in the center of Framingham town that states, 'Framingham, the town that changed America's heart!' released at the 50th anniversary of the FHS in 1998. Now the town can claim some credit for changing America's brain health as well.

The study was also possible thanks to the work of earlier generations of researchers, as well as colleagues at the FHS who contribute to ongoing data collection. This study was carried out in collaboration between Inserm researchers at the Bordeaux School of Public Health / Inserm in France and Boston University School of Medicine.

Funding for this study was provided by the National Heart, Lung and Blood Institute's Framingham Heart Study (Contract No. N01-HC-25195 and No. HHSN268201500001I) and by grants from the National Institute of Aging (AG008122 and AG033193) and National Institute on Neurological Disorders and Stroke (NS017950).

http://www.eurekalert.org/pub_releases/2016-02/acs-cac021016.php

Creating a color printer that uses a colorless, non-toxic ink inspired by nature

Development of a colorless, non-toxic ink for use in inkjet printers

From dot-matrix to 3-D, printing technology has come a long way in 40 years. But all of these technologies have created hues by using dye inks, which can be taxing on the environment. Now a team reports in *ACS Nano* the development of a colorless, non-toxic ink for use in inkjet printers. Instead of relying on dyes, the team exploits the nanostructure of this ink to create color on a page with inkjet printing.

Current technologies blend dyes -- think CMYK or RGB -- to print in color. But these substances can harm the environment. Some dyes are toxic to marine life or can react with disinfectants like chlorine and form harmful byproducts. An alternative to dyes involves changing the nanostructure of materials so that they reflect light in particular ways. An example of this kind of coloring by light interference is found in nature: Squids can modify the nanostructure of their skin to mirror back their surrounding environment, creating a natural camouflage. Previous research has investigated printing color by light interference, but these attempts have required high-temperature fixing or specialized printing surfaces. Aleksandr V. Yakovlev, Alexandr V. Vinogradov and colleagues at ITMO University wanted to develop a nanostructure color printing technology that is "greener" and can be printed on a wide variety of surfaces.

The team found that a colorless titanium dioxide-based colloidal ink was the best suited for the job. It does not require high temperature fixing and can be deposited on many surfaces. The researchers can control the color produced on surfaces by varying the thickness of ink deposition from a normal inkjet printer. Creating a vibrant color red with this method and this very narrow angle of coloring remains a challenge. This method, however, has generated the first reported "green" ink that is both safe for the ecosystem and does not fade from UV exposure, the researchers say.

The researchers acknowledge funding from the Russian government's Ministry of Education and Science and ITMO University.

http://www.eurekalert.org/pub_releases/2016-02/uobc-usf021016.php

UBC-led study finds beliefs about all-knowing gods fosters co-operation

Beliefs about all-knowing, punishing gods may have played a key role in expanding co-operation among far-flung peoples

Beliefs about all-knowing, punishing gods -- a defining feature of religions ranging from Christianity to Hinduism -- may have played a key role in expanding co-operation among far-flung peoples and led to the development of modern-day states, according to a UBC-led study published in *Nature*.

The research, an international collaboration among anthropologists and psychologists, looked at how religion affects humans' willingness to co-operate with those outside their social circle. The study involved interviews and behavioural experiments with nearly 600 people from communities in Vanuatu, Fiji, Brazil, Mauritius, Siberia and Tanzania whose religious beliefs included Buddhism, Christianity, Hinduism, animism and ancestor worship.

"Certain kinds of beliefs -- involving gods who are aware of human interactions and punish for moral transgressions -- can indeed contribute to the evolution of human co-operation," said lead author Benjamin Purzycki, a postdoctoral research fellow at UBC's Centre for Human Evolution, Cognition and Culture.

"If you think you're being watched, and expect to be divinely punished for being too greedy or thieving, you might be less inclined to engage in anti-social behavior towards a wider range of people who share those beliefs."

Results show that believers in all-knowing gods who punish for wrongdoing are more likely to behave fairly towards anonymous, distant "co-religionists" -- those who share beliefs about gods and rituals, but may not belong to the same religious organization.

When people act this way, the study suggests, they are engaging in behaviour that can support key features of modern-day societies - such as large, co-operative institutions, trade, markets and partnerships.

"Religious beliefs may have been one of the major contributing factors in the development and stability of highly complex social organizations, such as states," said Purzycki.

Background

The paper, "Moralistic gods, supernatural punishment and the expansion of human sociality," is published in *Nature*.

The study included interviews along with two games that involved the distribution of coins to participants or other believers based locally or in distant communities. In these games, participants were supposed to use a die to determine who would get the coins. However, as anonymous players, they could override the die and give coins to whomever they wished. For both games, participants were more likely to play by the rules and dole out more coins to distant believers if they reported that their gods knew about people's thoughts and behaviour, and punished for wrongdoing.

http://nyti.ms/1WhsNLJ

Johns Hopkins to Perform First H.I.V.-Positive Organ Transplants in U.S.

First kidney and liver transplants between H.I.V.-positive donors and H.I.V.-positive patients in the United States

By DANIEL VICTOR FEB. 10, 2016

Johns Hopkins said it was set to perform the first kidney and liver transplants between H.I.V.-positive donors and H.I.V.-positive patients in the United States, a development that advocates said could create a lifesaving pipeline for H.I.V. patients while shortening organ donor waiting lists for all.

Dr. Dorry Segev, an associate professor of surgery at the Johns Hopkins University School of Medicine, estimated that organs from 500 to 600 H.I.V.-positive potential donors have gone to waste each year and that allowing those donations could save more than 1,000 people.“That’d be the greatest increase in organ transplantation that we’ve seen in the past decade,” he said in an interview Tuesday.

Since 1988 until November 2013, when President Obama signed the H.I.V. Organ Policy Equity Act into law, medical facilities had been forbidden from such transplants. After receiving approval in January from the United Network for Organ Sharing, which manages the nation’s organ transplant system, Johns Hopkins was prepared to perform a transplant as soon as a suitable organ and recipient emerged, the hospital said.

H.I.V.-positive patients can receive organs from donors without H.I.V., so the addition of the new organs could also bump those without H.I.V. up the waiting list. About 122,000 people in the United States are on the list, Johns Hopkins said. Patients without H.I.V. would not receive organs from H.I.V.-positive donors.

Giving H.I.V.-positive patients donated organs was once considered unnecessary. The 2013 HOPE Act reversed a transplant ban that was passed in 1988 — a time when AIDS fears were high — as part of an amendment to the National Organ Transplant Act. Dr. David Klassen, the chief medical officer for the United Network for Organ Sharing, said the medical outlook for H.I.V. patients had drastically changed since then.

“Nobody would consider transplanting an H.I.V.-positive recipient because everyone knew their life span was short,” Dr. Klassen said. He added that “the notion that H.I.V.-positive recipients could be transplanted arose as a result of their extended life spans.”

Because H.I.V.-positive organ transplants have never been done in the United States, medical facilities do not have systems in place to handle them, Dr. Segev said. He anticipated a trickle of transplants at first until those systems are established, with the rate slowly ticking upward. At least initially, the focus will be on deceased donors, Dr. Segev said. More studies are required to ensure it is safe for an H.I.V.-positive patient to donate a kidney, he said.

Aside from the medical potential, the ability to become an organ donor upon death is welcome news among H.I.V.-positive patients, Dr. Segev said.

“People want to leave a living legacy; they want to help,” he said. “And to be stigmatized and told, ‘You can’t help because you’re H.I.V.-positive’ can be devastating. This removes yet another stigma associated with H.I.V.”

Michael Kaplan, president of the AIDS United lobbying group, has lived with AIDS since 1992 and Type 1 diabetes since 1980. He said in an interview that H.I.V.-positive patients would appreciate having more medical options — and that he suddenly realized he would have to update his own donor information.

“The idea that my organs could now benefit someone living with H.I.V.? Heck yeah,” he said.

http://bit.ly/1RvtySa

Whole Zika genome recovered from brain of baby with microcephaly

Link between the Zika virus and microcephaly is still unproven, but the evidence is building up

The link between the Zika virus and microcephaly, **which results in babies being born with brain damage and unusually small heads**, is still unproven but the

evidence is building up. *New Scientist* explores how much we now know, and what gaps remain

What's the latest evidence?

For the first time, the complete genome of the Zika virus has been recovered from a fetus with microcephaly. The fetus was conceived by a Slovenian woman while she worked as a volunteer in Brazil. After returning home 28 weeks into her pregnancy, ultrasound scans revealed such severe brain abnormalities that she had the pregnancy terminated, enabling researchers to analyse the brain.

As well as the Zika genome, the researchers found high levels of viral RNA and viral particles in brain cells. There was no evidence of the presence of other pathogens that could have caused the brain damage, and no other organs were damaged suggesting the virus preferentially attacks the brain. "Microscopic examination revealed that brain cells were destroyed due to infection with the virus. While it can't be definitive proof, it may present the most compelling evidence to date that congenital brain malformations associated with Zika virus infection in pregnancy are a consequence of viral replication in the fetal brain," says Tatjana Avšič Županc of the University of Ljubljana in Slovenia, who was involved with the autopsy.

Organisations tracking the problem say the new evidence is of concern. "The case report from Slovenia adds to the body of evidence that trans-placental infections with the Zika virus can cause severe central nervous system damage and microcephaly," says Giovanni Mancarella of the European Centre for Disease Prevention and Control. "What we lack is how often these infections take place across the placenta and how often it results in brain malformations," he says. "It's unlikely all Zika infections during pregnancy result in fetal infection, because if it was, we would seem many more cases in the affected countries," he said.

What other evidence is there of the link?

Zika virus RNA has been found in the amniotic fluid of two women whose unborn babies were diagnosed with microcephaly by ultrasound in Brazil. It has also been identified in blood and tissue samples, including from the brain and placenta, in babies who were miscarried or died soon after birth, and in spinal fluid from surviving babies with the condition.

The other strand of evidence linking Zika and microcephaly is the pattern of spread. Microcephaly cases in Brazil started to rise around 6 months after authorities confirmed Zika transmission there, hinting that the defect might have been caused by exposure to the virus in the womb. An increase in brain defects was also seen in newborns in French Polynesia in 2014, following a large Zika outbreak there.

Does anyone doubt that Zika is the cause?

Some researchers have said that Brazil has historically under-reported cases of microcephaly. Only 150 cases were reported in 2014. The incidence is two to fourfold higher in countries such as the US. Sceptics say that the surge of almost 4800 cases since October last year is down to increased surveillance since people became aware of the Zika threat. An analysis from the US Centres for Disease Control and Prevention challenges this. It says that the rise from 0.5 to 20 cases per 10,000 live births in the second half of last year goes way beyond this and suggests instead "a sharp increase in birth prevalence".

However, of the 4783 cases of microcephaly identified as of 5 February, closer examination of 1113 of them by Brazilian health officials revealed that only 404 could be linked to Zika, suggesting the others had other causes such as a genetic predisposition. To get to the bottom of what's going on, Brazil will follow 6000 women in infected areas in the north of the country to try and better pin down the cause.

What evidence would prove the link beyond doubt?

One approach is comparing rates of Zika infection in babies born with and without microcephaly, but getting a definitive answer could take months or even years.

Catherine Spong, deputy director of the US National Institute of Child Health and Human Development in Bethesda, Maryland, says that it will take several lines of inquiry. "We need to demonstrate what happens when someone has the virus, so we need to identify and follow women from pregnancy through to birth through well-designed studies that compare those that do and those that don't get infected," says Spong. "We also need to rule out any other possible causes, such as cytomegalovirus or rubella, and identify all influencing factors, such as whether the stage of pregnancy affects outcomes." In parallel, we need animal and lab studies to look at how the virus impacts the brain and cells within it, she says.

