http://www.eurekalert.org/pub_releases/2016-06/qsoa-inl060316.php

Inbred Neanderthals left humans a genetic burden

Non-African human populations today have marginally lower fitness thanks to Neanderthal inheritance

The Neanderthal genome included harmful mutations that made the hominids around 40% less reproductively fit than modern humans, according to estimates published in the latest issue of the journal GENETICS. Non-African humans inherited some of this genetic burden when they interbred with Neanderthals, though much of it has been lost over time. The results suggest that these harmful gene variants continue to reduce the fitness of some populations today. The study also has implications for management of endangered species.

"Neanderthals are fascinating to geneticists because they provide an opportunity to study what happens when two groups of humans evolve independently for a long time--and then come back together," says study leader Kelley Harris, of Stanford University. "Our results suggest that inheriting Neanderthal DNA came at a cost."

Previous studies of DNA extracted from Neanderthal remains revealed that these Eurasian hominids were much more inbred and less genetically diverse than modern humans. For thousands of years, the Neanderthal population size remained small, and mating among close relatives seems to have been common.

Then, 50,000-100,000 years ago, groups of anatomically modern humans left Africa and moved to the homelands of their distant Neanderthal cousins. The two groups interbred, mingling their previously distinct genomes. But though a small fraction of the genome of non-African populations today is Neanderthal, their genetic contribution is uneven. Neanderthal sequences are concentrated in certain parts of the human genome, but missing from other regions.

"Whenever geneticists find a non-random arrangement like that, we look for the evolutionary forces that caused it," says Harris.

Harris and her colleague Rasmus Nielsen (University of California, Berkeley / University of Copenhagen) hypothesized that the force in question was natural selection. In small populations, like the Neanderthals', natural selection is less effective and chance has an outsized influence. This allows weakly harmful mutations to persist, rather than being weeded out over the generations. But once such mutations are introduced back into a larger population, such as modern humans, they would be exposed to the surveillance of natural selection and eventually lost.

To quantify this effect, Harris and Nielsen used computer programs to simulate mutation accumulation during Neanderthal evolution and to estimate how humans were affected by the influx of neanderthal genetic variants. The simulations incorporated data on the mutation rates, genome properties, and population dynamics of hominids.

The results suggest that Neanderthals carried many mutations with mild, but harmful effects. The combined effect of these weak mutations would have made Neanderthals at least 40% less fit than humans in evolutionary terms--that is, they were 40% less likely to reproduce and pass on their genes to the next generation.

Related conclusions were reached in an independent study that used very different methods, led by Ivan Juric at the University of California, Davis. This work is currently being peer reviewed and is available at the pre-publication preprint server bioRxiv.

Harris and Nielsen's simulations also suggest that humans and Neanderthals mixed much more freely than originally thought. Today, Neanderthal sequences make up approximately 2% of the genome in people from non-African populations. But Harris and Nielsen estimate that at the time of interbreeding, closer to 10% of the human migrants' genome would have been Neanderthal. Because there were around ten times more humans than Neanderthals, this number is consistent with the two groups acting as a single population that interbred at random. Recent DNA evidence has confirmed that the Neanderthal contribution to Eurasian genomes was higher in the past.

Although most of the harmful mutations bequeathed by our Neanderthal ancestors would have been lost within a few generations, a small fraction likely persists in people today. Harris and Nielsen estimate that non-Africans may have historically had approximately 1% lower reproductive fitness due to their Neanderthal heritage. This is in spite of the small number of Neanderthal gene variants thought to be beneficial today, including genes related to immunity and skin color.

The results also have implications for conserving endangered species. Many vulnerable populations in fragmented habitats face similar genetic problems to the Neanderthals: inbreeding, low genetic diversity, and accumulation of harmful mutations. One management strategy for overcoming these problems is genetic rescue--improving the health of an inbred population by outcrossing it with other populations.

"Genetic rescue is designed to move gene variants from an outbred population to an inbred population," says Harris. "Our results suggest managers must ensure that this movement only goes one way; otherwise harmful mutations from the inbred population may lower the fitness of the outbred group."

The Genetic Cost of Neanderthal IntrogressionKelley Harris, Rasmus Nielsen GENETICS June, 2016 Vol. 203, no. 2 881-891; DOI: 10.1534/genetics.116.186890
http://www.genetics.org/content/203/2/881

This work was supported by an NIH Ruth L. Kirschstein National Research Service Award (NRSA) to Kelley Harris, award number F32GM116381 and by National Science Foundation IR01GM109454-01 (Rasmus Nielsen)

http://www.eurekalert.org/pub_releases/2016-06/cfgr-cto060616.php

Clinical trial opens new avenues for pharmacological therapy in Down's syndrome

CRG and IMIM scientists have shown that epigallocatechin gallate together with a cognitive stimulation protocol, might improve some cognitive domains in individuals with Down's syndrome

A team of scientists led by doctors Rafael de la Torre at Hospital del Mar Medical Research Institute (IMIM) and Mara Dierssen at the Centre for Genomic Regulation (CRG) have shown that epigallocatechin gallate together with a cognitive stimulation protocol, might improve some cognitive domains in individuals with Down's syndrome.

The results of the phase 2 study will be published on 6th June in the prestigious journal The Lancet Neurology. The findings suggest that participants who had received the treatment had better scores in the visual memory recognition and inhibition tasks, and improvement in adaptive behaviour than those in the control group (placebo and cognitive training).

Though not a cure, this is the first time that a treatment has shown some effectiveness in this syndrome, and it opens the door to new research geared towards treating what was believed to be orphan of treatment.

Barcelona, 6th June 2016 - A team of scientists led by doctors Rafael de la Torre at Hospital del Mar Medical Research Institute (IMIM) and Mara Dierssen at the Centre for Genomic Regulation (CRG) have shown that epigallocatechin gallate, a compound present in green tea, together with a cognitive stimulation protocol, might improve some of the intellectual capacities in individuals with Down's syndrome, and might modify the excitability and functional connectivity of their brains.

The scientists present the results of their research in an article published in the prestigious The Lancet Neurology. Their discovery is the fruit of prolonged basic, pharmacological, and clinical research efforts, and shows the importance of research cooperation under a multidisciplinary strategy, and the commitment of the centres to conduct translational research. This is a scientific and social landmark for people with Down's syndrome and their families, and for the Catalan research system, as proof of the quality and leadership of its centres.

"This is the first time that a treatment has shown some efficacy in the improvement of some cognitive tasks in persons with this syndrome, states Dr. Dierssen, head of the Cellular and Systems Neurobiology group at the Centre for Genomic Regulation and lead author of the paper. "It must be made clear that our discovery is not a cure for Down's syndrome and that our results have to be proven in larger populations, but it may be a treatment to improve these individuals' quality of life," she adds.

According to the World Health Organization, Down's syndrome affects approximately one out of 1,000 persons in the world, and is the most common cause of genetic-origin intellectual disability. It is caused by a trisomy of chromosome 21. In other words, Down's syndrome people have three, not two, copies of chromosome 21. This causes the genes present in this chromosome to be overexpressed.

The work of the IMIM and CRG researchers focuses on the role of a compound called epigallocatechin gallate, which compensates for the excess of function of one of the genes present in chromosome 21 (DYRK1A), involved in cerebral plasticity and certain cognitive functions. The study results indicate that individuals treated with epigallocatechin gallate and a cognitive stimulation protocol had score improvements in visual recognition memory, inhibitory control, and adaptive behaviour, and that these changes might be correlated with biological changes in their cerebral connectivity.

An example of translational, multidisciplinary research

The research of Dr. Dierssen's group focuses on the molecular and behavioural analysis of learning and memory disorders in intellectual disability. Specifically, they have been studying mice models of the DYRK gene, which is responsible for many of the deficiencies of cognition and neuronal plasticity in Down's syndrome. Once the effect of an overexpression of DYRK1A was demonstrated in mice, the objective was to discover whether inhibiting it led to improved function and development of the brain. Working with another research group at the CRG led by Cristina Fillat (now at IDIBAPS), they met this goal through gene therapy, although unfortunately, the results were not applicable to humans. Once epigallocatechin gallate was proposed as a possible inhibitor of the effects of DYRK1A, Dr. Dierssen began to use this compound in her experiments, achieving results that confirmed its efficacy on mice.

To bridge the gap from preclinical research to a clinical trial, it was essential to work with a group specialized in neuropharmacology. "We were facing the great opportunity to take our results to clinical practice, and the team led by Rafael de la Torre was the best traveling partner we could have had on this journey," recalls Dr. Dierssen. She adds, "It has been a truly enriching cooperation for both sides, and a successful example of translational research in which, with basic and clinical researchers joining forces in a single project, a real-life difference is made."

The teams that led the study were the Hospital de Mar Medical Research Institute Integrated Pharmacology and Neuroscience Systems Research group of Dr. Rafael de la Torre and the Centre for Genomic Regulation Cellular and Systems Neurobiology group of Dr. Mara Dierssen, which have had the support of other professionals from Hospital de Mar and a number of organizations and foundations (Catalan Down Syndrome Foundation, the Espai Salut Foundation, and the Catalan Fragile X Syndrome Association). The study has been the work of a multidisciplinary team approaching the same problem from a number of different angles, with the participation of neuroscience experts, pharmacologists, biochemists, geneticists, neuropsychologists, neurophysiologists and neuroimaging specialists.

Epigallocatechin gallate and stimulation, an inseparable partnership for success

The work just published by the researchers in The Lancet Neurology presents the results of a clinical trial led by the Integrative Pharmacology and Systems Neuroscience Research group of Dr. Rafael de la Torre with 84 persons with Down's syndrome aged 16 to 34 years. "The results suggest that individuals who received treatment with the green tea compound, together with the cognitive stimulation protocol, had better score in their cognitive capacities," states Dr. de la Torre. However, studies in larger populations have still to be done.

Epigallocatechin gallate was known to inhibit the excess of the DYRK1A gene, and the success achieved in previous studies with mice suggested that the treatment could also work for human beings. The scientists studied more than the cognitive effects on the study participants. They also conducted neuro-imaging tests to determine whether the improvement was attributable to physical or neurophysiological changes in the brain. "It was surprising to see how the changes are not just cognitive--in the reasoning, learning, memory and attention capacities--but suggest that the functional connectivity of the neurons in the brain was also modified" says Dr. de la Torre.

Drs. Dierssen and de la Torre have plans to continue this research, and will soon launch a clinical trial in children with Down's syndrome. "Our results have been already marginally positive in the adult population, in which cerebral plasticity is limited because the brain is already completely developed. We believe that if the treatment is applied to children, the results might be even better," say the researchers. Now the volunteers and necessary financing must be secured for this new clinical trial. Also, clinical trials in larger populations are essential to ensure positive effects and safety of the treatment to make recommendations for patients.

A challenge at all levels, but with great rewards

Carrying out this study has been a major challenge at a number of levels. In the first place, Down's syndrome was generally believed to be untreatable, and the proposal for a treatment has resituated the way this syndrome is approached by the scientific and medical communities. Also, the researchers had to develop new and more sensitive test batteries to measure the possible improvement of study participants. Now, the scientific community will have access to this information for future research projects in this field.

This project has rendered outcomes that are already available for the Down's syndrome community. For example, researchers collaborated in the design a product to dispense the epigallocatechin gallate to the clinical trial participants. It faces both the swallowing difficulties and nutritional problems of some individuals with Down's syndrome. The program to administer the cognitive stimulation protocol used in this clinical trial is available. The researchers are also building a new improved videogame to train memory, attention and executive functions. Even though, families aiming to follow up with this project and to continue in touch with researchers, can follow a specific Facebook page launched to this end.

Last, the greatest reward has been the social involvement around the study. The research now being presented was made possible by the support and cooperation of leading organizations and foundations that have contributed to the project. Mainly the Jérôme Lejeune Foundation with the additional contribution of the Institute of Health Carlos III, the 'la Caixa' Foundation, as well as the Catalan Down Syndrome Foundation, and the Down España Foundation. But it is also important to highlight the participation and involvement of many initiatives from smaller organizations, or even private proposals that have made this project a true instrument of social change.

The donations from private citizens have made it possible for this study to now come to light, in crowdfunding platforms such as Precipita promoted by the Spanish Foundation for Science and Technology, the campaign "Shortening distances, approaching capacities" of the Friends of the Hospital de Mar (Amics de l'Hospital del Mar), in which three swimmers crossed the Strait of Gibraltar and returned, or popular initiatives like the one by students from the La Salle school in Mollerussa, that are currently running a photo contest and campaign for this project.

De la Torre et al. 'Safety and efficacy of cognitive training plus epigallocatechin--3--gallate for cognitive improvement in young adults with Down syndrome (TESDAD): a double--blind, randomised controlled, phase 2 trial". Lancet Neurology. June 6, 2016.
http://dx.doi.org/10.1016/S1474--4422(16)30034--5
Comment at Lancet Neurology:
Pharmacotherapy in Down's syndrome: which way forward? Jamie O Edgin, Departments of Psychology, Neurology, the BIO5 Institute, and Evelyn F McKnight Brain Institute, University of Arizona, USA. Lancet Neurology. June 6, 2016.

http://www.eurekalert.org/pub_releases/2016-06/kcl-btt060616.php

Blood test to personalize depression treatment for the first time

Scientists at King's College London have developed a blood test that accurately and reliably predicts whether depressed patients will respond to common antidepressants, which could herald a new era of personalised treatment for people with depression.

Guided by this test, patients with blood inflammation above a certain threshold could be directed towards earlier access to more assertive antidepressant strategies, such as a combination of antidepressants, before their condition worsens.

Approximately half of all depressed patients do not respond to first-line antidepressants and a third of patients are resistant to all available pharmacological treatments. Until now, it has been impossible to establish if individual patients will respond to common antidepressants or if they need a more assertive antidepressant treatment plan, which may include a combination of more than one medication.

As a result, patients are treated with a trial-and-error approach whereby one antidepressant is tried after another, often for 12 or more weeks for every type of antidepressant. This can result in long periods of ineffective antidepressant treatment for individuals who may not show an improvement in symptoms anyway.

The study, published today by The International Journal of Neuropsychopharmacology, focused on two biomarkers that measure blood inflammation, as previous studies have already shown that elevated levels of inflammation are associated with poor response to antidepressants.

They measured the quantity of two biomarkers - of Macrophage Migration Inhibitory Factor (MIF) and interleukin (IL)-1β- in two independent clinical samples of depressed patients, before or after they took a range of commonly prescribed antidepressants.

The researchers found that blood test results above a specified threshold level could precisely and reliably predict the probability of individuals responding to the treatments. Patients with levels of MIF and IL-1βabove the thresholds showed a 100 per cent chance of not responding to conventional, commonly prescribed antidepressants. Those with inflammation below the suggested threshold could be expected to respond to first-line antidepressants, according to the study authors.

The two biomarkers examined in the study are both thought to be important in predicting how people with depression respond to antidepressants, as they are involved in several brain mechanisms relevant to depression. These include the birth of new brain cells and connections between them, as well as the death of brain cells through a process called 'oxidative stress.'Oxidative stress occurs when the body both overproduces and then struggles to remove molecules called 'free radicals.'These free radicals break down brain connections and disrupt the brain's chemical signalling, which in turn can lead to the development of depressive symptoms by reducing the brain's protective mechanisms.

Professor Carmine Pariante from the Institute of Psychiatry, Psychology & Neuroscience (IoPPN) at King's College London and senior author of the study, said: 'The identification of biomarkers that predict treatment response is crucial in reducing the social and economic burden of depression, and improving quality of life of patients.

'This study provides a clinically-suitable approach for personalising antidepressant therapy - patients who have blood inflammation above a certain threshold could be directed toward earlier access to more assertive antidepressant strategies, including the addition of other antidepressants or anti-inflammatory drugs.'

Dr Annamaria Cattaneo, first author from the IoPPN at King's College London, said: 'This is the first time a blood test has been used to precisely predict, in two independent clinical groups of depressed patients, the response to a range of commonly prescribed antidepressants.

'These results also confirm and extend the mounting evidence that high levels of inflammation induce a more severe form of depression, which is less likely to respond to common antidepressants.'

Dr Cattaneo added: 'This study moves us a step closer to providing personalised antidepressant treatment at the earliest signs of depression.

'It is really crucial now to carry out a clinical study comparing the current clinical practice in antidepressant prescription, based on trial-and-error, with our novel approach of 'personalised psychiatry', where the antidepressant treatment plan is guided by the blood test.'

This research was funded by the Medical Research Council and the NIHR Maudsley Biomedical Research Centre.

http://www.eurekalert.org/pub_releases/2016-06/jqum-eff060616.php

Early farmers from across Europe were direct descendants of Aegeans

International research team led by Mainz paleogeneticists demonstrates that farming was spread into and across Europe by people originating in modern-day Greece and Western Turkey

For most of the last 45,000 years Europe was inhabited solely by hunter-gatherers. About 8,500 years ago a new form of subsistence - farming - started to spread across the continent from modern-day Turkey, reaching central Europe by 7,500 years ago and Britain by 6,100 years ago. This new subsistence strategy led to

profound changes in society, including greater population density, new diseases, and poorer health. Such was the impact of farming on how we live that scientists have debated for more than 100 years how it was spread across Europe. Many believed that farming was spread as an idea to European hunter-gatherers but without a major migration of farmers themselves.

This week, an international research team led by paleogeneticists of Johannes Gutenberg University Mainz (JGU) publishes a study in the journal Proceedings of the National Academy of Sciences of the United States of America showing that early farmers from across Europe have an almost unbroken trail of ancestry leading back to the Aegean. The scientists analyzed the DNA of early farmer skeletons from Greece and Turkey. According to the study, the Neolithic settlers from northern Greece and the Marmara Sea region of western Turkey reached central Europe via a Balkan route and the Iberian Peninsula via a Mediterranean route. These colonists brought sedentary life, agriculture, and domestic animals and plants to Europe. During their expansion they will have met hunter-gatherers who lived in Europe since the Ice Age, but the two groups mixed initially only to a very limited extent. "They exchanged cultural heritage and knowledge, but rarely spouses," commented anthropologist Joachim Burger, who lead the research. "Only after centuries did the number of partnerships increase."

Professor Joachim Burger, his Mainz paleogeneticist team, and international collaborators have pioneered paleogenetic research of the Neolithization process in Europe over the last seven years. They showed a lack of interbreeding between farmers and hunter-gatherers in prehistoric Europe in 2009 and 2013 (Bramanti et al. 2009; Bollongino et al. 2013). Now, they demonstrate that the cultural and genetic differences were the result of separate geographical origins. "The migrating farmers did not only bring a completely foreign culture, but looked different and spoke a different language," stated Christina Papageorgopoulou from Democritus University of Thrace, Greece,, who initiated the study as a Humboldt Fellow in Mainz together with Joachim Burger.

The study used genomic analysis to clarify a long-standing debate about the origins of the first European farmers by showing that the ancestry of Central and Southwestern Europeans can be traced directly back to Greece and northwestern Anatolia. "There are still details to flesh out, and no doubt there will be surprises around the corner, but when it comes to the big picture on how farming spread into Europe, this debate is over," said Mark Thomas of University College London (UCL), co-author on the study. "Thanks to ancient DNA, our understanding of the Neolithic revolution has fundamentally changed over the last seven years."

Sedentary life, farming, and animal husbandry were already present 10,000 years ago in the so-called Fertile Crescent, a region covering modern-day Turkey, Syria, Iran, and Iraq. Zuzana Hofmanová and Susanne Kreutzer, the lead authors of the study, concluded: "Whether the first farmers came ultimately from this area is not yet established, but certainly we have seen with our study that these people, together with their revolutionary Neolithic culture, colonized Europe through northern Aegean over a short period of time."

Another study has shown that the spread of farming, and farmers, was not the last major migration to Europe. Approximately 5,000 years ago people of the eastern Steppe reached Central Europe and mixed with the former hunter-gatherers and early farmers. The majority of current European populations arose as a mixture of these three groups.

http://www.eurekalert.org/pub_releases/2016-06/cmon-lhn060616.php

Lucy had neighbors: A review of African fossils

Confirms co-existence of multiple early human species during middle Pliocene

Cleveland - If "Lucy" wasn't alone, who else was in her neighborhood? Key fossil discoveries over the last few decades in Africa indicate that multiple early human ancestor species lived at the same time more than 3 million years ago. A new review of fossil evidence from the last few decades examines four identified hominin species that co-existed between 3.8 and 3.3 million years ago during the middle Pliocene. A team of scientists compiled an overview that outlines a diverse evolutionary past and raises new questions about how ancient species shared the landscape.

The perspective paper, "The Pliocene hominin diversity conundrum: Do more fossils mean less clarity?" will be published June 6, 2016 as part of a Human Origins Special Feature in the Early Edition of the Proceedings of the National Academy of Sciences.

Authors Dr. Yohannes Haile-Selassie and Dr. Denise Su of The Cleveland Museum of Natural History and Dr. Stephanie Melillo of the Max Planck Institute for Evolutionary Anthropology in Germany provide an up-to-date review of middle Pliocene hominin fossils found in Ethiopia, Kenya and Chad. The researchers trace the fossil record, which illustrates a timeline placing multiple species overlapping in time and geographic space. Their insights spur further questions about how these early human ancestors were related and shared resources.

"It is now obvious that more than one species of early hominin co-existed during Lucy's time," said lead author Dr. Yohannes Haile-Selassie, curator of physical anthropology at The Cleveland Museum of Natural History. "The question now is not whether Australopithecus afarensis, the species to which the famous Lucy

belongs, was the only potential human ancestor species that roamed in what is now the Afar region of Ethiopia during the middle Pliocene, but how these species are related to each other and exploited available resources."

The 1974 discovery of Australopithecus afarensis, which lived from 3.8 to 2.9 million years ago, was a major milestone in paleoanthropology that pushed the record of hominins earlier than 3 million years ago and demonstrated the antiquity of human-like walking. Scientists have long argued that there was only one pre-human species at any given time before 3 million years ago that gave rise to another new species through time in a linear manner. This was what the fossil record appeared to indicate until the end of the 20th century. The discovery of Australopithecus bahrelghazali from Chad in 1995 and Kenyanthropus platyops from Kenya in 2001 challenged this idea. However, these two species were not widely accepted, rather considered as geographic variants of Lucy's species, Australopithecus afarensis. The discovery of the 3.4 million-year-old Burtele partial foot from the Woranso-Mille announced by Haile-Selassie in 2012 was the first conclusive evidence that another early human ancestor species lived alongside Australopithecus afarensis. In 2015, fossils recovered from Haile-Selassie's ongoing research site at the Woranso-Mille area of the Afar region of Ethiopia were assigned to the new species Australopithecus deyiremeda. However, the Burtele partial foot was not included in this species.

"The Woranso-Mille paleontological study area in Ethiopia's Afar region reveals that there were at least two, if not three, early human species living at the same time and in close geographic proximity," said Haile-Selassie. "This key research site has yielded new and unexpected evidence indicating that there were multiple species with different locomotor and dietary adaptations. For nearly four decades, Australopithecus afarensis was the only known species -- but recent discoveries are opening a new window into our evolutionary past."

Co-author Dr. Denise Su, curator of paleobotany and paleoecology at The Cleveland Museum of Natural History, reconstructs ancient ecosystems. "These new fossil discoveries from Woranso-Mille are bringing forth avenues of research that we have not considered before," said Su. "How did multiple closely related species manage to co-exist in a relatively small area? How did they partition the available resources? These new discoveries keep expanding our knowledge and, at the same time, raise more questions about human origins."

Paleoanthropologists face the challenges and debates that arise from small sample sizes, poorly preserved prehistoric specimens and lack of evidence for ecological diversity. Questions remain about the relationships of middle Pliocene hominins and what adaptive strategies might have allowed for the coexistence of multiple, closely related species.

"We continue to search for more fossils," said Dr. Stephanie Melillo of the Max Planck Institute for Evolutionary Anthropology in Germany. "We know a lot about the skeleton of A. afarensis, but for the other middle Pliocene species, most of the anatomy remains unknown. Ultimately, larger sample sizes will be the key to sorting out which species are present and how they are related. This makes every fossil discovery all the more exciting."

The Woranso-Mille Project:

The Woranso-Mille Paleontological project conducts field and laboratory work in Ethiopia every year. This multidisciplinary project is led by Dr. Yohannes Haile-Selassie of The Cleveland Museum of Natural History. Graduate and undergraduate students from Ethiopia and the United States of America also participate in the field and laboratory activities of the ongoing project.

Support:

The Authority for Research and Conservation of Cultural Heritage (ARCCH) of the Ministry of Culture and Tourism of the Ethiopian government annually issues fieldwork research permit to the Woranso-Mille project. The National Museum of Ethiopia and the Directorate of Collections, Curation, and Laboratory Services of ARCCH provide laboratory research facility and fossil storage space. The Afar Regional State, Mille District administration, and the local Afar people of Waki and Waytaleyta areas facilitate the fieldwork. The Woranso-Mille project field and laboratory work are financially supported by grants from the L.S.B, Leakey Foundation, the National Geographic Society, The Cleveland Museum of Natural History and the National Science Foundation.