Journal reference: New England Journal of Medicine, DOI: 10.1056/NEJMoa1600651

http://bbc.in/240ElbS

Heart transplant surgeon: Longest living patient 'remarkable'

The surgeon who operated on the world's longest-surviving heart transplant patient has said surviving "in excess of 30 years" was "remarkable"

John McCafferty, 73, died on Tuesday, 33 years after his operation.

Professor Sir Magdi Yacoub performed Mr McCafferty's transplant at Harefield Hospital, west London, on 20 October 1982. Sir Magdi said surgeons did not know at the time "how long patients [could] survive after transplantation".

Mr McCafferty lived in Newport Pagnell, Buckinghamshire, but was originally from Shotts in North Lanarkshire. He had been diagnosed at 39 with dilated cardiomyopathy, a disease of the heart muscle.

He was told he had five years to live when he received the transplant. But in 2013 he was recognised as the world's longest surviving heart transplant patient by Guinness World Records.

Sir Magdi said the five-year prognosis had been estimated. "John showed quite clearly that people can survive in excess of 30 years... so that's remarkable," Sir Magdi said. "It shows how transplantation can give life and that's entirely due to the generosity of the British public, the donor family that is."

The British Heart Foundation said more than three-quarters of heart transplant patients lived for more than five years.

Mr McCafferty's widow Ann said the years they had together after his heart transplant were "brilliant". But she said: "He was in pain for the last three years of his life and was taken to hospital in Milton Keynes on 27 January. Unfortunately, he wasn't able to return home."

What is a heart transplant?

- ***A heart transplant is when a diseased heart is replaced by a healthy human heart from a donor***
- ***The operation which usually takes between four and six hours***
- ***In 2014/15 there were 181 heart transplants at seven hospitals around the UK***
- ***The first-ever successful heart transplant operation was performed in South Africa in 1967 by Prof Christiaan Neethling Barnard and a team of 30 physicians at the Groote Schuur Hospital, Cape Town***
- ***The patient, Louis Washkansky, survived for 18 days with the new heart***

Source: British Heart Foundation / BBC

http://www.bbc.com/news/science-environment-35553549

Gravitational waves: Numbers don't do them justice

First direct detection of ripples in the fabric of space-time caused by the merger of two black holes

Jonathan Amos Science correspondent

"It's astonishing; it really is." Jim Hough can't stop repeating the phrase.

The veteran gravitational wave hunter from Glasgow University has come to the National Press Club in Washington DC to witness the announcement of the first direct detection of ripples in the fabric of space-time caused by the merger of two "intermediate-sized" black holes.

The numbers look bald on paper, but it's when you try to imagine the scenario being described in those numbers that you rock backwards.

Imagine two monster black holes spinning down on each other in space. One has a mass which is about 35 times that of our Sun, the other roughly 30. At the moment just before they coalesce, they're turning around each other several tens of times a second. And then, their event horizons merge and they become one - like two soap bubbles in a bath.

David Reitze, executive director of the Laser Interferometer Gravitational-Wave Observatories (LIGO), described it thus: "Take something about 150km in diameter, and pack 30 times the mass of the Sun into that, and then accelerate it to half the speed of light. Now, take another thing that's 30 times the mass of the Sun, and accelerate that to half the speed of light. And then collide [the two objects] together. That's what we saw here. It's mind boggling." In that moment of union, the holes radiate pure energy in the form of gravitational waves, and lose mass equivalent to three times that of our Sun. Energy equals mass times the speed of light, squared. Everyone knows the equation; this is it in action.

That tremendous release of energy, and the warping of space-time that results, is why the LIGO laboratories have been able to sense it, even though this staggering event occurred about 1.3 billion light-years from Earth.

A thousand researchers from 80 institutions in 15 countries are celebrating this moment. The excitement this week, building up to the announcement in the US capital, has been palpable. It's easy to see why. The detection of the black hole merger was made at 09:50:45 GMT on 14 September.

The laser interferometers operated by LIGO had only just come online after several years refurbishment to enhance their sensitivity. They weren't even in a formal science observation mode. The researchers were still going through commissioning checks when the detectors picked up the signal - a disturbance equivalent to someone nudging the ultra-quiet equipment by minute fractions of the width of a proton, the particle at the heart of all atoms.

The LIGO lab at Livingston in Louisiana saw it first. The Hanford, Washington State, observatory 3,000km away sensed the bump seven milliseconds later. The distance to the event, the scientists are pretty confident about; the location, less so. Somewhere in the southern sky.

In some ways, it's difficult to know what to concentrate on. Is it the history-making detection of the waves themselves, or the detail of astrophysics they represent? This is the first direct observation of black holes, of black holes this size, and of them orbiting each other and merging.

And all the numbers are exquisitely in agreement with Einstein's equations. As predicted, the waves radiate at the speed of light - meaning the graviton, the putative particle that mediates gravitation, is massless (to the level that it's possible to tell).

"Although Einstein's equations are famously complicated, they are the simplest equations he could have come up with, given all the constraints he had to satisfy," commented Bernie Schutz from Cardiff University. "It is remarkable that nature didn't add in even more complexity. But the equations are what they are, and they're beautiful."

There will of course need to be further detections. The scientists think they may also have seen an event, much smaller, some weeks later, but this will need further assessment.

Looking to the summer, the LIGO labs will be running again after a period of downtime. When this happens, they'll be joined by a third observatory called Virgo, built near Pisa in Italy. Others are coming, too, in Japan and in India.

With all these "ears on the cosmos", it should be easier to identify where precisely in the sky the detected events are occurring.

And the European Space Agency is developing a gravitational wave observatory to put in orbit far from Earth. It will launch in the 2030s.

Currently, it's not the grand mission that everybody had hoped for, because the US space agency got in a muddle over its funding some years back and dropped the project. The scale of the mission was therefore redrawn. Many now hope that this historic breakthrough will prompt Nasa to come back in.

"The compromise that was made, to build it in Europe so that the Americans didn't have to contribute, because they weren't going to, was not the best thing to do for the science; not for the size and the risk of doing that space mission," observed MIT's Rai Weiss.

"Consequently, many of us are trying to get the collaboration re-established."

It is really only by going into space and measuring gravitational waves from even bigger events, away from the noisy surface of the Earth, that researchers expect to see small chinks start to emerge in those glorious equations of Einstein.

Who gets the prize?

It is inevitable on these occasions that talk turns to Nobel Prizes. No-one is in any doubt that Thursday's announcement deserves one; the debate, as ever, is over who should receive it.

Obvious candidates include the American Kip Thorne, the Scotsman Ron Drever and the German-born Rai Weiss himself. They are regarded as the fathers of LIGO, having proposed the concept back in the 1980s.

But for Jim Hough, who started working on gravitational waves as a postgrad in the late 1970s, it would be appropriate if some of the glory went to the broad collaboration of researchers who made LIGO what it is.

One thousand and four authors are listed on the breakthrough paper in Physical Review Letters.

"The Nobel committee should have given a prize to the Large Hadron Collider itself for the detection of the Higgs boson. All those experimentalists worked so hard to do it, and they should have been rewarded for it," he told me.

"But it's quite likely we'll see the same thing happening with gravitational waves, which would be a great pity in my view."

http://www.eurekalert.org/pub_releases/2016-02/uow-wrt020816.php

Wisconsin researchers transform common cell to master heart cell

By genetically reprogramming the most common type of cell in mammalian connective tissue primitive progenitors that form the developing heart.

MADISON, Wis. -- By genetically reprogramming the most common type of cell in mammalian connective tissue, researchers at the University of Wisconsin-Madison have generated master heart cells -- primitive progenitors that form the developing heart.

Writing online Feb. 11 in the journal *Cell Stem Cell*, a team led by cardiologist Timothy J. Kamp reports transforming mouse fibroblasts, cells found mostly in connective tissue such as skin, into primitive master heart cells known as induced cardiac progenitor cells. The technology could permit a scalable method for making an almost unlimited supply of the three major types of cells in the heart. If replicated in human cells, the feat could one day fuel drug discovery, powerful new models for heart disease and the raw material for treating diseased hearts.

The lead author of the new study, UW-Madison postdoctoral fellow Pratik A. Lalit, found that 11 genes that play a central role in embryonic heart development could be used to reprogram the fibroblasts. He and his colleagues then narrowed the number of essential genes to five. Importantly, the group also defined the conditions necessary for the transformed cells to be effectively cultured in the laboratory.

Using the five genes, Lalit, Kamp and their team could push the fibroblast cells back in developmental time to become the cardiac progenitor cells that make cardiomyocytes, smooth muscle cells and endothelial cells -- the trio of workhorse cells that make up the organ. The induced cardiac progenitor cells are capable of making billions of the critical heart cells, providing ample material to study heart disease in the laboratory dish, equip high-throughput screens to test various compounds for safety and efficacy, and ultimately, to treat heart disease by replacing diseased cells with healthy ones.

"Because the reprogrammed cells are actively dividing, we can generate billions of cells with relative ease," says Kamp, who also co-directs the UW-Madison Stem Cell and Regenerative Medicine Center.

The study, explains Lalit, was like an exercise in reverse engineering: observing the genetic factors in play as the heart develops in a mouse embryo and using those to direct the fibroblast down the cardiac developmental pathway or lineage. "We're learning from what happens in the embryo during cardiac development," he says. "What does it take to make a normal heart?"

A key advantage of the engineered cardiac progenitor cells, notes Kamp, is that unlike all-purpose pluripotent stem cells, which can become any of the 220

different kinds of cells in the human body, the induced progenitor cells made from fibroblasts are faithful only to the cardiac lineage -- a desired feature for cardiac applications. A potential drawback of cell transplants derived from all-purpose stem cells is the small but very real possibility of creating a teratoma, a tumor from tissue other than the intended cell lineage. "With cardiac progenitor cells, you can reduce the risk of tumor formation as they are more committed to the heart lineages and are unlikely to form a tumor," says Kamp.

Lalit and Kamp's team tested the new cells in mice by experimentally inducing heart attacks. Injecting the engineered cells into the damaged hearts of mice, they observed the cells migrating to the damaged part of the heart and making cardiomyocytes -- the heart cells that contract to underpin the beating of the heart -- as well as smooth muscle and endothelial cells, key cells that form blood vessels. The implanted cells led to an uptick in survival of the heart-impaired mice.

The work was completed by a team of Wisconsin investigators, funded through the National Heart, Lung and Blood Institute's Progenitor Cell Biology Consortium, part of the National Institutes of Health, and the American Heart Association. Contributing to the work were scientists from the University of Minnesota.

http://www.eurekalert.org/pub_releases/2016-02/qgc-qpl021116.php

GGC physicist leads team in innovative black hole research

First-ever simulation supports aspects of popular science fiction scenarios

Black holes are the subject of much fascination, not just in science but also in popular media. For example, the 2014 movie "Interstellar" portrays a fast-rotating, supermassive black hole, into which the protagonist falls in order to probe its center.

Such a scenario may be more than the stuff of Hollywood magic, according to a research team led by Lior Burko, associate professor of physics at Georgia Gwinnett College, and including Gaurav Khanna, associate professor of physics at UMass Dartmouth, and Anil Zenginoğlu, science coordinator at the Center for Scientific Computation and Mathematical Modeling at the University of Maryland.

At the center of a black hole, density and gravity are infinite and the laws of physics and space-time, as we know them, cease to exist. The mysteries of this phenomenon have driven scientists to push the boundaries of what is known about black holes. Supercomputers are required to run the complex computer simulations used in this kind of research.