http://bit.ly/1RZtYLU

Sorting Out Lucy's Neighbours

Pliocene Hominin Diversity – Neighbours for Lucy

By Mike, June 7, 2016

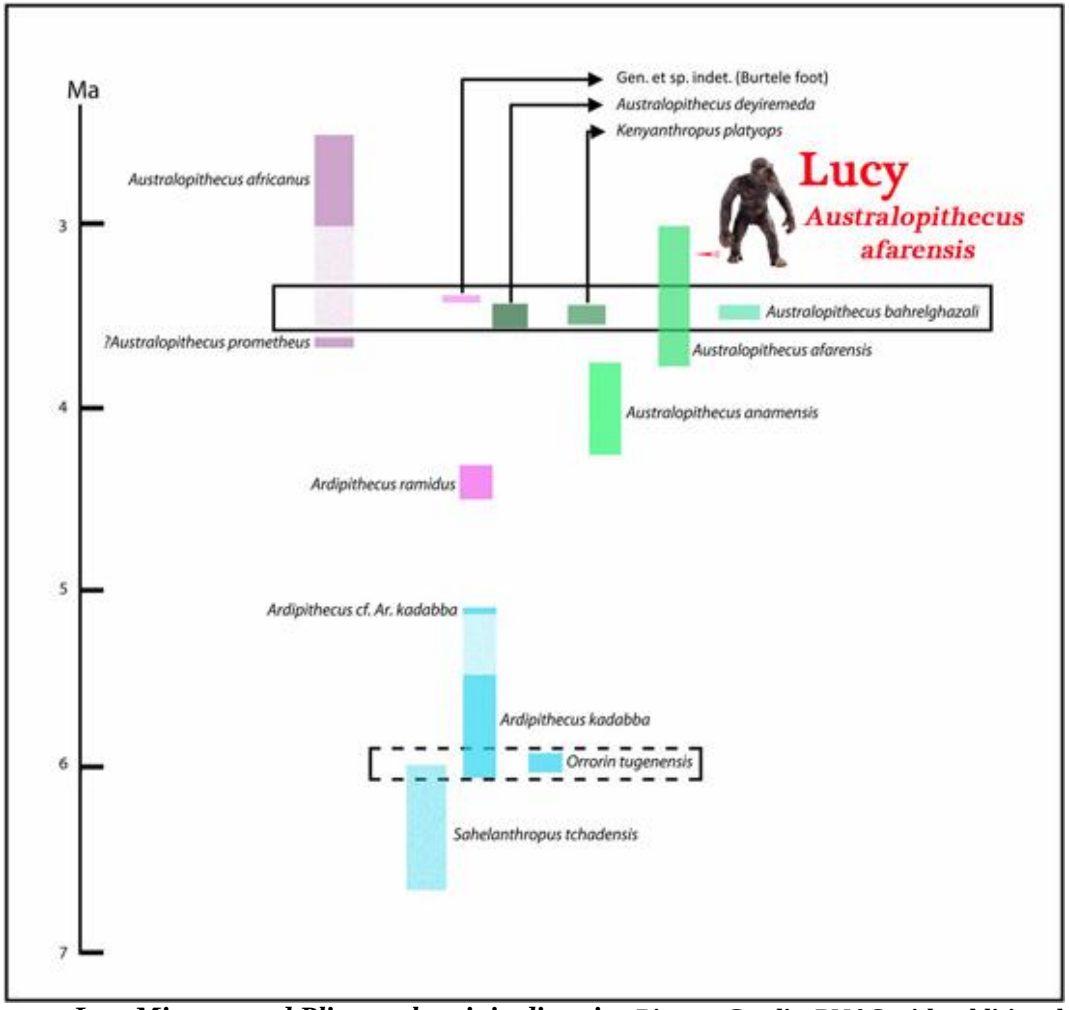
Anthropologists have discovered that the human family tree, that branch of the hominins that led ultimately to our own species *H. sapiens*, is very complicated. We might like to think that our own evolution was pre-destined, once the first apes that left the trees and started to walk upright on a regular basis, our big-brained species was bound to come along, but that does not seem to be the case. For example, scientists have now concluded that there were at least four species of hominin present in Europe and Asia up until relatively recently. In a new paper, published in the "Proceedings of the National Academy of Sciences", researchers have reviewed Late and Middle Pliocene hominin fossils and concluded that there were multiple species of early hominins around between 3.8 and 3.3 million years ago. It seems that "Lucy" the most famous example of *Australopithecus afarensis* had company – lots of company in fact.

All Early Hominin Fossils Packed into a Suitcase

Four decades ago, the number of early hominin fossils discovered in eastern Africa was very low. We recall anthropologists joking, but with some degree of

truth, that the entire east African hominin fossil record could be packed into a single, large suitcase. However, recent fossil discoveries have greatly increased the amount of fossil material known and raised the possibility that early hominins in Africa were at least as speciose as later members of the human family tree.

Late Miocene and Pliocene Hominin Chronological Distribution



Late Miocene and Pliocene hominin diversity. **Picture Credit: PNAS with additional annotation by Everything Dinosaur**

The graph above plots the current recognised species of Late Miocene and Early Pliocene hominin species over the last seven million years or so. The different coloured columns represent different taxa and the length of each column equates to the approximate length of time that each taxon is known to have existed. Dotted parts indicate uncertainty in the age of a taxon or the absence of fossils from that particular time span. Lucy, as a member of the Australopithecines (southern apes), and an *A. afarensis* represents a species that lived from approximately 3.9 million years ago to around 3 million years ago. The solid, black line forming a rectangle shape on the timeline around 3.6 million years ago shows the presence of multiple hominin species during the Middle Pliocene. It seems that *Australopithecus afarensis* had lots of other hominin species for company.

In the diagram above, the dashed rectangle situated around the 6 million years ago mark, indicates possible hominin diversity as far back as the Late Miocene, if the three earliest named hominin species represent different taxa.

An Update on Pliocene hominin fossils from Africa

The authors of the scientific paper, Dr. Yohannes Haile-Selassie and Dr. Denise Su (The Cleveland Museum of Natural History), in collaboration with their colleague Dr. Stephanie Melillo (Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany), have compiled a detailed review of the current fossil material of early hominins, collating data from fossil discoveries from Ethiopia, Chad and Kenya. This review demonstrates the complexity of the early hominin evolutionary tree and it raises the intriguing question, how did these early humans relate to each other? For example, was there niche partitioning taking place? How did these different species compete for resources?

Lead author of the report, Dr. Yohannes Haile-Selassie (Curator of Physical Anthropology at The Cleveland Museum of Natural History), commented:

"It is now obvious that more than one species of early hominin co-existed during Lucy's time. The question now is not whether Australopithecus afarensis, the species to which the famous Lucy belongs, was the only potential human ancestor species that roamed in what is now the Afar region of Ethiopia during the middle Pliocene, but how these species are related to each other and exploited available resources."

***Dr. Yohannes Haile-Selassie Holds a Cast of the Jaws of* Australopithecus deyiremeda**

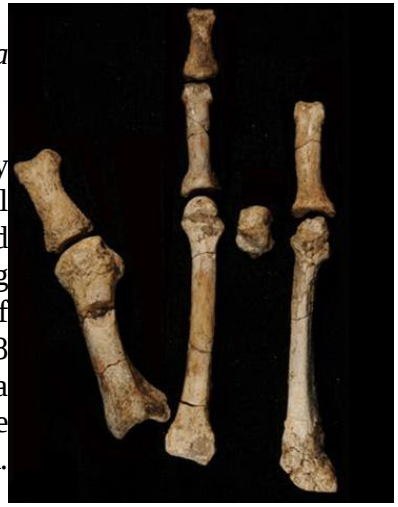
A cast of the jaws of* A. deyiremeda *an Australopithecine from northern Ethiopia.
Picture Credit: Laura Dempsey

Australopithecus deyiremeda

The idea that a number of Australopithecines co-existed is not new. Back in 2015, Everything Dinosaur reported on the discovery of *Australopithecus deyiremeda* by a team of researchers led by Dr. Yohannes Haile-Selassie. This new species was named after four fragmentary pieces of fossil jaw bone complete with teeth, which represented three individuals had been discovered in the Woranso-Mille area of the Afar region in March 2011.

To read about the *Australopithecus deyiremeda* research: A New Face to the Human Family Tree

Putting an Evolutionary Foot In It!



The paucity of the fossil record and the highly fragmentary nature of most of the known fossil material makes interpreting the fossil record extremely difficult. Perhaps the most compelling evidence for the presence of more than one type of early human species in eastern Africa between 3.8 and 3.3 million years ago, was the discovery of a partial foot (the Burtele foot), in the Woranso-Mille region of Afar, the same area where the jaws of *A. deyiremeda* were discovered.

A partial right foot with an opposable big toe representing an as yet not described species of early human. **Picture Credit: The Cleveland Museum of Natural History/ Dr. Yohannes Haile-Selassie**

The specimen (BRT-VP-2/73), is photographed above in the correct anatomical position. These bones represent the right foot and the bones on the left of the picture are the big toe (hallux). Researchers have concluded that this digit was opposable, so the foot was also used for grasping. The foot bones, referred to as the "Burtele foot", come from strata that is little younger than the strata where the jaw bone fossils of *Australopithecus deyiremeda* were found. However, it is possible that these two species may have co-existed.

The foot represents a species that was contemporaneous with *A. afarensis* and probably several other early hominin species too. Assessment of the walking abilities of the creature represented by the Burtele foot, indicates that its locomotion was different from that of *A. afarensis*, perhaps the foot bones provide evidence to support the idea that a more ancient human-like species, *Ardipithecus ramidus* persisted much longer than previously thought, or these foot bones could represent an as yet unknown species.

Commenting on the need to continue to explore eastern Africa to help unravel this early human puzzle, Dr. Stephanie Melillo of the Max Planck Institute stated:

"We continue to search for more fossils. We know a lot about the skeleton of A. afarensis, but for the other Middle Pliocene species, most of the anatomy remains unknown. Ultimately, larger sample sizes will be the key to sorting out which species are present and how they are related. This makes every fossil discovery all the more exciting."

http://bit.ly/1Ohn0XV

Eating Fat Doesn't Make You Fat, Study Finds

Eating Fat Doesn't Make You Fat, Study Finds

By Sara G. Miller, Staff Writer | June 6, 2016 06:30pm ET

It seems logical to think that eating a high-fat diet would tip the scale upward, but a new study suggests that might not be the case. What's more, eating more of certain types of fats may help move the scale in the other direction.

Men and women in the study who followed a high-fat, Mediterranean diet that was rich in either olive oil or nuts lost more weight and reduced their waist circumference more than the people in the study who were simply instructed to reduce their fat intake, according to the study.

The Mediterranean diet, rich in healthy fats and plant proteins, has been linked in previous studies to a wide range of health benefits, including a reduced risk of heart disease and type 2 diabetes — two conditions that are also linked to obesity. [5 Diets That Fight Diseases]

But despite such benefits, "obese people [have] continued to be reluctant to eat vegetable fats such as extra-virgin olive oil and nuts, because they believe these foods lead to weight gain," said Dr. Ramon Estruch, an internal medicine physician at the University of Barcelona in Spain and the lead author of the study.

The findings of the new study show, on the other hand, that a diet rich in dietary fats and vegetables, such as the Mediterranean diet, does not promote weight gain, Estruch said.

In the study, the researchers looked at data on people who had participated in the PREDIMED trial, a five-year study in Spain that looked at the effects of the Mediterranean diet on heart health. There were nearly 7,500 older adults in the study, the majority of whom were overweight or obese and all of whom had either type 2 diabetes or at least three risk factors for heart disease.

The people in the study were asked to follow one of three diets: a Mediterranean diet with at least 4 tablespoons of extra-virgin olive oil each day, a Mediterranean diet with at least three servings of nuts each week or a control diet, where the participants were advised to generally avoid fat in their diet.

Both olive oil and nuts contain relatively high amounts of fat, but the fat in them is primarily monounsaturated fat, which is thought to be better for health than the saturated fat found in animal-based foods such as meat and cheese.

The study received funding from both olive oil and nut industry groups. However, these funders had no role in designing the study, in collecting, analyzing and interpreting the data or in writing the report, the researchers wrote in the study, published today (June 6) in the journal The Lancet Diabetes & Endocrinology.

The researchers found that after five years, the people in the olive oil group had lost a small but statistically significant amount of weight, compared to the control group: The people in the olive oil group lost about 1 lb. (0.4 kilograms) more, on average, than those in the control group.

The people in the nut group also lost a small amount of weight as well, compared to the control group. However, the difference between the olive oil group and the nut group was not statistically significant (meaning it could have been due to chance).

In addition, both the olive oil and nut groups experienced slight reductions in their waist circumferences compared to the control group, according to the study.

The key finding is that neither diet, although rich in fats, led to weight gain or increases in waist circumference, Estruch told Live Science.

The researchers noted that although the participants in the olive oil and nut groups were not instructed to limit their calorie intake, the people in both groups did end up consuming fewer calories on average than they had consumed before the study started. This may have been due to the filling effects of fat, the researchers wrote in their study.

Maintaining a certain body weight requires balancing the calories you consume versus the calories you burn, but it seems that calories from vegetable fats have different effects on weight than calories from animal fats, Estruch said. [10 New Ways to Eat Well]

Though the participants in the study were overweight or obese older adults, Estruch said that he believes that the benefits of the Mediterranean diet on weight and waist circumference could extend to people of any age and weight, including young men and women.

This is not the first study to suggest that eating more plant-based fats does not lead to a larger waistline.

The results of this study are consistent with a range of observational studies suggesting that eating more fat is not linked to a change in people's weights, said Dr. Dariush Mozaffarian, a cardiologist and the dean of the Friedman School of Nutrition Science and Policy at Tufts University, who was not involved in the new study. Mozaffarian wrote an editorial that was published alongside the study in the journal.

People should focus more on eating healthy foods, rather than worrying about dietary fats, Mozaffarian told Live Science.

The new study may in fact have underestimated the health benefits of the Mediterranean diet, Mozaffarian added. Because the study took place in Spain, where people already eat a Mediterranean-style diet, there may not have been as big a change in eating patterns as there would have been if people had shifted from an American-style diet, for example, he said.

http://bit.ly/1UIj6nd

Flamingo stars turn pink when they gobble iron-rich planets

A star is what it eats. Consuming a planet or two early in its life may explain why some young stars are iron-rich – and those habits can change its colour.

By Conor Gearin

Last year, a team of scientists led by Lorenzo Spina of the University of São Paulo, Brazil, suggested a young, particularly iron-rich star may have gotten its metals from eating a planet early in its development.

Now, Emanuele Tognelli and Pier Giorgio Prada Moroni of the University of Pisa, Italy, have shown how that star's planet-eating habits can change its colour.

The pair used computer simulations to compare what happens when planets of various sizes – from Earth-like to 50 times more massive – get enveloped by the outer layer of a young star.

This showed that swallowing one or more planets containing iron is enough to change the chemical make-up of the star, giving it a reddish tint.

"The main effect of the planet ingestion is to increase the metal content in the outer region of the star," the researchers told New Scientist. The metals absorb light in shorter, bluer wavelengths, making its red hues more prominent.

Hungry stars

It's similar to how flamingos become pinker with every pigment-rich shrimp they slurp – but on a solar scale.

Since this happens early on in a star's evolution, it's hard to say if more mature stars had planet-eating habits in their youth. But it's possible that our sun ate one or more planets long ago, say Tognelli and Prada Moroni.

Spina says the study did a good job of simulating what happens to small stars that eat planets. "The model is excellent," he says. "It takes into account all the effects produced by such a dramatic event."

There's still much more to learn, though. "We do not know if stars often ingest planets," Spina says. And since a star gulps a planet down quickly, it's probably a tricky event to watch in real time. "The change in colour due to a planet engulfment episode has not been observed yet, and probably is still difficult to spot," he says. *Journal reference: arXiv, arxiv.org/abs/1605.07920*

http://bit.ly/1WJ1hL4

From dark gravity to phantom energy: what's driving the expansion of the universe?

There is something strange happening in the local universe, with galaxies moving away from each other faster than expected.

There are two broad ways to measure the expansion of the universe. One is based on the cosmic microwave background, shown here, along with our own galaxy viewed in microwave wavelengths. ESA, HFI & LFI consortia (2010)

There is something strange happening in the local universe, with galaxies moving away from each other faster than expected.

What is driving this extra expansion, and what does it mean for the cosmos? To explore this, let's start with the observations.

The rate of cosmic expansion is encapsulated in the "Hubble constant", although don't let the name fool you, as it's not a constant and changes as the universe expands.

To determine this constant, astronomers must relate the distances to galaxies to the velocity they're travelling away from us. But measuring astronomical distances has always proven difficult. This is because we lack convenient signposts, known as standard candles and rulers, to chart the heavens.

So astronomers have built up cosmic distances through a series of steps, using overlapping methods to span the heavens. But each step in this cosmological distance ladder has its own quirks and uncertainties, and extraordinary effort over many decades has been expended to calibrate the various methods.

A new paper has pushed this calibration even harder, using a number of methods to tie down the Hubble constant to an accuracy of 2.4% within a few hundred million light years (which is local by cosmic standards).

A great success! But there's a problem.

We can also determine the universal expansion from observations of the cosmic microwave background, which is the radiation leftover from the Big Bang.

Unlike local observations, this reveals the global expansion of the universe. And this is where the problems begin, as this global expansion is 9% slower than that seen in the local universe. In both measurements, the astronomers have worked hard to reduce the uncertainties, and so are confident this difference is valid.

So what can explain this tension in cosmic measurement? Here are a few of the contenders.

Cosmic contenders

Dark matter The first potential culprit is dark matter, the dominant mass in the universe. We know it is not smoothly spread through space, so perhaps the lumps and bumps, like the galaxies and clusters of galaxies, are exacting less gravitational pull in the local universe.

Perhaps we are in a cosmic void, a region whose density is below the universal average.

If this were the case, we would have to be inhabiting a strange corner of the universe, sitting at the centre of immense emptiness not very unlike anything expected in our cosmological ideas.

Dark energy And then there is dark energy, the dominant energy in the universe. This component is responsible for accelerating the cosmic expansion, but is assumed to have a very simple form, eternal and unchanging over all of history.

But what if dark energy is dynamic and evolving, changing its properties as the universe expands? If it changed quite recently (in cosmic terms), the additional expansion could be imprinted on the local universe, but have not yet impacted the global expansion.

If this is the case, the universe has something to worry about, as this new form of dark energy would be a "phantom", driving universal expansion faster and faster into a "big rip", which is more dramatic than it sounds.

A diagram representing the evolution of the universe, starting with the Big Bang to present day. The red arrow marks the flow of time. New research suggests it's expanding even faster than shown here. NASA/GSFC

Dark radiation Another potential solution is "dark radiation", which consists of hyper-fast particles that zipped around in the early universe.

While there is no single definition on what constitutes dark radiation, a favoured candidate is a new member of the neutrino family, affectionately known as sterile neutrinos.

While dark radiation is theoretical, there is little observational evidence for its existence. But if it had been present in the early universe, it would have influenced the early expansion of the universe, which would still be imprinted on the global value of the Hubble constant, but would now be washed out of the local value.

Dark gravity The potential solutions so far have considered modifying the properties of components in the universe, but there is the more drastic alternative: dark gravity.

This suggests that we don't fully understand the fundamental nature of the universe, and that gravity does not follow the rules laid out by Albert Einstein in his general theory of relativity.

Such theories of modified gravity have existed for a long time, and come in many forms, and it is not clear how we deduce the impact of such gravity on the universal expansion.

Dark speculations

So there are several alternatives that could potentially explain the discrepancy between the local and global measurements of the Hubble constant. Which one is correct?

At the moment, the observations are rather raw and do not discriminate between the possibilities. And so we enter the realm of theoretical speculation, where ideas are tried and discarded until viable explanations are discovered.

At the same time, astronomers will seek more data, and will continue to tie down calibrations and methods. This brings us to our final possibility.

No observations are perfect, and much of science is about understanding the uncertainties of measurements. Scientists can generally wrangle random errors and understand how uncertainties in measurement impact uncertainties in results.

But there is another uncertainty: the systematic error, which can strike fear into a researcher. Instead of scattering results, systematic errors shift all results one way or another.

Systematic errors can also influence astronomical distance measures. And if they propagate through the distance ladder, they could potentially shift the local measurement of the Hubble constant away from the global value.

With new data and methods, this tension may evaporate. Some astronomers are already suggesting that this is a “more reasonable explanation”.

http://www.bbc.com/news/health-36458483

Cancer needs Ebola-level action - Biden

The hunt for a cancer cure should be treated with as much urgency as the Ebola outbreak, says US Vice-President Joe Biden.

By James Gallagher Health editor, BBC News website in Chicago

He said he had dreamed of being the president that cured cancer and believed it was possible. He is now leading the US "cancer moonshot" programme to cure cancer. He told scientists their success could "literally change the world" but criticised the barriers to getting on clinical trials.

In a speech to American Society of Clinical Oncology annual meeting he said: "[When] we were worried about Ebola we were able to aggregate tens of millions of dollars and the entire US military because the World Health Organization couldn't handle it. "That's the kind of urgency we need with regard to cancer."

In January, President Barack Obama announced the $1bn (£710m) "moonshot" and that Joe Biden would lead it. The vice-president said: "If I could have done anything I would have wanted to be the president that ended cancer as we know it because I believe it is now possible."

It is a personal mission for Mr Biden, who lost his son Beau to brain cancer at the age of 46 last year.

He told the meeting of 30,000 of the world's leading cancer scientists and doctors that his son had been able to take part in pioneering clinical trials.

But "what about the 96% of people" who miss out, he asked, and called for new measures to help the poorest patients take part.

"Nobody should have to forgo a critical clinical trial because they cannot afford the gas to get there or a baby sitter at home," he said.

His speech referenced many of the major themes that have emerged at the meeting in Chicago including the transformative power of immunotherapy and the unparalleled understanding of the genetics of cancer.

"[They are] offering profound promise that wasn't there five years ago," he said.

But Mr Biden said the progress could be much faster if only scientists worked closely together.

He said: "Imagine if we all worked together... shared the data behind breakthroughs so that the field as a whole can move forward faster and avoid unnecessary redundancy.

"The whole world is looking to you, your success can literally change the world. We need you now more than we ever have."

Huge breakthroughs

Dr Deborah Mayer, one of the expert advisers to the moonshot, said there had been terrific progress in cancer science and the field was now at a "tipping point".

Huge breakthroughs in harnessing the power of the immune system to attack tumours or in tailoring drugs to the weak spot in individual patients' tumours are already helping patients.

In the US, five-year cancer survival has increased from 30% in 1950 to 48% in 1975 and 68% in 2010.

Dr Mayer told the BBC News website that the moonshot would act as a catalyst to bring breakthroughs to patients faster.

"Hopefully it will close that 17-year gap between what we know and what we do.

"The benefit to patients of this moonshot is we will move forward to enhanced treatments, we're going to find cancers earlier when they're more curable and we're going to figure out how to prevent them."

The American Society of Clinical Oncology has recommended four key areas the moonshot needs to deal with.

- ***Shortening the time needed to perform trials and bring drugs to market***
- ***Developing tests that show which targeted therapies will benefit patients***
- ***Increasing data sharing between companies, researchers and hospitals***
- ***Boosting collaboration in the cancer field***

The organisation's president Dr Julie Vose said: "The Moonshot Initiative can be a vehicle for major new progress against cancer."

http://www.eurekalert.org/pub_releases/2016-06/uorm-ssf060316.php

Swapping sick for healthy brain cells slows Huntington's disease

Researchers have successfully reduced the symptoms and slowed the progression of Huntington's disease in mice using healthy human brain cells.

The findings, which were published today in the journal Nature Communications, could ultimately point to a new method to treat the disease.

The research entailed implanting the animals with human glia cells derived from stem cells. One of the roles of glia, an important support cell found in the brain, is to tend to the health of neurons and the study's findings show that replacing sick mouse glia with healthy human cells blunted the progress of the disease and rescued nerve cells at risk of death.

"The role that glia cells play in the progression of Huntington's disease has never really been explored," said Steve Goldman, M.D., Ph.D., co-director of the University of Rochester Center for Translational Neuromedicine. "This study shows that these cells are not only important actors in the disease, but may also hold the key to new treatment strategies."

Huntington's is a hereditary neurodegenerative disease that is most closely characterized by the loss of a specific nerve cell in the brain that plays a critical role in motor control called the medium spiny neurons. Over time, the disease results in involuntary movements, problems with coordination, and cognitive decline and depression. There is currently no way to slow or modify this fatal disease.

Most of the damage in Huntington's disease occurs in a region of the brain called the striatum. Researchers have observed that as medium spiny neurons in the striatum die as a result of the disease, and that neighboring glial cells called astrocytes also become sick and do not function properly. However, it had not been clear if the sick astrocytes contributed to the signs and symptoms of the disease.

The researchers conducted a series of experiments in which they isolated human glial progenitors - the cells in the central nervous system that give rise to astrocytes - from both embryonic stem cells and brain tissue and implanted the cells into the striatum of mice with Huntington's disease. Consistent with prior studies, they observed that the resulting human astrocytes outcompeted the native glia cells, resulting in mice with native neurons but human glia.

The researchers discovered that human glia transplanted into mice with the Huntington's disease mutation appeared to keep neurons healthier and extended the animals survival.

They also conducted a battery of tests designed to measure the animals' behavior, memory, and motor skills, and the mice with healthy human glia performed significantly better than untreated mice with Huntington's disease.

Conversely, when healthy mice were implanted with human glia carrying the genetic mutation that causes Huntington's, the animals exhibited symptoms of the disease.

The researchers believe that the healthy human glia were able to essentially stabilize and perhaps even rescue neurons by restoring the normal signaling function that is lost during the disease.

A complex series of chemical interactions must transpire when nerve cells fire and communicate with their neighbors. This activity requires neurons to constantly adjust and rebalance concentrations of important chemicals such as potassium, which participates in neuronal firing. Medium spiny neurons become overexcited in Huntington's disease due to a genetic flaw that prevents potassium from entering the cells in sufficient amount - a condition that gives rise to the motor control and cognitive symptoms of the disease and produces a toxic chain reaction that ultimately kills the nerve cells.

One of the roles of astrocytes is to function like a sponge and absorb potassium from the space surrounding neurons and create an environment that prevents neurons from becoming overactive. However, this function is impaired in glia in Huntington's disease.

The scientists found that the transplanted healthy glia were able to reestablish normal potassium uptake and thereby restore normal neuronal activity and rescue cells that might have otherwise died from hyper-excitability.

Because glia cells have been shown to migrate and proliferate throughout the brain once implanted, these findings could herald a potential new approach to rescue nerve cells threatened by the disease.

"The partial rescue of deficiencies we observed in this study tells us that there is a significant glia component in Huntington's disease and that we may be able to improve function and delay progression with glial transplants," said Goldman.

Additional co-authors of the study include Abdellatif Benraiss, Su Wang, Stephanie Herrlinger, Xialjie Li, Devin Chandler-Militello, Joseph Mauceri, Hayley Burm, Michael Toner, Qiwu Xu, Fengfei Ding, Fushun Wang, Ning Kang, Martha Windrem, and Maiken Nedergaard with the University of Rochester, Mikhail Osipovitch with the University of Copenhagen, Jian Kang with the New York Medical College, and Paul Curtin and Daniela Brunner with Psychogenetics, Inc. Goldman and Nedergaard maintain labs at both the University of Rochester and the University of Copenhagen. The study was support with funds from the CHDI Foundation, the National Institutes of Health, the Leila Y. and G. Harold Mathers Charitable Foundation, the New York State Stem Cell Research Program, and the Dr. Miriam and Sheldon G. Adelson Medical Research Foundation.

http://bit.ly/28txH09

Olympics Allows Refugees to Compete on Their Own Team

Ten refugee-athletes from Syria, Sudan, Ethiopia and the Republic of Congo will compete at the Rio Olympics

By Jason Daley

When the parade of nations enters Maracanã Stadium later this summer for the opening ceremonies of the Rio de Janeiro Olympics, there will be one extra flag. Ten refugees from around the world will compete as a team for the first time under the Olympic banner.