"Non-rotating black holes have been studied in computer simulations for decades," Burko said. "We developed a first-of-its-kind computer simulation of how physical fields evolve on the approach to the center of a rotating black hole."

The complexity of the simulation led the scientists to develop a new model that will help other researchers further understand black holes. The simulation also revealed a result that might come as a surprise for those familiar with the usual portrayal of black holes.

"It has often been assumed that objects approaching a black hole are crushed by the increasing gravity," Burko said. "However, we found that while gravitational forces increase and become infinite, they do so fast enough that their interaction allows physical objects to stay intact as they move toward the center of the black hole. Therefore, the simulation is consistent with aspects of popular science fiction scenarios in which black holes are used as portals for hyperspace travel, which require space ships, and the astronauts within them, to stay intact."

The team's work will appear in a paper in the Feb. 9 edition of Rapid Communication in Physical Review D, a peer-reviewed publication of the American Physical Society. The research was supported by the National Science Foundation. Critical to the project was the novel supercomputing support from UMass Dartmouth's Center for Scientific Computing & Visualization Research (CSCVR). Khanna serves as associate director of the CSCVR, which provides services for collaborative research in the computational sciences within the university and with researchers at other universities, national labs and industry.

"This has never been done before, although there has been lots of speculation for decades on what actually happens inside a black hole," Khanna said. "The problem is very challenging - requiring development of many new mathematical and computational techniques. I expect this to be a new additional area of focus for my research program over the next several years."

Burko joined the Georgia Gwinnett faculty in 2014. He received his bachelor's, master's and doctorate degrees in physics from The Technion - Israel School of Technology in Haifa, Israel. Burko has held faculty positions at institutions such as the University of Utah and University of Alabama at Huntsville. His research interests include computer simulation/modeling, gravitational physics, black holes, space-time singularities and physics education.

http://www.eurekalert.org/pub_releases/2016-02/kcl-al021016.php

'Grit' adds little to prediction of academic achievement

Perseverance and passion for long-term goals, adds little to the prediction of school achievement

Personality characteristics - especially conscientiousness - have previously been shown to have a significant but moderate influence on academic achievement. However, a new study from the Institute of Psychiatry, Psychology & Neuroscience (IoPPN) at King's College London, suggests that 'grit', defined as perseverance and passion for long-term goals, adds little to the prediction of school achievement.

The study authors point out that previous research, indicating small associations between grit and academic achievement, has relied on highly selected samples such as spelling competition finalists and teachers, which may have led to stronger associations between grit and achievement in later life.

This new study, which used a sample of 4,500 16-year-old twins*, found that aspects of personality predict around six per cent of the differences between GCSE results and, after controlling for these characteristics, grit alone only predicted 0.5 per cent of the differences between GCSE results.

According to the researchers these findings, published today in the *Journal of Personality and Social Psychology*, warrant concern given the present emphasis placed by education policymakers on teaching grit to pupils, both in the UK and in the US. This research is the first to investigate the genetic and environmental origins of grit, as well as its influence on academic achievement, within a large representative UK sample of 16-year-olds.

In the study, the 'Grit-S' questionnaire was used to measure perseverance of effort and consistency of interest at the age of 16. Twins rated the extent to which they agreed with statements such as 'Setbacks don't discourage me' (perseverance) and 'I have a difficulty maintaining my focus on projects that take more than a few months to complete' (consistency of interest). The 'Big Five' Personality questionnaire was used to assess personality traits, comprising those highlighted by psychologists as the most important: extraversion, agreeableness, conscientiousness, openness and neuroticism.

In addition to measuring the association between grit and academic achievement, the researchers also analysed the extent to which grit is 'heritable' (i.e. the extent to which genes contribute to differences between people in their levels of grit). Some scientists have previously suggested that grit may be more malleable than other predictors of academic achievement, such as socioeconomic status and intelligence, which has led to proposals for grit training programmes in schools.

This new study found that grit was about as heritable as other personality traits, with DNA differences explaining around a third of the differences between children in levels of grit.

The study's first author, Kaili Rimfeld from the Institute of Psychiatry, Psychology & Neuroscience (IoPPN) at King's College London, said: 'Until now there has been very little evidence about the origins of differences between children in grit and its influence on academic achievement, despite the fact that it plays an important role in UK and US education policies.

'Our study suggests that grit adds little to the prediction of academic achievement when other personality factors are taken into account.

'This does not mean that teaching children to be grittier cannot be done or that it is not beneficial. Clearly children will face challenges where qualities of perseverance are likely to be advantageous. However, more research into intervention and training programmes is warranted before concluding that such training increases educational achievement and life outcomes.'

**The twins are part of the Medical Research Council (MRC) funded Twins Early Development Study (TEDS). Find out more about TEDS: http://www.teds.ac.uk/*

http://www.eurekalert.org/pub_releases/2016-02/aaft-ndm020816.php

Neandertal-derived DNA may influence depression and more in modern humans

Modern humans have inherited many physical traits from the Neanderthals.

Researchers have found correlations between Neandertal-derived genes and disease states in modern humans - including those influencing the skin, the immune system, depression, addiction, and metabolism.

The results show how ancient liaisons between Neandertals and anatomically modern humans (AMH) continue to impact our genetic heritage.

Previous studies have suggested that when AMH populations migrated out of Africa, they interbred with Neandertals.

More recently, scientists have identified parts of the human genome carrying Neandertal genetic variants, but - in part because Neandertal-derived DNA is so hard to identify and also because of the expense of performing tests for its influence on individuals - scientists still don't fully understand how Neandertal-derived variants influence modern human traits.

Now, by comparing a recent genome-wide map of Neanderthal haplotypes, or gene groups, with health records of 28,000 adults of European ancestry, Corinne Simoniti and colleagues have documented the lingering effects of Neandertal-derived alleles.

The researchers first defined about 135,000 "high-confidence" Neandertal genetic variations (or SNPs) in modern humans.

Next, they looked at the relationships between these SNPs and conditions Neandertal-derived alleles are thought to influence, ultimately finding that Neandertal alleles were significantly correlated with the risk for 12 traits, including depression, myocardial infarction, and blood disorders.

It is possible, the authors say, that some Neandertal alleles provided a benefit in early AMH populations as they moved out of Africa, but then became detrimental in modern Western environments.

http://www.eurekalert.org/pub_releases/2016-02/icl-iit021016.php

Iron in the blood could cause cell damage, say researchers

Concentrations of iron similar to those delivered through standard treatments can trigger DNA damage within 10 minutes, when given to cells in the laboratory

Concentrations of iron similar to those delivered through standard treatments can trigger DNA damage within 10 minutes, when given to cells in the laboratory.

This is the finding of scientists from Imperial College London, who suggest that researchers need to look carefully at the amount of iron given in standard treatments, such as tablets and infusions, and the effects this could be having on the body.

Iron is essential for the body to function and has a crucial role in transporting oxygen -- low levels cause anaemia which leads to tiredness and lethargy. Iron tablets, which are available over the counter or on prescription, are taken by millions of people in the UK -- with six million prescriptions issued each year for iron tablets in England and Wales alone.

In the study, published in the journal PLOS ONE, the team used human endothelial cells, which line blood vessels, and added a placebo or an iron solution of 10 micromolar (a similar concentration to that seen in the blood after taking an iron tablet).

Through looking at genes used within cells, and then examining the cells in more detail, they found that within ten minutes, cells treated with the iron solution had activated DNA repair systems. These were still activated six hours later.

Dr Claire Shovlin, senior author of the study, at the National Heart and Lung Institute at Imperial, said: "We already knew that iron could be damaging to cells in very high doses. However, in this study we found that when we applied the kinds of levels of iron you would find in the blood stream after taking an iron tablet, this also seemed to be able to trigger cell damage -- at least in the laboratory. In other words, cells seem more sensitive to iron than we previously thought."

Dr Shovlin added: "This is very early stage research, and we need more work to confirm these findings and investigate what effects this may have on the body. We are still not sure how these laboratory findings translate to blood vessels in the body."

She stressed that prescribed iron supplements are essential for many patients: "We're not at the stage yet where we would advise doctors to change their approach to prescribing iron supplements. Many people need extra iron -- it is crucial to allow our bodies to function properly -- and anyone with any concerns about their iron supplements should talk to their healthcare provider.

"However, this study helps to open the conversation about how much iron people take. At the moment, each standard iron tablet contains almost 10 times the amount of iron men are recommended to eat each day - and these dosages haven't changed for more than 50 years. This research suggests we may need to think more carefully about how much iron we give to people, and try and tailor the dose to the patient."

The team initially started researching this area after finding that a small proportion of people using iron tablets for the condition hereditary haemorrhagic telangiectasia, which causes abnormalities in the blood vessels, reported their nose bleeds got worse after iron treatment.

http://www.eurekalert.org/pub_releases/2016-02/lsuh-sff021116.php

Study finds freezing nerves prior to knee replacement improves outcomes

The first study of its kind has found that freezing nerves before knee replacement surgery combined with traditional pain management approaches significantly improves patient outcomes.

New Orleans, LA - The results of the preliminary retrospective study led by Vinod Dasa, MD, Associate Professor of Clinical Orthopaedics at LSU Health New Orleans School of Medicine, were published online Feb. 10, 2016, in the journal, *The Knee*, as an Article in Press available at http://www.thekneejournal.com/article/S0968-0160%2816%2900012-0/fulltext.

The study, a retrospective chart review, investigated the cases of 100 patients with advanced osteoarthritis requiring total knee replacement in Dr. Dasa's LSU Health New Orleans orthopaedic practice. Half of them were treated with standard multiple pain management options, before cryoneurolysis (nerve freezing) was introduced to the practice. The first 50 patients to undergo cryneurolysis in addition to multimodal pain management comprised the treatment group, which was compared to the control group who had standard therapy alone. The treatment and control groups were similar in terms of gender, age and body mass index. The only difference is that the treatment group received cryoneurolysis via an FDA-approved handheld device five days prior to surgery. The KOOS (Knee Injury and Osteoarthritis Outcome Score), PROMS (Patient-reported Outcomes Measurement Information System), WOMAC (Western Ontario and McMaster Universities Arthritis Index) and Oxford Knee Score were used to measure outcomes.

"Patients in the treatment group had significantly shorter hospital stays, were prescribed significantly fewer opioids during the first 12 weeks post-operatively and had significantly fewer knee symptoms," notes Dr. Vinod Dasa, Associate

Professor of Clinical Orthopaedics at LSU Health New Orleans School of Medicine.

The ability to decrease hospital length of stay following total knee replacement should substantially reduce costs for hospitals and payers. In the present study, only 6% of patients treated with cryoneurolysis prior to surgery stayed in the hospital for two or more days compared to 67% of patients who did not receive this treatment. Similarly, almost half of patients treated with cryoneurolysis were discharged on the same day of surgery compared with only 14% in the control group. The shorter length of stay of the patients in the treatment group may be due to better local control of pain and a reduced need for nerve blocks that can impair motor function, as well as reduced use of opioids for pain control, which allows patients to walk and function well enough to go home sooner.

Approximately 600,000 knee replacements are performed each year, and this number is expected to increase in coming years. Although knee replacements usually are very successful in the long term, patients often experience a significant amount of pain during the immediate post-operative period, which can be a major hindrance to effective rehabilitation and restoration of function following surgery.

In addition to Dr. Dasa, LSU Health New Orleans orthopaedic resident Dr. Ryan Bliss, Julia Volaufova, PhD, Professor of Biostatistics at the LSU Health New Orleans School of Public Health, and LSU Health New Orleans medical students Gabriel Lensing, Miles Parsons and Justin Harris participated in the study.