International Olympic Committee chairman Thomas Bach announced the formation of the refugee team last Friday. "It is a signal to the international community that refugees are our fellow human beings and are an enrichment to society," he said in a statement. "These refugee athletes will show the world that despite the unimaginable tragedies that they have faced, anyone can contribute to society through their talent, skills and strength of the human spirit."

But the athletes aren't just symbolic; they have the athletic chops to compete with the best of the best. Five of the athletes, all track and field competitors, come from South Sudan. Two are Syrian swimmers living in Europe, two are judo competitors from the Democratic Republic of Congo residing in Brazil and one is an Ethiopian marathoner from a refugee camp in Kenya.

According to Barbie Latza Nadeau at the Daily Beast, the team members were chosen from a short list of 43 refugee-athletes. All ten had to qualify under the standards set for all Olympic athletes. "There were no shortcuts," an IOC spokesperson tells Nadeau. "Each Refugee Olympic Team member earned the position."

For most of the athletes, just getting to the Olympics is a gold medal performance. As Lulu Garcia-Navarro writes at NPR, Popole Misenga and Yolande Mabika were members of the Republic of Congo's judo team when they traveled to Brazil for the Judo World Championships in 2013. Their coach stole the team's money and documents and left his team stranded.

The two decided to stay in Brazil instead of going back to the violence and instability of their home country, where many of their friends and family members had been killed. But with no money—not to mention no understanding of Portuguese—it has been difficult making a living and continuing on with the sport they love.

Nadeau tells the story of Syrian swimmer named Yusra Mardini, who paid a trafficker to help her and 20 other passengers reach the Greek island of Lesbos in 2015 to flee the violence in her home country. An hour into the trip, the rubber raft they were on began sinking. Yusra and her sister Sarah, another swimming champ, jumped in the water and pulled the raft for four hours until the group safely reached land. "I thought it would be a real shame if I drowned at sea because I am a swimmer," Mardini said at a press conference. She eventually made it to Germany where she was granted asylum.

Once in Berlin, Philip Oltermann at the Guardian reports Mardini was quickly accepted to an elite training club and trains twice a day at a special sports school. Because of her refugee status, she did not qualify for Germany's Olympic team and Syria will likely not field a national team this year, and probably wouldn't accept refugees even if it did. The new team gives Mardini a chance to show her stuff despite her circumstances.

"I want to make all the refugees proud of me," she tells Oltermann. "It would show that even if we had a tough journey, we can achieve something."

The refugee team will march into the stadium ahead of the Brazil delegation along with 15 coaches and trainers.

http://www.eurekalert.org/pub_releases/2016-06/wtsi-sil060716.php

Sanger Institute: Landmark study shows AML is at least 11 different diseases

Acute Myeloid Leukaemia is not a single disorder, but at least 11 different diseases

Scientists at the Wellcome Trust Sanger Institute and their international collaborators have shown that Acute Myeloid Leukaemia (AML) is not a single disorder, but at least 11 different diseases, and that genetic changes explain differences in survival among young AML patients. Published in the New England Journal of Medicine, the ground-breaking study on the genetics of AML could improve clinical trials and the way patients are diagnosed and treated in the future.

In the largest study of its kind, researchers studied 1540 patients with AML that were enrolled in clinical trials. They analysed more than 100 genes known to cause leukaemia, to identify common genetic themes behind the development of the disease.

The researchers found that the patients were divided into at least 11 major groups, each with different constellations of genetic changes and distinctive clinical features. Despite finding common themes however, the study also showed that most patients had a unique combination of genetic changes driving their leukaemia. This genetic complexity helps explain why AML shows such variability in survival rates among patients.

Full knowledge of the genetic make-up of a patient's leukaemia substantially improved the ability to predict whether that patient would be cured with current

treatments. This information could be used to design new clinical trials to develop the best treatments for each AML subtype, with the ultimate aim of bringing more extensive genetic testing into routine clinical practice.

Dr Peter Campbell, co-leader of the study from the Wellcome Trust Sanger Institute, said: "This is our first detailed look at how the genetic complexity of a cancer impacts on its clinical outcomes. Two people may have what looks like the same leukaemia down the microscope, but we find extensive differences between those leukaemias at the genetic level. These genetic differences can explain so much of why one of those patients will be cured, while the other will not, despite receiving the exact same treatment.

"We have shown that AML is an umbrella term for a group of at least 11 different types of leukaemia. We can now start to decode these genetics to shape clinical trials and develop diagnostics."

Acute myeloid leukaemia (AML) is an aggressive blood cancer that affects people of all ages, often requiring months of intensive chemotherapy in hospital. It develops in cells in the bone marrow.

This study shows that by using a comprehensive approach, scientists will be able to understand the complex interplay between the genetic changes seen in a cancer and the clinical outcomes of that cancer. This requires full genetic analysis of samples from large numbers of patients matched with detailed information about the treatment and survival of those patients. Further research into leukaemia, and indeed other cancers, will allow researchers to understand the patterns of how the disease develops and how patients are going to respond to treatment.

Prof. Hartmut Döhner, Medical Director of Hematology/Oncology at Ulm University and chair of the German-Austrian AML Study Group, said: "This landmark study has showcased the importance of international collaboration between academic institutions and clinical trials and the large scale of the study. These results represent a major step forward in translating the exciting findings from molecular genetics into better disease classification, diagnosis, and improved care of our patients with acute myeloid leukaemia."

Dr Elli Papaemmanuil, joint first author from the Sanger Institute and the Memorial Sloan Kettering Cancer Centre in New York, said: "Leukemia is a global problem with poor outcomes for most patients. We combined detailed genetic analysis with patient health information to help understand the fundamental causes of AML. For the first time we untangled the genetic complexity seen in most AML cancer genomes into distinct evolutionary paths that lead to AML. By understanding these paths we can help develop more appropriate treatments for individual patients with AML. We are now extending such studies across other leukaemias."

Publication: E. Papaemmanuil and M. Gerstung et al. (2016). Genomic classification and prognosis in acute myeloid leukemia. New England Journal of Medicine.

Funding: The work was supported by the Wellcome Trust, Bundesministerium fur Bildung und Forschung, Deutsche Krebshilfe and Deutsche Forschungsgemeinschaft, the European Hematology Association, Amgen and the Kay Kendall Leukaemia Fund.

http://bit.ly/1tpmtKe

Four new element names to be added to the periodic table

Forget earth, wind, water and fire – there are four new elements in town.

By Jacob Aron

The International Union of Pure and Applied Chemistry (IUPAC) has announced that recently discovered elements 113, 115, 117 and 118 will now be known as nihonium, moscovium, tennessine and oganesson, pending a public review.

The four elements, which complete the seventh row of the periodic table, were officially recognised in January this year following discoveries by teams in Japan, Russia and the US, which submitted names to governing body IUPAC.

Researchers at RIKEN in Wako, Japan proposed nihonium (symbol Nh) for their discovery, element 113, after Nihon, one of the Japanese words for “Japan”.

Moscovium (Mc) and tennessine (Ts), formally elements 115 and 117, were proposed by teams at the Joint Institute for Nuclear Research in Dubna, Russia, and Oak Ridge National Laboratory, Vanderbilt University and Lawrence Livermore National Laboratory (LLNL) in the US, after Moscow and Tennessee.

Finally, oganesson (Og) was proposed by the Dubna and LLNL teams after Yuri Oganessian, a Russian physicist who helped discover element 114 in 1999. It and element 116, now known as flerovium and livermorium, were the last to join the periodic table, back in 2011.

The IUPAC limits choices for elements names to mythological characters, minerals, places, properties of the element, or scientists – ruling out public calls to name an element after heavy-metal band Motörhead frontman Lemmy, who died earlier this year.

The new names will now undergo a five-month public review to allow for any potential objections, meaning they could officially join the periodic table by the end of this year. In the meantime, the hunt for heavier elements, and the first entry of the eighth row, continues.

http://www.eurekalert.org/pub_releases/2016-06/njio-smg060816.php

Slime mold gives insight into the intelligence of neuron-less organisms

How do organisms without brains make decisions?

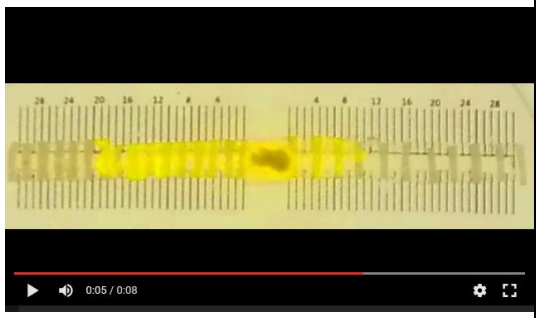
Most of life is brainless and the vast majority of organisms on Earth lack neurons altogether. Plants, fungi and bacteria must all cope with the same problem as

humans - to make the best choices in a complex and ever-changing world or risk dying - without the help of a simple nervous system in many cases.

A team of researchers from New Jersey Institute of Technology (NJIT), the University of Sydney, the University of Sheffield and the University of Leeds recently studied this problem in the unicellular slime mold, Physarum polycephalum, a single-cell organism that can grow to several square meters in size. This giant cell, which typically lives in shady, cool and moist areas of temperate forests, spreads out to search its environment like an amoeba, extending oozy tendrils along the forest floor in search of its prey of fungi, bacteria and decaying vegetable matter.

Neither plant, animal nor fungus, P. polycephalum has become an unlikely candidate for studies of cognition, due to its spectacular problem-solving abilities.

In recent studies, Physarum has been shown to solve labyrinth mazes, make complicated trade-offs, anticipate periodic events, remember where it has been, construct transport networks that have similar efficiency to those designed by human engineers and even make irrational decisions - a capability that has long been viewed as a by-product of brain circuitry.



In this study, the researchers examined the decision-making ability of slime mold using a test classically used in humans, birds and other brained organisms: the two-armed bandit problem, named for the infamous slot machine, or one-armed bandit. In a two-armed bandit problem, the subject has two levers to pull, each of which delivers a certain, randomly determined reward. One of the levers is more likely to deliver a higher reward overall, so the challenge for participants is to decide at what point to stop exploring both options and decide to exclusively exploit just the one option in order to maximize their payoff. The phenomenon is called the exploration-exploitation tradeoff and is relevant to more than just slot machines, applying to many situations, including investors picking start-up companies to back or drivers choosing a parking space. As such, it has become a classical tool for testing the decision-making abilities of humans and other animals, but it has never before been used on an organism without a brain.

The researchers adapted the two-armed bandit test for slime mold by giving the organism the choice to explore two opposite directions. In each direction, the slime mold encountered discrete patches of food, more or less regularly distributed. One direction would contain more of these patches than the other.

They then observed how far in each direction the slime mold would explore before switching to the exploitation of one of the two directions only. The results of these experiments demonstrate that slime mold compares the relative qualities of multiple options, most often choosing the direction with the higher overall concentration of food. It was able to sum up the number of food patches encountered in each direction, as well as the quantity of food present at each patch to make correct and adaptive decisions as to the direction it should move next.

The slime mold's decision-making algorithm can be mathematically described as a tendency to exploit environments in proportion to their reward experienced through past sampling. The algorithm is intermediate in computational complexity between simple, reactionary heuristics and calculation-intensive optimal performance algorithms, yet it has very good relative performance.

"Working with Physarum constantly challenges our preconceived notions of the minimum biological hardware that is required for sophisticated behavior," says Simon Garnier, an assistant professor of biology at NJIT and the principal investigator of the study.

While the biological substrate of the algorithm remains to be identified, this study provides insight into ancestral mechanisms of decision making and suggests that fundamental principles of decision making, information processing and even cognition are shared among diverse biological systems.

This study by Reid et al. appears in the June edition of the Journal of The Royal Society Interface.

http://www.eurekalert.org/pub_releases/2016-06/mcoq-mom060816.php

Metabolite of multiple sclerosis drug could be safe, effective therapy for Parkinson's disease

The metabolite of a drug that is helping patients battle multiple sclerosis appears to significantly slow the onset of Parkinson's disease, researchers say.

AUGUSTA, Ga.- The oral drug, dimethylfumarate, or DMF, and its metabolite, monomethylfumarate, or MMF, both increase activity of Nrf2, a protein that helps protect the body from oxidative stress and inflammation, hallmarks of both diseases, said Dr. Bobby Thomas, neuroscientist in the Department of Pharmacology and Toxicology at the Medical College of Georgia at Augusta University.

But the new study provides the first evidence that the metabolite, which is essentially the active portion of the parent drug, more directly targets Nrf2, potentially reducing known side effects of the parent drug that include flushing, diarrhea, nausea, vomiting, abdominal pain and the brain infection encephalopathy, said Thomas, corresponding author of the study in The Journal of Neuroscience.

Particularly, the gastrointestinal side effects can exacerbate some problems patients with Parkinson's already experience, said Dr. John Morgan, neurologist, neuroscientist and Parkinson's disease specialist in the MCG Department of Neurology.

In addition to destroying neurons in the brain that produce dopamine, a neurotransmitter that enables movement and learning, Parkinson's causes nerve cell death in the gastrointestinal tract and related problems such as severe constipation.