The authors acknowledge the study's limitations, including its retrospective, nonrandomized and non-blinded nature. Adequately powered prospective randomized studies are needed to validate the findings of this preliminary report.

In the interest of full disclosure, Dr. Dasa consults with and holds equity options in Myoscience, which developed the iovera system used to administer the cryoneurolysis.

http://bit.ly/1QdTMJD

Mammal brain frozen and thawed out perfectly for first time

A mammal brain has been defrosted from cryogenic storage in an almost perfect state for the first time.

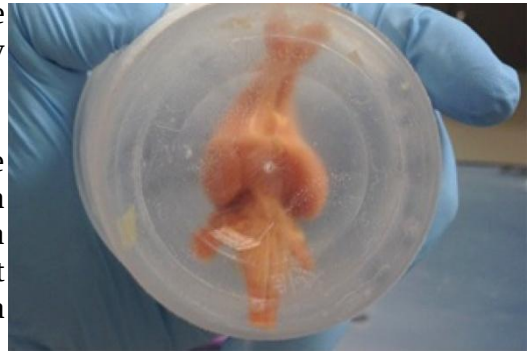
This breakthrough, accomplished using a rabbit brain, brings us one – albeit tiny – step closer to the prospect of reanimating a human brain that has been cryogenically preserved.

After death, organs begin to decay, but we can delay this by cooling these tissues, just like freezing food. But in the same way that a frozen strawberry becomes soggy when defrosted, it is difficult to perfectly preserve mammals at cold temperatures. We, and strawberries, contain large amounts of water, which freezes into ice crystals that damage cells.

Cryoprotectants can prevent this ice damage, working like medical-grade antifreezes and preventing organs from freezing. This works in small worms and rabbit kidneys, but it needs to be administered quickly, which usually causes brains to dehydrate and shrink.

New freezing technique

Now, Gregory Fahy and Robert McIntyre at the company 21st Century Medicine in Fontana, California, have developed a technique that appears to prevent dehydration and preserves the brain in a near-perfect state.



Freezing normally damages cells, but this defrosted rabbit brain was in a near-perfect state **Kenneth Hayworth, Brain Preservation Foundation**

By draining the blood immediately and replacing it with a chemical fixative called glutaraldehyde, they can instantly stop decay, allowing them to add cryoprotectants more slowly to prevent dehydration.

The brain is then cooled to -135 °C, which turns it into a glass-like state that can be stored for centuries without decay. When they tried this technique on rabbit brains, thawing them up to a week later, Fahy and McIntyre say the preservation appeared "uniformly excellent" when examined using electron microscopy. They have been awarded a US$26,735 prize by the Brain Preservation Foundation for the technique.

Frozen memories

Looking at slices of these brains, they saw that the individual connections between neurons remained intact. Such connections, known as the connectome, are thought to be vital for preserving personality and memory. A team at the Alcor Life Extension Foundation in Scottsdale, Arizona, showed last year that defrosted worms retained food-associated memories if their connectomes were well preserved.

Kenneth Hayworth, president of the Brain Preservation Foundation, has helped verify that Fahy and McIntyre's technique works, but he emphasises that the defrosted rabbit brain was not functional. "That was never the point," he says. "The point was to demonstrate that the structure of the delicate synaptic circuitry of the brain could be preserved over indefinite time spans."

Hayworth says the research completely refutes past suggestions that cryonics won't work because it's impossible to preserve the synapses between neurons that store memories.

Reviving frozen people

One limitation of the technique is that the glutaraldehyde used to chemically fix the brain is a deadly chemical, says Joao Pedro Magalhaes at the University of

Liverpool, UK, who coordinates the UK Cryonics and Cryopreservation Research Network. This means reviving a brain preserved in this way may not be possible, although some scientists believe nanotechnology may help overcome this hurdle, he says.

Although cryopreservation techniques have not yet been perfected, more than 100 people worldwide have already been cryogenically frozen after death by companies like Alcor.

“The prizewinning technique is totally different from the one that these companies use,” says Hayworth. “This is only the first step in a long process of serious research and experimentation that might eventually prove that medical application to human patients is warranted.”

Journal reference: Journal of Cryobiology, *DOI: 10.1016/j.cryobiol.2015.09.003*

http://www.bbc.com/news/business-35557558

GSK fined for deals with competitors

Pharmaceutical firm GlaxoSmithKline (GSK) and some generics companies have been fined for being anti-competitive.

The Competition and Markets Authority (CMA) says GSK made more than £50m of payments to companies making generic versions of its anti-depressant Seroxat to delay them coming to market. GSK has been fined £37,606,275 and the generic firms have to pay £7.4m. But GSK says its actions actually saved the NHS money and brought the generic drugs to the market sooner. The other companies fined were Generics UK, Merck, Alpharma, Activis UK and Xellia Pharmaceuticals.

The CMA found that between 2002 and 2004, GSK had made agreements to pay cash to its competitors to prevent them bringing the generic version of Seroxat, called paroxetine, to market.

In addition to the cash payments, the CMA said the deals allowed the competitors to bring small amounts of paroxetine to market instead of GSK, transferring some of the profits to the generic manufacturers without increasing competition.

'Illegal behaviour'

Michael Grenfell from the CMA said: "Today's decision sends out a strong message that we will tackle illegal behaviour that is designed to stifle competition at the expense of customers - in this case, the NHS and, ultimately, taxpayers."

But GSK said it disagreed with the ruling and was considering appealing. "GSK and the generics companies entered into these agreements at the time in order to settle costly, complex and uncertain patent disputes," its spokesperson said. "The agreements allowed the generics companies to enter the market early with a paroxetine product and ultimately enabled a saving of over £15m to the NHS."

The CMA pointed out that after generic paroxetine entered the market properly at the end of 2013, average prices for the drug fell more than 70% in two years.

http://www.eurekalert.org/pub_releases/2016-02/asu-rsi020316.php

Research success increasingly hinges on honing teamwork skills

Team science has led to important advances that could never have been accomplished by lone researchers

TEMPE. Ariz. - Finding solutions to technological and social challenges has become more complex over the past half-century, and making significant progress often demands collaboration by sizable teams of experts with diverse and highly specialized kinds of knowledge.

Such "team science," as it's called, has led to important advances that could never have been accomplished by lone researchers.

"But sometimes it doesn't work all that well," says Arizona State University professor and psychologist Nancy Cooke, "and that's a big concern because it can be a waste of valuable time, effort and research funding."

The problem is recognized by the National Science Foundation, which asked the National Academies of Science, Engineering and Medicine to assemble a group of experts to seek ways to ensure and improve the effectiveness of research teams.

The 13-member Committee on the Science of Team Science was led by Cooke, chair of the Human Systems Engineering program in ASU's Ira A. Fulton Schools of Engineering.

She will give a presentation titled "Growth of Team Science: Challenges and Opportunities," from 8 to 9: 30 a.m. February 12 at the American Association for the Advancement of Science (AAAS) 2016 Annual Meeting in Washington, D.C.

Her committee's report, "Enhancing the Effectiveness of Team Science," was the third most downloaded article published last year by the National Academies Press. See the report at: http://fullcircle.asu.edu/wp-content/uploads/2016/01/Team-Science-Report-Brief.pdf

Recruiting the people with the most impressive records of accomplishment and using the best research facilities is no guarantee for a successful team project, Cooke says.

"You must attend to the development of teamwork, communication and team leadership," she explains.

Those skills are especially important when team members are geographically dispersed, come from different cultures and work in different disciplines that don't always speak in the same technical parlance. Sometimes there is a language barrier even when team members speak the same or similar native languages.

"People in a particular field may use technical language in a way that means one thing to them but something different to experts in other areas," Cooke says.

For team chemistry to develop, "you need a sort of dating period," she says, during which team members focus on how to initiate and manage their

interactions, share knowledge, maintain communications and make certain that "everyone is on the same page" throughout the course of the project.

"Role clarity is a big issue," she says. "There must be clear understanding about who is responsible and accountable for what."

Some team endeavors are hampered when individual researchers "go off and do their own thing" without informing team members, or when one part of a team fails to meet expectations due to miscommunication, Cooke says.

Such missteps are particularly prone to happen when a project involves a "virtual team," one that communicates remotely, mostly - and often only - by e-mail, conference calls, video-conferencing and the like.

"Sometimes virtual interaction is the case even when research partners have offices in the same building," Cooke says.

Despite the convenience and other advantages of modern communication technologies, there is a bit of a cognitive disconnect when people engage remotely. "We are programmed for face-to-face communication," she says, "and there is no reliably surefire substitute for it yet."

Cooke's research interests include team cognition, focusing on the development, application and evaluation of methodologies to elicit and assess team situation awareness and performance.

She wants to provide better understanding of how teamwork skills can best be learned and retained, and find quantifiable measures for evaluating team coordination, particularly through the analysis and modeling of team communication.

In their National Academies committee report, Cooke and her colleagues say public agencies and private organizations funding research should consider more than the capabilities of the engineers and scientists involved. Funders should give equal attention to researchers' strategies for collaboration throughout the entire time period that grants are supporting the projects.

More than that, the committee advises funders to provide support for the leadership, communication and management skills researchers need to do productive team science.

AAAS is the world's largest science and technology society, and its annual meeting draws thousands of scientists, engineers, educators, policymakers and journalists from around the world.

Cooke's presentation at the AAAS annual meeting is part of a panel session titled "Team Science and Convergence: Implications for Education," organized by Katherine Bowman of the National Research Council.

Read more about Cooke's research into interactive team cognition at:
https://www.researchgate.net/publication/233736758_Interactive_Team_Cognition

http://www.eurekalert.org/pub_releases/2016-02/uoca-ncs021116.php

New CU study confirms giant flightless bird wandered the Arctic 50 million years ago

A single toe bone found on Ellesmere Island in the 1970s is described for the first time

It's official: There really was a giant, flightless bird with a head the size of a horse's wandering about in the winter twilight of the high Arctic some 53 million years ago.

The confirmation comes from a new study by researchers from the Chinese Academy of Sciences in Beijing and the University of Colorado Boulder that describes the first and only fossil evidence from the Arctic of a massive bird known as *Gastornis*.

A new study involving CU-Boulder and the Chinese Academy of Sciences has confirmed that a flightless bird weighing several hundred pounds roamed Ellesmere Island in the high Arctic about 50 million years ago. **Illustration by Marlin Peterson**

The evidence is a single fossil toe bone of the 6-foot tall, several-hundred-pound bird from Ellesmere Island above the Arctic Circle. The bone is nearly a dead ringer to fossil toe bones from the huge bird discovered in Wyoming and which date to roughly the same time.

The *Gastornis* (formerly *Diatryma*) fossil from Ellesmere Island has been discussed by paleontologists since it was collected in the 1970s and appears on a few lists of the prehistoric fauna there, said Professor Thomas Stidham of the Chinese Academy of Sciences in Beijing. But this is the first time the bone has been closely examined and described, he said. *Gastornis* fossils also have been found in Europe and Asia.

"We knew there were a few bird fossils from up there, but we also knew they were extremely rare," said CU-Boulder Associate Professor Jaelyn Eberle of geological sciences a study co-author who conducts research on fossil mammals, reptiles and fishes. In addition to the Gastornis bone from Ellesmere, another scientist reported seeing a fossil footprint there, probably from a large flightless bird, although its specific location remains unknown, Eberle said.

A paper by Stidham and Eberle appears in the most recent issue of *Scientific Reports*, an open access, weekly journal from the publishers of *Nature*.

About 53 three million years ago during the early Eocene Epoch, the environment of Ellesmere Island was probably similar to cypress swamps in the southeast U.S. today, Eberle said. Fossil evidence indicates the island, which is adjacent to Greenland, hosted turtles, alligators, primates, tapirs and even large hippo-like and rhino-like mammals.

Today Ellesmere Island is one of the coldest, driest environments on Earth, where temperatures can drop to minus 40 degrees Fahrenheit in winter, said Eberle, also the curator of paleontology at the University of Colorado Museum of Natural History.

Originally thought to be a fearsome carnivore, recent research indicates *Gastornis* probably was a vegan, using its huge beak to tear at foliage, nuts, seeds and hard fruit.

A second Ellesmere Island bird from the early Eocene also is described by Stidham and Eberle in the new paper. Named *Presbyornis*, it was similar to birds in today's duck, goose and swan family but with long, flamingo-like legs. The evidence was a single humerus, or upper wing bone, collected by the same paleontology team that found the *Gastornis* bone.

Like *Gastornis*, *Presbyornis* was mentioned in several lists of Ellesmere Island fauna over the years but the bone had never been described, said Stidham.

Stidham compared casts of *Presbyornis* bones excavated in ancient Wyoming to the single bone from Ellesmere Island, including all of the marks for muscle attachments. "I couldn't tell the Wyoming specimens from the Ellesmere specimen, even though it was found roughly 4,000 kilometers (2,500 miles) to the north," he said.

While the diversity of plants and animals on Ellesmere was surprisingly high in the early Eocene, one of the biggest challenges to life on the island may have been the Arctic winters, said Eberle. "Since Ellesmere Island is high above the Arctic Circle, the lights still went out there for several months of the year, just as they do today."

It is not known whether *Presbyornis* migrated north to Ellesmere Island every year or lived there year-round, said Stidham. "Given the fossils we have, both hypotheses are possible," he said. "There are some sea ducks today that spend the winter in the cold, freezing Arctic, and we see many more species of waterfowl that are only in the Arctic during the relatively warmer spring and summer months."

The paleontology team working on Ellesmere Island in the 1970s and who found the *Gastornis* and *Presbyornis* bones in the 1970s included Mary Dawson, Robert "Mac" West, Howard Hutchinson and Malcolm McKenna.

The new study has implications for the rapidly warming Arctic climate, primarily a result of greenhouse gases being pumped into Earth's atmosphere by humans.

"Permanent Arctic ice, which has been around for millennia, is on track to disappear," Eberle said. "I'm not suggesting there will be a return of alligators and giant tortoises to Ellesmere Island any time soon. But what we know about past warm intervals in the Arctic can give us a much better idea about what to expect in terms of changing plant and animal populations there in the future."

The study was funded in part by the U.S. National Science Foundation, the Chinese Academy of Sciences and the Chinese Natural Science Foundation.

http://bit.ly/1PwUG0w

Fossils Shed New Light on Human–Gorilla Split

The finding could help resolve a controversy over the continent where the ape and human lineages first evolved, according to researchers

By Charles Q. Choi, LiveScience

Fossils of what may be primitive relatives of gorillas suggest that the human and gorilla lineages split up to 10 million years ago, millions of years later than what has been recently suggested, researchers say. The finding could help resolve a controversy over the continent where the ape and human lineages first evolved, the scientists added.

Although the fossil record of human evolution is still patchy, it is better understood than that of great apes such as chimpanzees and gorillas. Since few great ape fossils have been found in Africa so far, "some scientists have forcefully suggested that the ancestors of African apes and humans must have emerged in Eurasia," said study senior author Gen Suwa, a paleoanthropologist at the University of Tokyo.

To shed light on the evolution of the ape and human lineages, Suwa and his colleagues investigated the Afar rift of Ethiopia. Previous research at the Afar rift unearthed fossils of some of the earliest known hominins — that is, humans and related species dating back to the split from the ape lineages. [Top 10 Mysteries of the First Humans]

The research team focused on the Chorora Formation, the oldest known sediments from the Afar rift. (The formation gets its name from Chorora, a village in the area.)

In 2007, Suwa and his colleagues discovered nine gorilla-size teeth from the Chorora Formation that belonged to an extinct ape they named *Chororapithecus abyssinicus*. "Chororapithecus" means "ape from Chorora," while "abyssinicus" refers to Abyssinia, the former name of Ethiopia.

The teeth of *Chororapithecus* appeared specialized for eating stems and leaves, and resembled those of modern gorillas, which suggests that,

"*Chororapithecus* probably represents an ancestral branch of the gorilla lineage," Suwa told Live Science. As such, heand his colleagues wanted to pin down how old *Chororapithecus* was, in order to better pinpoint when the human and gorilla lineages may have first diverged.

By analyzing volcanic rocks and once-magnetized particles of sediment above and below fossils from the Chorora Formation, the researchers have new evidence that *Chororapithecus* was probably about 8 million years old.

The age and location of these fossils strengthen the view that the human and the modern ape lines originated in Africa and not Asia, the researchers said.

"Until now, no mammalian fossils south of the Sahara have been securely dated to 8 million to 9 million years ago," Suwa said. "Any and all fossils from this crucial time period of Africa would help unravel the story of human origins and emergence. These are the first such fossils."

In addition, until recently, "most scientists, especially geneticists, thought that the human-chimp split was as recent as 5 million years ago, and that the human-gorilla split was only about 7 million to 8 million years ago," Suwa said. "This contradicted the fossil record. For example, fossils thought to be on the human side of the split such as *Ardipithecus kadabba* from Ethiopia and *Sahelanthropus* from Chad were 6 million years old — or, in the case of the Chad fossil, perhaps 7 million years old."

The new findings suggest that *Chororapithecus* is 8 million years old, so "the actual gorilla-human split must then have been up to several million years before that," Suwa said. Therefore, the study shows that the human-gorilla split could have happened "at around 10 million years ago and the human-chimp split at around 8 million years ago," he said.

The scientists detailed their findings in the Feb. 11 issue of the journal Nature.

http://www.eurekalert.org/pub_releases/2016-02/nios-net021216.php

New experimental test detects signs of Lyme disease near time of infection

In proof-of-concept study, new method detects Lyme bacteria before standard blood test

When it comes to early diagnosis of Lyme disease, the insidious tick-borne illness that afflicts about 300,000 Americans annually, finding the proverbial needle in the haystack might be a far easier challenge--until now, perhaps. An experimental method developed by federal and university researchers appears capable of detecting the stealthy culprit Lyme bacteria at the earliest time of infection, when currently available tests are often still negative.

The team suggests the approach might also be useful for early detection of other elusive bacterial infections. The collaborators--from the National Institute of Standards and Technology (NIST), Institute for Bioscience and Biotechnology Research, and Johns Hopkins School of Medicine--recently reported the successful first trial of their new method.

"Our hypothesis was that Lyme bacteria shed vesicle-like particles--or fragments--derived from the cell wall of the bacteria circulating in the serum of individuals. These particles would contain membrane proteins that can be detected to provide a unique indicator of infection," explains NIST research chemist Larik Turko.

The challenge was to detect these bacterial membrane proteins among the far, far more plentiful proteins normally present in serum, the watery, cell-free component of blood. The researchers speculated that running serum samples through a high-speed centrifuge--a standard step in chemistry labs--might selectively concentrate the larger, heavier fragments containing the bacterial membrane proteins into pellets. In effect, they predicted, this step would separate the wheat--the sparse target proteins--from the chaff--the much more abundant human serum proteins.

The new method's promise was demonstrated in tests on serum samples drawn from three patients with undetected Lyme disease at the time of their initial doctor visit. By customizing standard analytical techniques for determining the types and amounts of chemicals in a sample, the team detected extremely small amounts of the target protein in all three samples. For chemistry buffs, the protein in enriched samples was present at a level of about four billionths of a millionth of a mole, the standard unit for amount of substance.

In one patient, the experimental method detected the bacteria three weeks before infection was confirmed with the standard blood tests now used. For the other two, infection was detected simultaneously by the two methods.

"The complexity of Lyme disease, combined with lack of biomarkers to measure infection, has slowed progress," study collaborator John Aucott, head of the Johns Hopkins Lyme Disease Clinical Research Center.. "Now, thanks to recent advances in technology, the tiniest concentration of blood molecules can now be detected, molecules that were previously 'invisible' to scientists."

Aucott will feature the joint study as an example in his 2016 AAAS Annual Meeting presentation, Big Data Clinical Realities and the Human Dimensions of Interoperable Data.

The current standard blood test for Lyme disease exposes the infection only after antibodies have accumulated to detectable levels, which can take up to 4 to 6 weeks. If patients exhibit a telltale bull's-eye rash, diagnosis and treatment can

begin earlier. But the rash does not occur in 20 to 30 percent of Lyme disease patients, according to the Centers for Disease Control and Prevention.

Rather than waiting for an infected person's immune system to produce noticeable amounts of antibodies, the team chose to home in on the bacteria itself--specifically, proteins the bug sheds when attacked by the body's defenses.

"From many candidates, we chose one that is both easily distinguished from human serum proteins and an unambiguous indicator of the bacteria," Turko says. "This protein, which resides on the outer surface of membranes, became the target of our search in serum samples."

But finding that target required an important preliminary step to ensure the accuracy of their measurements: making a reference sample that contained ample amounts of the target protein. With the reference sample, the team established the unmistakable signature the bug's outer-surface membrane protein would yield when they examined samples drawn from patients. As a result of these steps, the team could detect the copies of the target protein, even though human proteins were 10 million times more plentiful.

"We believe that this approach may be universally applicable to detection of other bacterial infections in humans," the researchers write.

Article: C.S.F. Cheung, K.W. Anderson, K.Y. Villatoro Benitez, M.J. Soloski, J.N. Aucott, K.W. Phinney, and I.V. Turko, "Quantification of Borrelia burgdorferi *Membrane Proteins in Human Serum: A New Concept for Detection of Bacterial Infection."* Analytical Chemistry *(2015) 87, 11383-11388.*

http://www.eurekalert.org/pub_releases/2016-02/uoc-ri021016.php

Researchers identify 'neurostatin' that may reduce the risk of Alzheimer's disease

Drug targets the first step in the toxic chain reaction leading to the death of brain cells

Researchers have identified a drug that targets the first step in the toxic chain reaction leading to the death of brain cells, suggesting that treatments could be developed to protect against Alzheimer's disease, in a similar way to how statins are able to reduce the risk of developing heart disease.

The drug, which is an approved anti-cancer treatment, has been shown to delay the onset of Alzheimer's disease, both in a test tube and in nematode worms. It has previously been suggested that statin-like drugs - which are safe and can be taken widely by those at risk of developing disease - might be a prospect, but this is the first time that a potential 'neurostatin' has been reported.

When the drug was given to nematode worms genetically programmed to develop Alzheimer's disease, it had no effect once symptoms had already appeared. But when the drug was given to the worms before any symptoms became apparent, no evidence of the condition appeared, raising the possibility that this drug, or other molecules like it, could be used to reduce the risk of developing Alzheimer's disease. The results are reported in the journal Science Advances.

By analysing the way the drug, called bexarotene, works at the molecular level, the international team of researchers, from the University of Cambridge, Lund University and the University of Groningen, found that it stops the first step in the molecular cascade that leads to the death of brain cells. This step, called primary nucleation, occurs when naturally occurring proteins in the body fold into the wrong shape and stick together with other proteins, eventually forming thin filament-like structures called amyloid fibrils. This process also creates smaller clusters called oligomers, which are highly toxic to nerve cells and are thought to be responsible for brain damage in Alzheimer's disease.