"Nrf2 is a natural protective mechanism we have for oxidative stress," Thomas said. The fact that multiple sclerosis and Parkinson's have in common evidence of declining activity of the Nrf2 pathway has generated interest in the drug for Parkinson's and other neurodegenerative diseases.

DMF was approved for multiple sclerosis three years ago by the Food and Drug Administration.

While its metabolite MMF is not quite as potent as the parent drug in increasing Nrf2 activity, the new study indicates that its action is sufficient to dramatically slow the loss of dopamine-producing neurons as well as the parent drug, in an animal model of Parkinson's.

In their model, mice given the neurotoxin MPTP experience a dramatic loss of dopamine-producing neurons, losing about half within a handful of days, and rapidly develop Parkinson's-like symptoms. Patients, on the other hand, slowly develop symptoms over many years. By the time they seek medical care, patients may have lost 30-50 percent of their dopaminergic neurons, said Morgan, a study coauthor. "Presentation is after the disease is kind of out of the gate."

To accommodate the very compressed timeline in their model and the fact that several daily doses are needed before the drug starts to work, the researchers first gave the mice either the drug or metabolite the day before they started the toxin.

Dopamine-producing neurons are located in a darker-pigmented central portion of the brain called the substantia nigra.

Even in the absence of disease, making dopamine is a stressful job for these neurons that makes them generally more fragile and actually results in oxidative stress even in a healthy scenario, Morgan said. To make a difficult situation worse, increased oxidative stress can make dopamine toxic to neurons, he said.

To increase Nrf2 activity, the parent drug DMF also appears to first make bad matters worse. DMF increases oxidative stress by depleting the natural antioxidant, glutathione, and reduces the power of cell powerhouses, called mitochondria, by limiting their ability to use oxygen and glucose to make energy leading to reduced viability of dopamine-producing cells, Thomas said.

The metabolite MMF appears to more directly activate Nrf2, and actually increases glutathione and improves mitochondrial function, brain cell studies showed. While the parent drug ultimately produces a higher Nrf2 activation, the researchers found the MMF effect was sufficient to stop the dramatic neuron loss in the animal model.

Both DMF and MMF slowed neuron loss to a more normal level, and the neurons that survived continued to make dopamine. Inflammation and oxidative stress levels also were significantly reduced, the researchers said.

As a next step, they are working toward a clinical trial of MMF in patients with early Parkinson's disease. Although the metabolite could be easily formulated for humans, it has not yet been done, Thomas notes.

"If we can catch them early enough, maybe we can slow the disease," Morgan said. "If it can help give five to eight more years of improved quality of life that would be great for our patients."

Clinical studies of the drug in Parkinson's are being planned in the United Kingdom and additional analogues of its metabolite, which could be used clinically and which the researchers think ultimately will be the best option for patients, are under development.

Oxidative stress is a byproduct of the body's use of oxygen. Free radicals, generated by oxygen use, are unstable molecules that can interfere with usual cell function and are believed to contribute to a wide range of conditions from normal aging to Alzheimer's disease.

Simply giving antioxidants, such as vitamin E, which work more like scavengers to scarf up free radicals, has not worked in combating neurodegenerative disease, Thomas said. He's optimistic that directly targeting Nrf2 will be effective in at least slowing the disease, but there remains a need for clinically safe Nrf2 activators.

Activity of the Nrf2 pathway tends to slowly decline with age. Exercise upregulates Nrf2, and Morgan regularly encourages his patients to be as active as possible. A small group of patients with Parkinson's in Europe has a concentrated activation of Nrf2 that at least delays their disease onset. Parkinson's tends to be diagnosed in the mid-to-late 50s and early 60s and is more common in men.

One concern with chronically elevating anti-oxidant and anti-inflammatory molecules with drugs like DMF and MMF is creating some of the same problems that immunosuppressive drugs given to organ transplant patients create. Chronic suppression of the immune response makes patients more susceptible to invaders like cancers and infections.

The Parkinson's Disease Foundation estimates that there are seven to 10 million people worldwide living with Parkinson's.

http://www.eurekalert.org/pub_releases/2016-06/cwru-spa060816.php

Sports practice accounts for just 1 percent of elite athletes' performance differences

Among elite athletes, practice accounts for a scant 1 percent of the difference in their performances--and starting sports at an early age does not necessarily provide athletes an upper hand -- according to new research

Among elite athletes, practice accounts for a scant 1 percent of the difference in their performances--and starting sports at an early age does not necessarily provide athletes an upper hand--according to new research.

"While practice is necessary for elite athletes to reach a high level of competition, after a certain point, the amount of practice essentially stops differentiating who makes it far and who makes it to the very top," said Brooke Macnamara, assistant professor of psychological sciences at Case Western Reserve University and lead author of the study. "Human performance is incredibly complex," she said. "Multiple factors need to be considered, only one of which is practice."

The study was published in Perspectives on Psychological Science, with researchers analyzing 52 data sets on the relationship between practice and performance. Athletes, parents, recruiters and coaches can use the findings to weigh the importance of practice time and investment, researchers suggest.

Overall, practice explains about 18 percent of why some athletes perform better or worse than others--with 82 percent of this difference attributed to factors other than practice.

The findings counter the notion that anyone can become an expert or elite athlete with 10,000 hours of practice, a theory inspired by research from Florida State University professor Anders Ericsson in the early 1990s and popularized in the mainstream since.

"The concept of 10,000 hours taps into the American ideal of hard work and dedication leading naturally to excellence," said Macnamara. "But it does not account for the inherent differences across people and across sports."

Starting age holds little to no advantage

While some research has suggested a younger starting age provides an athlete more time to build skills critical to attaining high performance levels, Macnamara's findings offer contradictory evidence.

Higher-skill athletes start at about the same age as less-skilled athletes--or even began a little later--according to Macnamara's research. In fact, athletes may benefit from waiting to specialize in one sport: A more physically mature athlete can accomplish the fundamentals of an activity more easily, with a lower risk of injury from overuse.

"People and parents who buy into the 10,000-hour rule can push early specialization in a sport, leading to physical or mental burnout before it's clear that a child even has a penchant for that sport," Macnamara said.

Factors other than practice believed to influence athletic performance include genetic attributes, such as fast-twitch muscles and maximum blood oxygenation level; cognitive and psychological traits and behaviors--including confidence, performance anxiety, intelligence and working memory capacity--play roles as well, though researchers don't yet know the significance of each.

"As we look at multiple factors, I don't think we'll ever be able to--with 100 percent certainty--predict someone's performance in any activity, not just sports," Macnamara said. "But we can do better than we're doing now."

Study co-authors are David Moreau, a research fellow in the Centre for Brain Research at the University of Auckland, and David Z. Hambrick, a psychology professor at Michigan State University.

http://bit.ly/1S0MkMu

Miniature 'Hobbit' Humans Had Even Smaller Ancestors

The newfound hobbit ancestors would have been even smaller than the hobbits

By Charles Q. Choi, Live Science Contributor | June 8, 2016 01:00pm ET

Ancestors of the mysterious extinct human lineage nicknamed "hobbits" may have been discovered, a new study finds.

The newfound individuals may have been even littler than the hobbits, and date much further back in time (from some 700,000 years ago), scientists added. This suggests these ancestors may have shrunk rapidly after reaching the islands where the hobbits lived, the scientists said. Those islands include Flores, where the hobbit remains were originally found.

"These are priceless treasures that provide the first real insight into the evolutionary history of the mysterious 'hobbits' of Flores," said Adam Brumm, an archaeologist at Griffith University in Nathan, Australia, and co-lead author of one of two studies on the new finding published in the June 9 issue of the journal Nature.

Finding hobbits

In 2003, scientists unearthed fossils in Liang Bua cave on the Indonesian island of Flores that belonged to an unknown hominin, a close relative of modern humans, that lived between 60,000 and 100,000 years ago. Scientists have suggested that this hominin was a unique branch of the human lineagenamed Homo floresiensis. Its diminutive 3-foot (1 meter) stature earned this hominin the nickname of the "hobbit," after the tiny folk in J.R.R. Tolkien's book of the same name.

Scientists have proposed that H. floresiensis evolved from a group of Homo erectus, an extinct human species that is the earliest undisputed ancestor of

modern humans. Scientists also proposed that this population shrank in size either shortly before or after reaching Flores. Another possibility is that H. floresiensis evolved from even more primitive hominins with more ape-like skeletons and smaller brains, such as the extinct human species Homo habilis or even the prehuman Australopithecus species. Researchers have argued that if the hobbit did have such ancient origins, this would reveal that hominins left Africa much earlier than previously thought.

The new discovery — which includes seven fossils that date back a half-million years earlier than those of H. floresiensis — points to the H. erectus link, the researchers noted.

Before modern humans arrived

The new fossils were uncovered in 2014 at a site known as Mata Menge within the So'a Basin in central Flores, about 46 miles (74 kilometers) east-southeast of Liang Bua. The researchers have been conducting excavations in this region for more than 20 years.

"The temperatures in the So'a Basin can be extremely hot and very humid," said Gerrit van den Bergh, a paleontologist and geologist at the University of Wollongong in Australia and co-lead author of both studies. "You take one step and you are soaked with sweat. To reach the site, it takes thousands of steps. Not much you can do about it, just bring enough water and try to slow down a bit compared to what you are used to."

The remains were unearthed from the bed of an ancient stream that was covered, sealed and preserved by an ancient volcanic mudflow. Analysis of the sandstone in which the specimens were found suggested that these hominins lived in hot, dry, savannah-like grasslands interspersed with wetlands.

The fossils include an adult jaw fragment and six teeth from at least three individuals, including two tiny "milk teeth" from separate infants. The researchers found that these remains are at least 700,000 years old, dating to a time "when there were no modern humans on the planet," Yousuke Kaifu, a paleoanthropologist at Japan's National Museum of Nature and Science in Tokyo and co-lead author of one of the two studies, told Live Science. (Previous research has suggested that modern humans arose in Africa about 200,000 years ago.)

Island dwarfism

The researchers said the shape and age of the fossils suggest that these newfound hominins could be ancestors of H. floresiensis. "All the fossils are indisputably hominin, and they appear to be remarkably similar to those of Homo floresiensis," Kaifu said in a statement.

Intriguingly, the recently unearthed Mata Menge fossils are significantly smaller than the previously discovered Liang Bua remains. For instance, the Mata Menge jaw fragment, which came from the lower jaw of an adult, is 20 percent smaller than the smallest H. floresiensis lower jaw from Liang Bua.

"What is truly unexpected is that the size of the finds indicates that Homo floresiensis had already obtained its small size by at least 700,000 years ago," Kaifu said in the statement.

That these hobbits' ancestors were tiny suggests "the very small size that is characteristic of H. floresiensis may have evolved over a very short period of time," said Aida Gómez-Robles, a paleoanthropologist at George Washington University in Washington, D.C., who did not take part in this research.

Island life can radically change an organism's size. For instance, the dwarf dinosaur, *Magyarosaurus dacus*, which lived in what is now Transylvania, was about the size of a horse and weighed some 230 pounds (103 kg).

Radical changes in size are common when animals are trapped on islands. For instance, the extinct dog-size giant rats of East Timor are an example of island gigantism, while dwarf mammoths and dwarf dinosaurs are cases of island dwarfism.

"To date, Flores is the only island in the world where we have fossil evidence for a human lineage evolving in isolation and adapting to an insular environment over a period of almost 1 million years," van den Bergh told Live Science. "That is the main reason why Homo floresiensis is so different from any other human lineage from Africa, Europe or mainland Asia."

Separate hobbit species

Some researchers have argued that the Liang Bua hominins were not a distinct human species, but were in fact modern humans with a birth disorder or a debilitating illness. However, "it now appears the hobbit lineage was established on this remote Indonesian island at least hundreds of millennia before the evolution of our species in Africa," Brumm told Live Science.

"The finding and description of H. florensiensis more than 10 years ago was very surprising because it is such an unusual hominin species, which made some people reluctant to accept its validity," Gómez-Robles said. "The importance of the findings described in these new papers is that they demonstrate that the origin of H. floresiensis is very old, which confirms that this is a totally valid species with old evolutionary roots."

Alongside the Mata Menge fossils, the scientists found stone tools that were markedly similar to artifacts found with the Liang Bua hobbits. The researchers also noted that previous research unearthed stone tools on Flores that were at least 1 million years old, suggesting that hobbits and their ancestors lived on the island for at least that long.

The researchers noted these fossils are less ape-like than Australopithecus and H. habilis, suggesting that H. floresiensis is a dwarfed descendent of H. erectus, van den Bergh said.

"The Mata Menge fossils are intermediate in shape between Homo erectus and Homo floresiensis from Liang Bua," van den Bergh said.

It remains uncertain whether the ancestors of hobbits evolved miniature body proportions before or after they landed on Flores.

Future research will seek to uncover more hominin fossils from Mata Menge and from older sites nearby in the So'a Basin, which are about 1 million years old, the researchers said. Such work could help solve the mystery of the lineage to which the Mata Menge fossils belongs.

"We want to see other skeletal parts to know more about these 700,000-years-old hobbit-like hominins," Kaifu told Live Science.

"We would also like to know more about how these creatures survived for almost a million years on a potentially dangerous island, where active volcanoes every now and then create catastrophic eruptions, van den Bergh said.