"The body has a variety of natural defences to protect itself against neurodegeneration, but as we age, these defences become progressively impaired and can get overwhelmed," said Professor Michele Vendruscolo of Cambridge's Department of Chemistry, the paper's senior author. "By understanding how these natural defences work, we might be able to support them by designing drugs that behave in similar ways."

For the past two decades, researchers have attempted to develop treatments for Alzheimer's that could stop the aggregation and proliferation of oligomers. However, these attempts have all failed, in part because there was not a precise knowledge of the mechanics of the disease's development: Vendruscolo and his colleagues have been working to understand exactly that.

Using a test developed by study co-author Professor Tuomas Knowles, also from the Department of Chemistry, and by Professor Sara Linse, from Lund University, the researchers were able to determine what happens during each stage of the disease's development, and also what might happen if one of those stages was somehow switched off.

"In order to block protein aggregation, we need accurate understanding of exactly what is happening and when," said Vendruscolo. "The test that we have developed not only measures the rates of the process as a whole, but also the rates of its specific component sub-processes, so that we can reduce the toxicity of the aggregates rather than simply stopping them forming."

Johnny Habchi, the first author of the paper, and colleagues assembled a library of more than 10,000 small molecules which interact in some way with amyloid-beta, a molecule that plays a vital role in Alzheimer's disease.

Using the test developed by Knowles and Linse, the researchers first analysed molecules that were either drugs already approved for some other purpose, or

drugs developed for Alzheimer's disease or other similar conditions which had failed clinical trials.

The first successful molecule they identified was bexarotene, which is approved by the US Food and Drug Administration for the treatment of lymphoma. "One of the real steps forward was to take a molecule that we thought could be a potential drug and work out exactly what it does. In this case, what it does is suppress primary nucleation, which is the aim for any neurostatin-type molecule," said Vendruscolo. "If you stop the process before aggregation has started, you can't get proliferation."

One of the key advances of the current work is that by understanding the mechanisms of how Alzheimer's disease develops in the brain, the researchers were able to target bexarotene to the correct point in the process.

"Even if you have an effective molecule, if you target the wrong step in the process, you can actually make things worse by causing toxic protein assemblies to build up elsewhere," said study co-author Professor Chris Dobson, Master of St John's College, University of Cambridge. "It's like traffic control - if you close a road to try to reduce jams, you can actually make the situation worse if you put the block in the wrong place. It is not necessarily the case that all the molecules in earlier drug trials were ineffective, but it may be that in some cases the timing of the delivery was wrong."

Earlier studies of bexarotene had suggested that the drug could actually reverse Alzheimer's symptoms by clearing amyloid-beta aggregates in the brain, which received a great deal of attention. However, the earlier results, which were later called into question, were based on a completely different mode of action - the clearance of aggregates - than the one reported in the current study. By exploiting their novel approach, which enables them to carry out highly quantitative analysis of the aggregation process, the researchers have now shown that compounds such as bexarotene could instead be developed as preventive drugs, because its primary action is to inhibit the crucial first step in the aggregation of amyloid-beta.

"We know that the accumulation of amyloid is a hallmark feature of Alzheimer's and that drugs to halt this build-up could help protect nerve cells from damage and death," said Dr Rosa Sancho, Head of Research at Alzheimer's Research UK. "A recent clinical trial of bexarotene in people with Alzheimer's was not successful, but this new work in worms suggests the drug may need to be given very early in the disease. We will now need to see whether this new preventative approach could halt the earliest biological events in Alzheimer's and keep damage at bay in in further animal and human studies."

Over the next 35 years, the number of people with Alzheimer's disease is predicted to go from 40 million to 130 million, with 70% of those in middle or low-income countries. "The only way of realistically stopping this dramatic rise is through preventive measures: treating Alzheimer's disease only after symptoms have already developed could overwhelm healthcare systems around the world."

The body has a number of natural defences designed to keep proteins in check. But as we get older, these processes can become impaired and get overwhelmed, and some proteins can slip through the safety net, resulting in Alzheimer's disease and other protein misfolding conditions. While neurostatins are not a cure for Alzheimer's disease, the researchers say that they could reduce its risk by acting as a backup for the body's natural defences against misfolding proteins.

"You wouldn't give statins to someone who had just had a heart attack, and we doubt that giving a neurostatin to an Alzheimer's patient who could no longer recognise a family member would be very helpful," said Dobson. "But if it reduces the risk of the initial step in the process, then it has a serious prospect of being an effective preventive treatment."

But is there hope for those already affected by the disease? The methods that have led to the present advance have enabled the researchers to identify compounds that, rather than preventing the disease, could slow down its progression even when symptoms have become evident. "The next target of our research is also to be able to treat victims of this dreadful disease," said Vendruscolo.

http://www.eurekalert.org/pub_releases/2016-02/uoc--nat020316.php

New app turns smartphones into worldwide seismic network

MyShake Android app crowdsources ground shaking from smartphone accelerometers

University of California, Berkeley, scientists are releasing a free Android app that taps a smartphone's ability to record ground shaking from an earthquake, with the goal of creating a worldwide seismic detection network that could eventually warn users of impending jolts from nearby quakes.

The app, called MyShake, will be available to the public Friday, Feb. 12, from the Google Play Store and runs in the background with little power, so that a phone's onboard accelerometers can record local shaking any time of the day or night. For now, the app only collects information from the accelerometers, analyzes it and, if it fits the vibrational profile of a quake, relays it and the phone's GPS coordinates to the Berkeley Seismological Laboratory for analysis.

Once enough people are using it and the bugs are worked out, however, UC Berkeley seismologists plan to use the data to warn people miles from ground zero that shaking is rumbling their way. An iPhone app is also planned.

"MyShake cannot replace traditional seismic networks like those run by the U.S. Geological Survey, UC Berkeley, the University of Washington and Caltech, but we think MyShake can make earthquake early warning faster and more accurate

in areas that have a traditional seismic network, and can provide life-saving early warning in countries that have no seismic network," said Richard Allen, the leader of the app project, director of the Berkeley Seismological Laboratory and a professor and chair of the Department of Earth and Planetary Sciences. The lab operates a sensitive but widely spaced network of seismic sensors buried in vaults around Northern California

A crowdsourced seismic network may be the only option today for many earthquake-prone developing countries, such as Nepal or Peru, that have a sparse or no ground-based seismic network or early warning system, but do have millions of smartphone users.

"In my opinion, this is cutting-edge research that will transform seismology," said UC Berkeley graduate student Qingkai Kong, who developed the algorithm at the heart of the app. "The stations we have for traditional seismology are not that dense, especially in some regions around the world, but using smart phones with low-cost sensors will give us a really good, dense network in the future."

Taking advantage of gaming accelerometers

Smartphones can easily measure movement caused by a quake because they have three built-in accelerometers designed to sense the orientation of the phone for display or gaming. While constantly improving in sensitivity for the benefit of gamers, however, smartphone accelerometers are far less sensitive than in-ground seismometers. But they are sensitive enough to record earthquakes above a magnitude 5 -- the ones that do damage -- within 10 kilometers. And what these accelerometers lack in sensitivity, they make up for in ubiquity. There are an estimated 16 million smartphones in California, and 1 billion smartphones worldwide.

"Currently, we have a network of 400 seismic stations in California, one of the densest in the world," Allen said. "Even if we get only a small fraction of the state's 16 million mobile phones participating in our program, that would be a many-orders-of-magnitude increase in the amount of data we can gather."

In a paper to be published in the Feb. 12 issue of the journal Science Advances, Allen, Kong and Louis Schreier at Deutsche Telekom's Silicon Valley Innovation Center describe the algorithm in the mobile app that analyzes a phone's accelerometer data and distinguishes earthquake shaking from normal vibrations, such as walking, dancing or dropping the phone. In simulated tests, the algorithm Kong developed successfully distinguished quakes from non-quakes 93 percent of the time. Only when the app determines that the vibration is from a quake does it briefly activate the phone's GPS to obtain the phone's position and push a short packet of information out through a data or wifi connection.

Allen hopes that thousands of people will download and install the app so that he and his colleagues can give MyShake a good test. If successful, he anticipates an updated app that provides early warning within a year.

He will discuss MyShake and other earthquake early warning systems during a scientific session on Friday, Feb. 12, 10-11:30 a.m. EST, during the annual meeting of the American Association for the Advancement of Science in Washington, D.C.

Critical role for in-ground seismic network

A West Coast early warning system got a big boost in this year's federal budget when $8.2 million was appropriated to help the U.S.G.S. create such a system in conjunction with UC Berkeley, the universities of Washington and Oregon and Caltech. Allen and other seismologists gathered on Feb. 2 at the White House to discuss earthquake early warning plans and a new initiative to make all federal buildings earthquake-proof.

An early warning system along America's earthquake-prone Pacific edge would be based on a prototype called ShakeAlert now undergoing testing in California, Oregon and Washington. In the San Francisco Bay Area, agencies such as the Bay Area Rapid Transit system already receive warnings from ShakeAlert, such as a 5-second alert after the 6.0 magnitude quake that struck nearby Napa in August 2014. At the White House meeting last week, the Gordon and Betty Moore Foundation committed $3 million to further develop ShakeAlert, and another $1 million for MyShake.

In simulated tests based on real earthquakes, MyShake was able to provide timely early warning as well as or better than ShakeAlert.

Researchers have made other attempts to harness the public's computers or mobile phones for earthquake detection, mostly using their power-hungry connection to the global GPS network, but it has been hard to keep users, especially when software updates interfere with ease of use.

"With an app, you have access to millions of phones and the Google Play Store and Apple iTunes make is easy to distribute," Allen said.

Allen's long-term goal is to make earthquake detection so valuable that it becomes embedded in the mobile phone operating system, so that everyone becomes part of the network.

How the app works

The algorithm behind MyShake was turned into an app by programmers at the Silicon Valley Innovation Center in Mountain View, Calif., which is part of the Telekom Innovation Laboratories (T-Labs) operated by Deutsche Telekom, owner of T-Mobile. Over the past three years, as many as a eight people helped develop

the computer code that ties the sensors to the analysis algorithm, and then uploads the data to servers at UC Berkeley.

"This is really novel and inventive science, so we spent a lot of time on analysis, making sure the basics of the app were fine," said Schreier, the vice president of the T-Labs innovation center. "We wanted an app that could collect the data needed, but wouldn't lock up the phone, or use up all the phone's memory, or burn out a battery, any of which would cause people not to use it."

Kong then tested the algorithm, initially with 75 Android users from a class Allen taught, as well as friends and colleagues. T-Labs also provided phones that Kong tested on shake tables at UC Berkeley, which realistically simulate the vibrations from large quakes such as the 1989 Loma Prieta earthquake south of San Francisco.

The app continually monitors the phone's accelerometers and tests every motion to see if it fits the profile of an earthquake. If the algorithm decides that the shaking it from a quake, it immediately sends basic information to UC Berkeley: the time and amplitude of the shaking, and the phone's position as measured by GPS. Cloud-based software constantly reviews all incoming data and, if at least four phones detect shaking and this represents more than 60 percent of all phones within a 10-kilometer radius of the epicenter, the program confirms an earthquake. The researchers cross-check this with the California Integrated Seismic Network, which monitors earth movement all over the state using underground seismometers.

"Now, ShakeAlert only issues alerts when four of our traditional seismic stations are triggered," Allen said. "But if we also have mobile phone data, maybe we would need only one station to trigger before issuing an alert."

The app records accelerometer data continually, and after a confirmed earthquake will also send five minutes of data to the researchers, starting one minute before the quake and ending four minutes after. This happens only when the phone is plugged in and connected to a wifi network, however.

Once the app has proven reliable, earthquake detection could trigger an alert to cellphone users outside ground zero, providing users with a countdown until shaking arrives.