The researchers expect their chances of finding more bits from these hobbit ancestors are high, as the hominin fossils all came from the same layer of sandstone at Mata Menge. "This means that if we continue excavating this layer further, the likelihood of finding more human fossils is enormous," van den Bergh said.

http://nyti.ms/1S0OL1w

Microsoft Finds Cancer Clues in Search Queries

Analyzing large samples of search engine queries may enable scientists to identify internet users suffering from pancreatic cancer, even before diagnosis

By JOHN MARKOFF JUNE 7, 2016

Microsoft scientists have demonstrated that by analyzing large samples of search engine queries they may in some cases be able to identify internet users who are suffering from pancreatic cancer, even before they have received a diagnosis of the disease.

The scientists said they hoped their work could lead to early detection of cancer. Their study was published on Tuesday in The Journal of Oncology Practice by Dr. Eric Horvitz and Dr. Ryen White, the Microsoft researchers, and John Paparrizos, a Columbia University graduate student.

“We asked ourselves, ‘If we heard the whispers of people online, would it provide strong evidence or a clue that something’s going on?’” Dr. Horvitz said.

The researchers focused on searches conducted on Bing, Microsoft’s search engine, that indicated someone had been diagnosed with pancreatic cancer. From there, they worked backward, looking for earlier queries that could have shown that the Bing user was experiencing symptoms before the diagnosis. Those early searches, they believe, can be warning flags.

While five-year survival rates for pancreatic cancer are extremely low, early detection of the disease can prolong life in a very small percentage of cases. The study suggests that early screening can increase the five-year survival rate of pancreatic patients to 5 to 7 percent, from just 3 percent.

The researchers reported that they could identify from 5 to 15 percent of pancreatic cases with false positive rates of as low as one in 100,000. The researchers noted that false positives could lead to raised medical costs or create significant anxiety for people who later found out they were not sick.

The data used by the researchers was anonymized, meaning it did not carry identifying markers like a user name, so the individuals conducting the searches could not be contacted.

A logical next step would be to figure out what to do with that search information. One possibility would be some sort of health service where users could allow their searches to be collected, allowing scientists to monitor for questions that indicate warning flag symptoms. “The question, ‘What might we do? Might there be a Cortana for health some day?’” said Dr. Horvitz, in a reference to the company’s speech-oriented online personal assistant software service.

Although the researchers declined to offer specific details, Dr. White is now the chief technology officer of health intelligence in a recently created Health & Wellness division at Microsoft.

They acknowledged that health-related data generated from web search histories was still new territory for the medical profession. “I think the mainstream medical literature has been resistant to these kinds of studies and this kind of data,” Dr. Horvitz said. “We’re hoping that this stimulates quite a bit of interesting conversation.”

The new research is based on the ability of the Microsoft team to accurately distinguish between web searches that are casual or based on anxiety and those that are genuine searches for specific medical symptoms by people who are experiencing them, he noted.

Both a computer scientist and a medical doctor by training, Dr. Horvitz said he had been exploring this area in part because of a phone conversation with a close friend who had described symptoms. Based on their conversation, Dr. Horvitz advised him to contact his doctor. He received a diagnosis of pancreatic cancer and died several months later.

The availability of vast sets of behavior data based on individual web queries using the search engines offered by companies like Google and Microsoft has for a number of years been seen as a potential indicator of health-related information.

In 2009, Google published a research paper that explored the potential of early detection of flu epidemics based on statistical analysis of web search logs, though the results of that effort ultimately fell short of what had been hoped.

More recently, Microsoft researchers have had significant success in finding early evidence of adverse drug reactions from patterns observed in web logs. In 2013, they detected unreported side effects of prescription drugs before they were found by the Food and Drug Administration's warning system.

The researchers are exploring evidence related to a range of devastating diseases. They also said that unlike the drug interaction data, which would be of direct value to the F.D.A. as an early alert, it was possible that symptom alert data might be made available as part of a broader online health service that a company like Microsoft might offer.

http://bit.ly/1YiTvXF

Child's Rare Injury: What Is Internal Decapitation?

Child's Rare Injury: What Is Internal Decapitation?

By Rachael Rettner, Senior Writer | June 8, 2016 03:53pm ET

A boy in Idaho who was recently in a high-speed car crash has survived a rare injury called an "internal decapitation," which is typically fatal, and is more common in children than in adults.

The 4-year-old boy, named Killian, and his mother, were driving home from a birthday party when a hailstorm hit, and their car skidded into oncoming traffic and collided with another car, according to the New York Times. During the crash, the ligaments in Killian's neck that attach his skull to his spine were severed, which is referred to as internal decapitation. (The word "decapitation" is a bit of a misnomer, because the head is still attached to the body.)

This type of injury has a high fatality rate, said Dr. Toba Niazi, a pediatric neurosurgeon at Nicklaus Children's Hospital in Miami, who was not involved in Killian's treatment. When the ligaments become severed in such injuries, the head might move around more than it should. Consequently, if the injury isn't recognized early, there can be damage to the lower brain stem, Niazi said. The brain stem is a vital area of the brain that controls breathing.

The exact fatality rate in this type of injury is not known, said Niazi, noting that people who die in car crashes don't always undergo an autopsy to determine whether they had this injury. But a 2005 studyof internal-decapitation injuries at a hospital in Philadelphia found that, over a 17-year period, 16 children with the injury were seen at the hospital, and only five of those children (31 percent) survived.

The injury is known in medical terms as atlanto-occipital dislocation (the "atlas" is the name of the topmost vertebral bone of the spine; the "occipital" bone forms the lower part of the back of the skull). The injury is three times more common in children than in adults, according to a 2015 review study. This is partly because, compared to adults, children's heads are big for their body size, Niazi said. "It makes children more prone to these types of injuries because of the sheer weight of their head" versus the rest of their body, Niazi said.

In addition, children's ligaments are more lax than they are in adults, Niazi said, which may also make it more likely that children will experience this injury. (Ligaments connect bones to other bones, and can heal if they are torn, but do so slowly.)

To increase the chances of survival, it is critical to immobilize the head and neck, Niazi said. In the boy's case, a good Samarian arrived on the scene of the accident and held him upright, keeping his head steady until paramedics arrived, the New York Times said. Treatment of the injury always involves immobilizing the area, Niazi said. This is sometimes done with a device called a halo brace, which involves attaching a circle-shaped brace to the skull with pins. But this method is not always effective at stabilizing the area, Niazi said.

So instead, Niazi recommends surgery, during which rods, wires or screws are used to repair the connection between the skull and the spine.

But Killian has had neither a halo device nor surgery, and instead has just a hard collar around his neck. I was surprised to see this kid was just in a collar," Niazi said, looking at a published picture of the boy.

The 2015 review study noted that internal decapitation "is an essentially ligamentous injury and, as such, is unlikely to spontaneously heal well over time, even after prolonged external immobilization." However, the injury is "increasingly recognized as a potentially survivable injury," because there is more awareness about it, and because patients are being managed better before they arrive at the hospital, the researchers wrote in their paper.

According to a fundraising website for the family's medical expenses, "Killian's neurosurgeon is pushing for just trying the collars. … By not fusing the spine they are working outside the box so to speak. Anything you read will say to fuse [the skull with the spine using surgery]. But his neurosurgeon has been 3 for 3 in just wearing the collar."

To reduce the risk of head injuries among children who are in car accidents, it's important to secure them safely while they are riding in a car. This type of injury "underscores the importance of why children really need to be restrained appropriately," Niazi said. Toddlers and preschoolers can ride in a forward-facing car seat with a five-point seatbelt harness, and children under age 2 should be in a car seat that's facing the rear of the car, according to the American Academy of Pediatrics.

http://bit.ly/1WK5nT8

Fairer Way to Distribute Last-Ditch Drugs Gets Real-World Trial

Ethicists and medical experts are testing a system to distribute drugs in short supply that is inspired by the method used to prioritize organ transplants

By Sara Reardon, Nature magazine on June 8, 2016

Nancy Goodman wanted to spend as much time as possible with her dying child. But even as ten-year-old Jacob's brain cancer worsened, Goodman spent months contacting pharmaceutical companies that were developing drugs that might help him.

'Compassionate-use' laws in the United States allow pharmaceutical companies to provide unapproved drugs to patients in desperate need, but many firms provide little or no information on how to request these treatments. They are often reluctant to supply drugs in response to such pleas, especially if drug stocks are limited, although media campaigns on behalf of individual patients can sometimes embarrass firms into providing unapproved treatments. Anecdotes suggest that money and connections are also influential.

Now, ethicists and medical experts are testing what they hope is a fairer system to distribute drugs in short supply. The approach, presented on June 6 at the American Society of Clinical Oncology meeting in Chicago, Illinois, is inspired by the method used to prioritize organ transplants. In a test case, researchers worked with Janssen Pharmaceuticals to determine how to distribute limited supplies of daratumumab, an experimental drug intended to treat multiple myeloma.

The 10-person panel combed through 76 anonymized applications to determine how likely the drug was to work for each person, ultimately approving 60. "It's hard to say no, because people die," says Arthur Caplan, a bioethicist at New York University's Langone Medical Center who is leading the effort. But he says that a systematic approach could help companies to make unbiased decisions.

In Goodman's case, six of the eight companies that she contacted never responded. The other two declined to give her son their drugs because the treatments had never been tested in children. Jacob Goodman died in 2009, and his mother went on to found the advocacy group Kids v Cancer in Washington DC.

There are many legitimate reasons that companies might refuse to provide unapproved drugs, says Aaron Kesselheim, who studies health-care ethics at Brigham & Women's Hospital in Boston, Massachusetts. People who request such treatments are often very ill, and companies worry that their deaths while receiving the drug would reduce the compound's chances of approval from the Food and Drug Administration (FDA). Giving patients access to experimental drugs could also discourage them from enrolling in controlled trials that might assign a placebo, and would leave less drug available for use in the trial.

"These requests are some of the most difficult decisions I face as a physician," says Amrit Ray, chief medical officer of Janssen in Titusville, New Jersey. "It's a trade-off we have to consider carefully."

Since 2014, 28 states have enacted 'rightto-try' laws, which allow companies to provide drugs to patients without involving regulators. Caplan calls these "feel-good" laws, because the FDA approves most of the compassionate-use requests that it receives. (It is not clear how many applications are denied by companies and never reach the FDA.)

Vickie Buenger, president of the advocacy group Coalition Against Childhood Cancer in Philadelphia, Pennsylvania, says that right-to-try statutes contribute to patients' misunderstanding about the factors that go into a decision to supply or deny access to a drug. "It implies that companies and the FDA are either angels of mercy if they come through, or devils who have no compassion if they withhold it."

This lack of clarity, and poor communication by companies, has led many patients and their families to launch social-media campaigns to secure unapproved drugs.

Perhaps the most famous case came in 2014, when the family of seven-year-old Josh Hardy began a Facebook campaign for an unapproved antiviral drug called brincidofovir to treat a life-threatening infection. Its manufacturer, Chimerix of Durham, North Carolina, had declined, on the grounds that giving the drug to Josh — and any subsequent petitioners — would leave less of the compound available for an ongoing clinical trial. Within days, the Facebook page and Twitter campaign #savejosh were featured on national television. Chimerix quickly created a small clinical trial with Josh as its first patient.

"Every single CEO woke up the next morning and said, 'Oh my gosh, that might happen to me'," says Elena Gerasimov, who directs a programme at Kids v Cancer that helps parents of children with cancer to petition companies for drug access. (The FDA is attempting to make this process easier. On June 2, it released new forms to simplify the filing of compassionate-use appeals.)

Former Chimerix chief executive Kenneth Moch says that dozens of companies have since enlisted him as an adviser on such issues. His advice is simple: every company should create a transparent system to handle compassionate-use requests, guided by the FDA. That is in line with the advice of the Biotechnology Innovation Organization, an industry group in Washington DC that encourages its members to develop clear policies to explain whether they provide expanded access and to help physicians to request drugs. "That's the least we can do, to

facilitate people being able to contact us," says Kay Holcombe, the group's senior vice-president for science policy.

Caplan and Ray plan to test their system on another treatment later this year — possibly a mental-health drug or a childhood vaccine. Caplan hopes that more companies will adopt the approach, and imagines eventually creating a compassionate-use consulting panel to aid small companies.

Moch cautions that the approach might not be appropriate for every drug or company, but he likes how it helps to level the playing field. "Had Josh been a 37-year-old guy who kicked his dog and smoked, he wouldn't have gotten the same support as a lovely seven-year-old boy," he says.

Patient advocates also support Caplan's system for distributing drugs. "Putting it in the hands of people who understand the drug's possibilities is a reasonable thing," Buenger says.

But many also want the FDA to create incentives for companies to provide drugs for compassionate use. Until that happens, or until companies adopt programs such as Caplan's, social-media campaigns and other public appeals may be some patients' only option. "I'd do it," Goodman says. "I'd do anything to save my kid — anything to give Jacob a few more months."

http://www.bbc.com/news/health-36482333

Artificial Intelligence 'outsmarts cancer'

Early trial data shows a drug developed using artificial intelligence can slow the growth of cancer in clinical trials.

By James Gallagher Health editor, BBC News website

The data, presented at the American Society of Clinical Oncology conference, showed some tumours shrank by around a quarter. The compound will now be taken into more advanced trials.

Scientists said we were now in an explosive stage of merging advances in computing with medicine. Spotting every difference between a cancerous and a healthy cell is beyond even the brightest human minds.