"We need at least 300 smartphones within a 110-kilometer-by-110-kilometer area in order to have a reasonable estimate of the location, magnitude and origin time of an earthquake," Kong said. "The denser the network, the earlier you can detect the earthquake."

With a dense enough network, detection, analysis and warning can take less than a second.

"We want to make this a killer app, where you put it on your phone and allow us use your accelerometer, and we will deliver earthquake early warning," Allen said. Young-Woo Kwon of Utah State University is also a co-author of the paper.

http://bit.ly/1ogfoZS

Satellites Could Help Discover Modern and Ancient Shipwrecks

Discovering otherwise undetected shipwrecks scattered throughout the oceans could shed light on previously lost history

By Charles Q. Choi on February 12, 2016

Ancient shipwrecks might not only hold buried treasures, but also countless historical secrets. Now researchers suggest satellites could help spot submerged wrecks that might otherwise go undiscovered.

More than three million shipwrecks may be scattered across the oceans, UNESCO estimates. "Of all the wrecks in the world, maybe less than 10 percent have been found," says James Delgado, director of maritime heritage at the National Oceanic and Atmospheric Administration's Office of National Marine Sanctuaries. "Any technology that enables us to pinpoint wrecks is a step in the right direction."

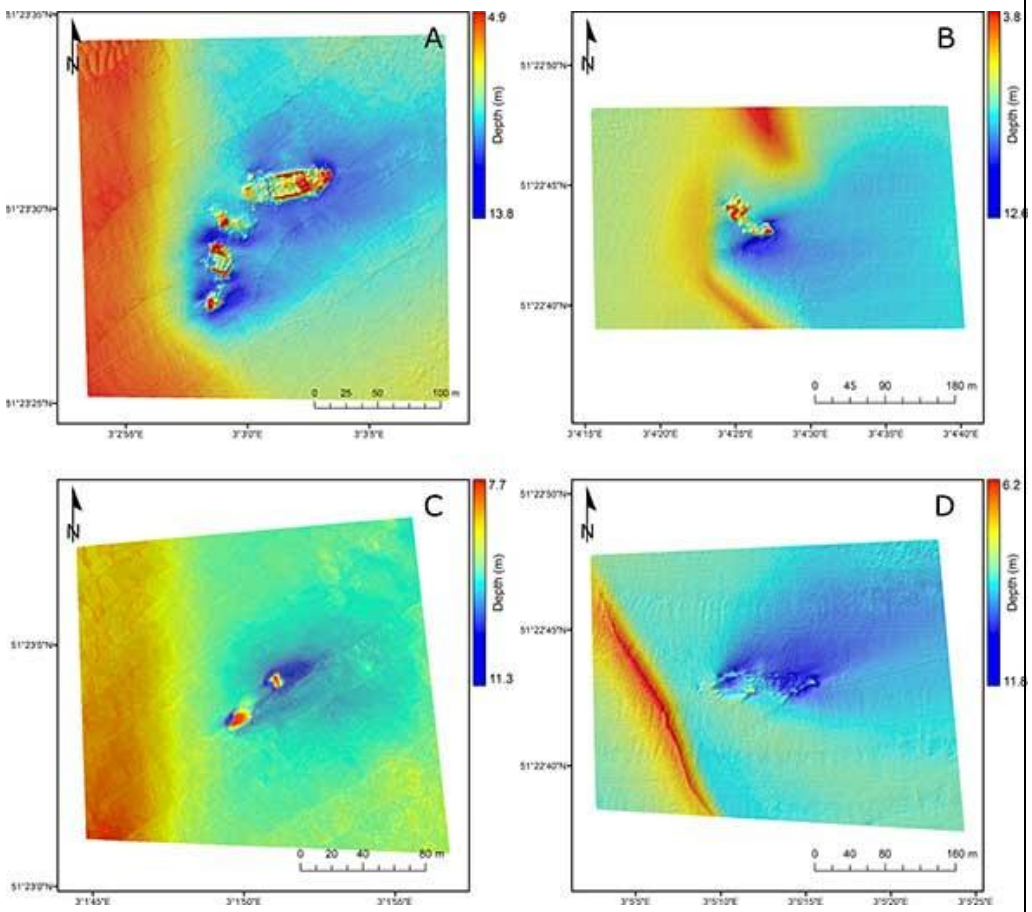
Landsat-8 image taken in 2013 of shipwreck sites off the coast of Belgium. **HIGHROC**

Submerged wrecks are currently detected via waterborne sonar and airborne LiDAR systems—the former searches for wrecks with sound whereas the latter uses lasers. Waterborne sonar is most effective for deep water; airborne LiDAR requires clear water.

Neither method works well for cloudy, shallow waters, however. This means that nearshore waters—often both shallow and cloudy—are frequently overlooked in hunts for old shipwrecks. This is a problem because "the majority of shipwrecks lie closer to shore, clustered around the entrances to harbors, just as most car accidents happen a kilometer or so away from home—say, when jockeying for a spot in a parking lot or at an intersection," Delgado says. "Near the Golden Gate Bridge there are more than 300 wrecks and off of Cape Hatteras, N.C., the 'Graveyard of the Atlantic,' there are more than 1,000."

Now in a new study detailed in the February *Journal of Archaeological Science*, marine geologist Matthias Baeye at the Royal Belgian Institute of Natural Sciences and his colleagues suggest that satellite color photos of the oceans could help find submerged wrecks in shallow cloudy waters. "It is a clever and elegant

solution for using satellites to find shipwrecks," says Peter Campbell, archaeological director of the Albanian Center for Marine Research who was not involved in this work.



Sonar images of four shipwreck sites off the coast of Belgium that reveal how the wrecks disturb surrounding sediment. A: SS Sansip; B: SS Samvurn; C: SS Neutron; D: SS Nippon. **The Flemish Hydrography, Coastal Division, Agency for Maritime and Coastal Services, Flemish Ministry of Mobility and Public Works.**

Baeye and his colleagues examined satellite color photos taken by Landsat 8, which NASA and the U.S. Geological Survey launched in 2013. The researchers analyzed four known wreck sites near the Port of Zeebrugge on the Belgian coast, all civilian vessels. Two of the wrecks sank after hitting mines during World War II, one sank shortly before the war after colliding with another vessel and one sank in 1965, likely after striking one of the World War II–era wrecks.

Baeye and his colleagues focused on suspended particulate mater in the seawater, such as sand and silt. High-resolution satellite imaging can measure the concentrations of these particles—the researchers had previously investigated how natural phenomena such as tides and human activity, such as fishing and dredging, could influence these particle levels, and unexpectedly noticed that shipwrecks could have an effect, too.

The scientists found that tidal currents flowing against these wrecks can generate distinctive linear plumes of these particles up to four kilometers long that are detectable from space. "It'd be like finding pyramids based only on how they disturb the patterns of wind around them," Delgado says.

The researchers noted that usage of Landsat 8 data is free, and suggest that their method could help spot promising sites for follow-up surveys. "I do think that this technique will lead to new discoveries," says Delgado, who did not take part in this research. "As this technique gets used and refined, it will help increase the population of known shipwrecks, and the opportunities to see what stories they have to tell will also increase."

Several archaeologists have already requested satellite data from the researchers, "mainly from the Mediterranean Sea but also from Belgium and the U.K.," Baeye says. Marine archaeologist Brendan Foley at Woods Hole Oceanographic Institution, who did not participate in this study, suggests "a very interesting possibility for this technique would be seeing if this works on wooden wrecks in the shallow, turbid, muddy-floored Baltic Sea, where low salinity results in remarkably well-preserved wooden hulls. Beautifully preserved wrecks from at least the 15th century A.D., and no doubt earlier, are numerous there."

Baeye notes it remains uncertain if there is a depth limit to their method—the four wrecks they looked at were all located in less than 15 meters of water. Deep plumes may not reach near the surfaces of oceans, and therefore satellites could not image them. "If it works in, say, 80 meters of water, then it could be a way to locate some historic wrecks," Foley says. "I'd like to find and survey the wreck of the USS *Tang*, the World War II submarine commanded by Medal of Honor recipient Richard 'Dick' O'Kane. It went down in the Taiwan Strait after sinking most of a Japanese convoy, a victim of a circular run of its last torpedo."

The shipwrecks that Baeye and his colleagues have analyzed so far with their technique are all modern metal wrecks. Older wooden ships may be more difficult to spot because they may have decayed and collapsed, therefore kicking up less of a plume. If further research reveals this method can also find older wooden wrecks, "I'd love to use satellites to look at Imari Bay in Japan for the fleets sent by Kublai Khan that were sunk by the fabled kamikaze typhoons," Delgado says.

http://www.eurekalert.org/pub_releases/2016-02/ru-wmc021016.php

When machines can do any job, what will humans do?

Human labor may be obsolete by 2045

HOUSTON -- Rice University computer scientist Moshe Vardi expects that within 30 years, machines will be capable of doing almost any job that a human can. In anticipation, he is asking his colleagues to consider the societal implications. Can the global economy adapt to greater than 50 percent unemployment? Will those out of work be content to live a life of leisure?

"We are approaching a time when machines will be able to outperform humans at almost any task," Vardi said. "I believe that society needs to confront this question before it is upon us: If machines are capable of doing almost any work humans can do, what will humans do?"

Vardi will address the issue in an 8 a.m. Sunday presentation, "Smart Robots and Their Impact on Society," at one of the world's largest and most prestigious scientific meetings -- the annual meeting of the American Association for the Advancement of Science in Washington, D.C.

"The question I want to put forward is, 'Does the technology we are developing ultimately benefit mankind?'" Vardi said. He will present a body of evidence that suggests the pace of advancement in the field of artificial intelligence (AI) is increasing, even as existing robotic and AI technologies are eliminating a growing number of middle-class jobs and thereby driving up income inequality.

Vardi, a member of both the National Academy of Engineering and the National Academy of Science, is a Distinguished Service Professor and the Karen Ostrum George Professor of Computational Engineering at Rice, where he also directs Rice's Ken Kennedy Institute for Information Technology. Since 2008 he has served as the editor-in-chief of Communications of the ACM, the flagship publication of the Association for Computing Machinery (ACM), one of the world's largest computational professional societies.

Vardi said some people believe that future advances in automation will ultimately benefit humans, just as automation has benefited society since the dawn of the industrial age.

"A typical answer is that if machines will do all our work, we will be free to pursue leisure activities," Vardi said. But even if the world economic system can be restructured to enable billions of people to live lives of leisure, Vardi questions whether it would benefit humanity.

"I do not find this a promising future, as I do not find the prospect of leisure-only life appealing. I believe that work is essential to human well-being," he said.

"Humanity is about to face perhaps its greatest challenge ever, which is finding meaning in life after the end of 'In the sweat of thy face shalt thou eat bread,'" Vardi said. "We need to rise to the occasion and meet this challenge" before human labor becomes obsolete, he said.

In addition to dual membership in the National Academies, Vardi is a Guggenheim fellow and a member of the American Academy of Arts and Sciences, the European Academy of Sciences and the Academia Europa. He is a fellow of the ACM, the American Association for Artificial Intelligence and the Institute for Electrical and Electronics Engineers (IEEE). His numerous honors include the Southeastern Universities Research Association's 2013 Distinguished Scientist Award, the 2011 IEEE Computer Society Harry H. Goode Award, the 2008 ACM Presidential Award, the 2008 Blaise Pascal Medal for Computer Science by the European Academy of Sciences and the 2000 Goedel Prize for outstanding papers in the area of theoretical computer science.

Vardi joined Rice's faculty in 1993. His research centers upon the application of logic to computer science, database systems, complexity theory, multi-agent systems and specification and verification of hardware and software. He is the author or co-author of more than 500 technical articles and of two books, "Reasoning About Knowledge" and "Finite Model Theory and Its Applications."

Background is available at:

Humans, machines, and the future of work --Dec. 18, 2015 speech at the University of Oxford
http://podcasts.ox.ac.uk/humans-machines-and-future-work

Is information technology destroying the middle class?--February 2015 column in the Communications of the ACM
http://cacm.acm.org/magazines/2015/2/182648-is-information-technology-destroying-the-middle-class/fulltext

The future of work: But what will humans do?--Sept. 11, 2015 column in Pacific Standard
http://www.psmag.com/business-economics/the-future-of-work-but-what-will-humans-do

The consequences of machine intelligence --Oct. 25, 2012 column in The Atlantic
http://www.theatlantic.com/technology/archive/2012/10/the-consequences-of-machine-intelligence/264066/

http://www.eurekalert.org/pub_releases/2016-02/uoe-hll020516.php

How learning languages translates into health benefits for society

The advantages of speaking a second language - for health and mental ability - are to come under the spotlight at an event at the AAAS annual meeting in Washington, DC.

Experts in bilingualism will examine how learning a second language at any age not only imparts knowledge and cultural understanding, but also improves thinking skills and mental agility. It can delay brain ageing and offset the initial symptoms of dementia.

During the symposium, researchers will examine how findings from bilingualism research are currently applied, and how they could best benefit society through

education, policymaking and business. Experts will examine current research themes related to bilingualism from infancy to old age, and explore their implications for society.

Professor Antonella Sorace of the University of Edinburgh, who established and directs the Bilingualism Matters Centre, will focus on research on minority languages, such as Gaelic and Sardinian. She will discuss whether the benefits associated with minority languages are consistent with those of learning more prestigious languages. Professor Sorace will be joined by researchers from San Diego State University, Pennsylvania State University, Concordia University, Nizam's Institute of Medical Sciences, the Chinese University of Hong Kong and the University of Connecticut.

The symposium, entitled 'Bilingualism Matters' is directly inspired by the Bilingualism Matters Centre at the University of Edinburgh, which is at the forefront of public engagement in this field and has a large international network. The event will take place from 1.30-4.30 pm on Saturday 13 February in the Marshall Ballroom South, Marriot Wardman Park, Washington DC.

Professor Sorace, of the University of Edinburgh's School of Philosophy, Psychology and Language Sciences, said: "We are excited to reflect on Edinburgh's experiences in bilingualism as an international example of cutting-edge scientific research and public engagement, and to share the current state of research in this area and its relevance for the general public."

http://www.eurekalert.org/pub_releases/2016-02/mc-sdc020916.php

Speech disorder called apraxia can progress to neurodegenerative disease

Mayo Clinic researchers to present at American Association for Advancement of Science meeting

ROCHESTER, Minn. - It may start with a simple word you can't pronounce. Your tongue and lips stumble, and gibberish comes out.

Misspeaking might draw a chuckle from family and friends. But, then, it keeps happening. Progressively, more and more speech is lost. Some patients eventually become mute from primary progressive apraxia of speech, a disorder related to degenerative neurologic disease.

Two Mayo Clinic researchers have spent more than a decade uncovering clues to apraxia of speech. Keith Josephs, M.D., a neurologist, and Joseph R. Duffy, Ph.D., a speech pathologist, will present "My Words Come Out Wrong: When Thought and Language Are Disconnected from Speech" on Sunday, Feb. 14, at the American Association for the Advancement of Science annual meeting in Washington, D.C.

Because patients and even many medical professionals don't recognize apraxia of speech, treatment typically is sought in later stages of the disease, says Dr. Josephs. As apraxia progresses, it frequently is misdiagnosed as Alzheimer's disease or amyotrophic lateral sclerosis. One patient received vocal cord injections of Botox by a physician who thought the issue was muscle spasms of the larynx. Apraxia of speech even has been diagnosed as mental illness.

"Because it first presents as 'just' a speech problem, some people are told, 'This is in your head.' We've seen that. It's very sad," Dr. Josephs says.

When it's caused by a stroke, apraxia of speech typically does not worsen and may get better over time. But, apraxia of speech often is ignored as a distinct entity that can evolve into a neurologic disorder, causing difficulty with eye movement, using the limbs, walking and falling that worsens as time passes.

"I don't want the take-home message to be that this condition is benign," warns Dr. Josephs. "It is a devastating disease, in some sense worse than Alzheimer's disease, which typically spares balance and walking until very late in the disease course. It may start with the person simply not being able to pronounce a few words. Six years after that, they are in a diaper, can't speak, can't walk and are drooling."

The benefit to getting an early and correct diagnosis is that people can receive appropriate therapy. "It would be good if people recognized that changes in speech can be the first signs of neurologic disease," Dr. Duffy says. "An important part of treatment is providing information about the condition."

While speech therapy doesn't reverse or halt the progression of apraxia, it can develop compensations for producing better sounds. People with apraxia of speech also can use computers or texting for alternate means of communicating.

Both the value and complexities of speech often are underappreciated. "Speech is what connects us to the world," Dr. Duffy says.

Speech is a complex brain-body achievement, these researchers note. It first requires selection of appropriate words, organizing them into a coherent message. This message activates 100 muscles between the lungs and lips to produce at least 14 distinct sounds per second that can be comprehended by a listener. A problem with speech programming - directing the muscles and structures that move - is apraxia.

People with apraxia of speech or their loved ones may notice:

Slow speech rate

Inconsistent mistakes, such as saying a word or sound correctly sometimes and not others

Impaired rhythm of speech

Groping of the mouth to make sounds

Better automatic speech, such as greetings, compared with purposeful speech

Apraxia of speech differs from aphasia, a language disorder that interferes with a patient's ability to understand or use words. Patients, however, can have apraxia of speech and aphasia.

While the cause of primary progressive apraxia of speech has not been determined, an abnormal accumulation of tau protein -- a factor also contributing to Alzheimer's disease -- has been found in the brains of those with apraxia of speech who have died.

Mayo Clinic has received National Institutes of Health grants, for which Dr. Josephs is the primary investigator, to focus on apraxia of speech in the context of neurodegenerative cognitive and motor disorders.

Drs. Josephs, Duffy and fellow researchers have published articles about their findings in Brain, the American Journal of Alzheimer's Disease & Other Dementias, Neurology and the Journal of Neurology.

http://wapo.st/1oD78CZ

Space tourism projects at a glance

A look at projects currently under development

By John Antczak | AP February 15 at 1:51 AM

Virgin Galactic later this month in Mojave, California, is preparing to roll out its new SpaceShipTwo, a vehicle the company hopes will one day take tourists to the edge of space.

It comes roughly 15½ months since an earlier incarnation was destroyed in a test flight, killing one of the pilots.

Despite the setback, the dream of sending tourists to the edge of space and beyond is still alive.

Space tourism companies are employing designs including winged vehicles, vertical rockets with capsules and high-altitude balloons.

A look at projects currently under development:

VIRGIN GALACTIC

The most prominent space tourism program, the commercial space line founded by adventurer-business mogul Sir Richard Branson will use a winged rocket plane dubbed SpaceShipTwo, successor to SpaceShipOne, which in 2004 won the $10 million Ansari X Prize that was intended to spur the industry's development.

SpaceShipTwo is designed to be flown by two pilots and carry up to six passengers on a suborbital trajectory to altitudes above 62 miles (100 kilometers), an internationally recognized boundary of space.

Like early U.S.

X-planes, Virgin Galactic's craft will be carried aloft by another aircraft, called WhiteKnightTwo, and released at about 50,000 feet before its rocket engine is ignited for a supersonic thrill ride to the fringes of space and a view of the Earth far below.

The space line says SpaceShipTwo's cabin is roomy enough for passengers to float during a few minutes of weightlessness before beginning an unpowered glide to a runway landing.

A key feature of the design is the so-called feathering system — a term derived from the feathers of a badminton projectile.

Twin tails extending rearward from the tips of each wing rotate upward as a means to slow and stabilize SpaceShipTwo as it re-enters the atmosphere.

The "feathers" then rotate back to their normal position for the rest of the glide and landing.

Virgin Galactic's first SpaceShipTwo was destroyed on Oct.

31, 2014, when a co-pilot prematurely unlocked the feathers during a powered test flight and aerodynamic forces broke the craft apart.

The co-pilot was killed but the pilot parachuted to safety.

The company will roll out its new SpaceShipTwo later this month in Mojave, California, but the timeline for testing and commercial operation has not been released.

Hundreds of people have put down deposits of $250,000 for a chance to fly into space with Virgin Galactic, which plans to operate from Spaceport America in New Mexico.

BLUE ORIGIN

Amazon founder Jeff Bezos' Blue Origin project is testing a vertical-takeoff rocket topped by a six-passenger capsule for suborbital hops.

Like Astronaut Alan Shepard's pioneering 1961 flight during Project Mercury, the capsule separates from the booster rocket and descends beneath parachutes without going into orbit around the Earth.

The unconventional twist is reusability.

Blue Origin recently conducted a test launch from Texas in which the rocket dubbed New Shepard performed a vertical landing, slowing its descent by relighting its engine as it fell back to Earth.

In January, the company launched the same rocket and it again landed intact.

Blue Origin says that during flights passengers will experience a few minutes of weightlessness after the capsule separates from the booster.

Passengers will be able to leave their seats and float about the capsule before a signal tells them to be reseated for landing.

The company has chosen Florida for its base of operations.

Details of space tourism operations have not been released.

XCOR AEROSPACE

The company has spent years developing a rocket plane named Lynx that is intended to be capable of making multiple flights each day with a pilot and one passenger aboard.

Unlike Virgin Galactic's SpaceShipTwo, the Lynx will take off under its own power from a runway, climb toward space and then glide back to a runway landing. XCOR also plans flights surpassing an altitude of 62 miles.

This undated image provided by XCOR shows the XCOR Lynx, a suborbital horizontal-takeoff, horizontal-landing, rocket-powered spaceplane under development by the California-based company XCOR. Space tourism companies are employing designs including winged vehicles, vertical rockets with capsules and high-altitude balloons. While developers envision ultimately taking people to orbiting habitats, the moon or beyond, the immediate future involves short flights into or near the lowest reaches of space without going into orbit. **(XCOR via AP) (Associated Press)**

In December, the company said it reached a milestone in development of the Lynx propulsion system by successfully using waste heat to drive essential engine parts, eliminating the need for large and heavy tanks of compressed gas.

XCOR, now headquartered in Midland, Texas, also reported progress late last year in completing structural components of its first Lynx as well as a flight simulator system for pilot training.

The company says it has more than 350 clients.

The price of booking a seat rose from $100,000 to $150,000 on Jan.

1, but the company has not said when flights will begin.

"The fact is that we are in a process in which you just can't rush things," Lynx test pilot Harry van Hulten said in press release last fall.

WORLD VIEW

The Arizona company plans to loft passengers to altitudes above 100,000 feet in a capsule suspended below a "parawing" and a helium balloon.

The trip some 19 miles high would be to "near space" but would give a substantial view of the Earth far below while avoiding the stress of G forces endured during rocket flight.

Compared to flights on rocket-powered space tourism vehicles offering a few minutes at the top of a suborbital trajectory, World View envisions spending two hours at the maximum altitude, with amenities such as a lavatory.

The two-member crew then begins the landing process by venting helium until the capsule descends to 50,000 feet.

The balloon is then released and the parawing allows the capsule to glide to a landing spot.

The company announced last month that it plans to conduct launches from Spaceport Tucson.