So the US biotechnology company Berg has been feeding as much data as its scientists could measure on the biochemistry of cells into a supercomputer. The aim was to let an artificial intelligence suggest a way of switching a cancerous cell back to a healthy one. It led to their first drug, named BPM31510, which tries to reverse the Warburg effect - the phenomenon in which cancerous cells change their energy supply. Data from 85 patients showed signs the approach could kill tumours. The trial was designed to test only for toxicity, but in one patient the tumour shrank by a 25%.

Dr Niven Narain, one of the founders of Berg, said it was still early days for the drug, but claimed supercomputing was the future of cancer. He told the BBC News website: "I think we're at a very explosive stage, this fusion of biology with technology in helping us understand the basis of this disease more fundamentally. "It's going to allow us to make better decisions on how we develop drugs, to whom we give these drugs to so that we're able to increase the survival outcome."

Innovative treatments

The results from these patients are being fed back into the artificial intelligence in order to further target the therapy at those most likely to respond. The company thinks cancers with high energy demands will benefit the most and is planning a more advanced trial in patients in pancreatic cancer.

Dr Alan Worsley, from Cancer Research UK, said we were only at the beginning of harnessing the huge advances in computing to understand cancer. "We still don't fully understand how cancer cells get the energy they need to grow or how this differs from normal cells. "It remains to be seen if a drug developed using this information will help cancer patients, but we need to keep finding new ways to find innovative treatments for patients."

But he said that in order to deliver personalised cancer treatment - that responds to the genetic changes taking place inside each patient's tumour - then computers, not doctors, will be analysing the data.

http://www.eurekalert.org/pub_releases/2016-06/gumc-itb060916.php

In the brain, one area sees familiar words as pictures, another sounds out words

Georgetown neuroscientists say once a word is known, sounding it out is not necessary

WASHINGTON -- Skilled readers can quickly recognize words when they read because the word has been placed in a visual dictionary of sorts which functions separately from an area that processes the sounds of written words, say Georgetown University Medical Center (GUMC) neuroscientists. The visual dictionary idea rebuts a common theory that our brain needs to "sound out" words each time we see them.

This finding, published online today in NeuroImage, matters because unraveling how the brain solves the complex task of reading can help in uncovering the brain basis of reading disorders, such as dyslexia, say the scientists.

"Beginning readers have to sound out words as they read, which makes reading a very long and laborious process," says the study's lead investigator, Laurie Glezer, PhD, a postdoctoral research fellow. The research was conducted in the Laboratory for Computational Cognitive Neuroscience at GUMC, led by Maximilian Riesenhuber, PhD.

"Even skilled readers occasionally have to sound out words they do not know. But once you become a fluent, skilled reader you no longer have to sound out words you are familiar with, you can read them instantly," Glezer explains. "We show that the brain has regions that specialize in doing each of the components of reading. The area that is processing the visual piece is different from the area that is doing the sounding out piece."

Glezer and her co-authors tested word recognition in 27 volunteers in two different experiments using fMRI. They were able to see that words that were different, but sound the same, like "hare" and "hair" activate different neurons, akin to accessing different entries in a dictionary's catalogue.

"If the sounds of the word had influence in this part of the brain we would expect to see that they activate the same or similar neurons, but this was not the case -- 'hair' and 'hare' looked just as different as 'hair' and 'soup.'"

Glezer says that this suggests that in this region of the brain all that is used is the visual information of a word and not the sounds. In addition, the researchers found a different distinct region that was sensitive to the sounds, where 'hair' and 'hare' did look the same. "This suggests that one region is doing the visual piece and the other is doing the sound piece," explains Riesenhuber.

"One camp of neuroscientists believe that we access both the phonology and the visual perception of a word as we read them, and that the area or areas of the brain that do one, also do the other, but our study suggests this isn't the case," says Glezer. Riesenhuber says that these findings might help explain why people with dyslexia have slower, more labored reading. "Because of phonological processing problems in dyslexia, establishing a finely tuned system that can quickly and efficiently learn and recognize words might be difficult or impossible," he says.

Other Georgetown authors include Guinevere Eden, DPhil, director of Georgetown's Center for the Study of Learning, and Xiong Jiang, PhD, director of the Cognitive Neuroimaging Laboratory, and Judy Kim. Additional authors include Megan Luetje and Eileen Napoliello of San Diego State University.

The authors report no personal financial interests related to the study. This study was funded by the National Science Foundation and the Eunice Kennedy Shriver National Institute of Child Health and Human Development.

http://www.eurekalert.org/pub_releases/2016-06/teia-iaf060616.php

In a first, Iceland power plant turns carbon emissions to stone

Study shows unexpectedly fast reactions lock in greenhouse gas

Scientists and engineers working at a major power plant in Iceland have shown for the first time that carbon dioxide emissions can be pumped into the earth and changed chemically to a solid within months--radically faster than anyone had predicted. The finding may help address a fear that so far has plagued the idea of capturing and storing CO2 underground: that emissions could seep back into the air or even explode out. A study describing the method appears this week in the leading journal Science.

The Hellisheidi power plant is the world's largest geothermal facility; it and a companion plant provide the energy for Iceland's capital, Reykjavik, plus power for industry, by pumping up volcanically heated water to run turbines. But the process is not completely clean; it also brings up volcanic gases, including carbon dioxide and nasty-smelling hydrogen sulfide.

An experimental drill core held by coauthor Sandra Snaebjornsdottir is loaded with solidified carbonate, apparently produced by the new process. **Kevin Krajick/Lamont-Doherty Earth Observatory**

Under a pilot project called Carbfix, started in 2012, the plant began mixing the gases with the water pumped from below and reinjecting the solution into the volcanic basalt below. In nature, when basalt is exposed to carbon dioxide and water, a series of natural chemical reactions takes place, and the carbon precipitates out into a whitish, chalky mineral. But no one knew how fast this might happen if the process were harnessed for carbon storage. Previous studies have estimated that in most rocks, it would take hundreds or even thousands of years. In the basalt below Hellisheidi, 95 percent of the injected carbon was solidified within less than two years.

"This means that we can pump down large amounts of CO2 and store it in a very safe way over a very short period of time," said study coauthor Martin Stute, a hydrologist at Columbia University's Lamont-Doherty Earth Observatory. "In the future, we could think of using this for power plants in places where there's a lot of basalt--and there are many such places." Basically all the world's seafloors are made of the porous, blackish rock, as are about 10 percent of continental rocks.

Scientists have been tussling for years with the idea of so-called carbon capture and sequestration; the 2014 report of the Intergovernmental Panel on Climate Change suggests that without such technology, it may not be possible to limit global warming adequately. But up to now, projects have made little progress. It has been tried at only a handful of sites, and most experiments have involved pumping pure carbon dioxide into sandstone, or deep, salty aquifers. Here, it is hoped, pressure and solid layers of caprock above would seal in the waste. But

scientists have worried that any miscalculation could result in emissions making their way back up through fractures, or that natural earthquakes or tremors caused by the injection itself could rupture subterranean reservoirs. A coal-fired power plant in Saskatchewan that currently runs North America's only large-scale operation at a generating station has been plagued by technical problems--and the captured carbon dioxide is being sent to oil producers who inject it into ailing wells to pressure out more oil, which produces more carbon dioxide when burned.

In 2007 Hellisheidi's operator, Reykjavik Energy, joined with a consortium including Columbia and the universities of Copenhagen and Iceland to get rid of its CO2 emissions, along with the hydrogen sulfide, which was plaguing the area. The plant produces 40,000 tons of CO2 a year--5 percent the emissions of an equivalent coal-fired plant, but still considerable. Lab experiments showed that, unlike the sedimentary rocks that most other projects have used for injection, the local basalt contains plenty of calcium, iron and magnesium, which are needed to precipitate out carbon. Experiments showed that large amounts of water would also have to be added to make the reaction go--another departure from previous projects, which have just pumped down pure carbon dioxide.

In a 2012-2013 pilot, the team piped 250 tons of CO2 mixed with water and hydrogen sulfide down 400 to 800 meters, then monitored the formation's chemistry through a series of wells. Fast-changing compositions of carbon isotopes in water samples, initially reported in 2014, signaled that much of the carbon had mineralized within months. The new Science paper lays out the evidence conclusively.

Edda Aradottir, who heads the project for Reykjavik Energy, initially estimated the solidification process might take 8 to 12 years--much faster than previous studies had indicated. "People said there was very little truth to that--they thought it couldn't happen that fast," she said. "Then, it happened much faster. It was a very welcome surprise." Cores drilled from the injected area show the rock is heavily laced with whitish carbonate veins, apparently produced by the process.

With initial signs of success, in 2014 Reyjavik Energy started injecting carbon dioxide at the rate of 5,000 tons per year. Ongoing monitoring indicates that mineralization has kept pace, said Aradottir. This summer, the company plans to double the injection rate, she said.

Sigurdur Gislason, a University of Iceland geologist and study coauthor, said geothermal companies around the world have shown interest in the technology. But, he said, its greatest promise would be with fossil-fuel-powered plants, smelters and other heavy industries that produce far more emissions. The main stumbling block beyond the needed basalt, he said, is the water required--about 25 tons for every ton of CO2. But, he said, in many places seawater could be used. A 2010 Lamont study has already outlined basaltic seafloors off U.S. coasts that could be used to take up emissions. Separation and injection of CO2 in most other projects has been estimated to cost a steep $130 or so a ton. The Hellisheidi operation has an advantage in that it largely uses the plant's existing infrastructure to reinject the solution, and doesn't bother purifying the CO2. Its cost is only $30 a ton, said Aradottir.

Fossil-fuel plants might not be able to do it as cheaply--and they would not be able to do it at all without abundant water. Another possible hitch: a separate study out this May identified subterranean microbes that seem capable of feeding off carbonate minerals and using them to release methane, a greenhouse gas even more potent than carbon dioxide. That means nature could sneak in and reverse the solidification process. Such microbes were thought to exist only on the deep ocean floor, but researchers found them in a California spring. Microbiologists from the Paris Institute of Earth Physics have already started studying underground microbes at the Carbfix site to investigate how they might interact with the carbon in injection.

Recently, other companies have looked at other innovative ways to use up power plants' carbon emissions. Projects include one backed by Exxon to build fuel cells that turn CO2 to energy, and an initiative by Ford to convert emissions to solid foams to build the interiors of vehicles. In a project in Oman, a separate Lamont-Doherty group is looking into pumping emissions into a different kind of rock, peridotite, which may react even more rapidly with CO2.

Lead author Juerg Matter, an adjunct researcher at Lamont now based at the United Kingdom's University of Southampton, said, "We need to deal with rising carbon emissions. This is the ultimate permanent storage--turn them back to stone."

The paper, "Rapid carbon mineralization for permanent disposal of anthropogenic carbon dioxide emissions" is available from the authors or from Science: 202-326-6440 or scipak@aaas.org

http://www.eurekalert.org/pub_releases/2016-06/tl-tln060816.php

The Lancet: New stem cell transplantation method may halt multiple sclerosis symptoms long-term, but therapy comes with high risk

Stem cell transplantation has fully halted clinical relapses and development of new brain lesions

A new use of chemotherapy followed by autologous haematopoietic stem cell transplantation (aHSCT) has fully halted clinical relapses and development of new brain lesions in 23 of 24 patients with multiple sclerosis (MS) for a prolonged period without the need for ongoing medication, according to a new phase 2

clinical trial, published in The Lancet. Eight of the 23 patients had a sustained improvement in their disability 7.5 years after treatment. This is the first treatment to produce this level of disease control or neurological recovery from MS, but treatment related risks limit its widespread use.

MS is among the most common chronic inflammatory diseases of the central nervous system, with around 2 million people affected worldwide. It is caused when the immune system attacks the body, known as autoimmunity. Some specialist centres offer aHSCT for MS, which involves harvesting bone marrow stem cells from the patient, using chemotherapy to suppress the patient's immune system, and reintroducing the stem cells into the blood stream to "reset" the immune system to stop it attacking the body. However, many patients relapse after these treatments, so more reliable and effective methods are needed.

Dr Harold L Atkins and Dr Mark S Freedman from The Ottawa Hospital and the University of Ottawa, Ottawa, Canada, and colleagues tested whether complete destruction, rather than suppression, of the immune system during aHSCT would reduce the relapse rate in patients and increase long-term disease remission. They enrolled 24 patients aged 18-50 from three Canadian hospitals who had all previously undergone standard immunosuppressive therapy which did not control the MS. All patients had poor prognosis and their disability ranged from moderate to requiring a walking aid to walk 100m, according to their Expanded Disability Status Scale (EDSS) scores [1].

The researchers used a similar method of aHSCT as is currently used, but instead of only suppressing the immune system before transplantation, they destroyed it completely using a chemotherapy regimen of busulfan, cyclophosphamide and rabbit anti-thymocyte globulin. Dr Atkins explains that this treatment is "similar to that used in other trials, except our protocol uses stronger chemotherapy and removes immune cells from the stem cell graft product. The chemotherapy we use is very effective at crossing the blood-brain barrier and this could help eliminate the damaging immune cells from the central nervous system."[2]

The primary outcome of the study was multiple sclerosis activity-free survival at 3 years (as measured by relapses of MS symptoms, new brain lesions, and sustained progression of EDSS scores) which occurred in 69.6% of patients after transplantation.

Out of the 24 patients, one (4%) died from hepatic necrosis and sepsis caused by the chemotherapy. Prior to the treatment, patients experienced 1.2 relapses per year on average. After treatment, no relapses occurred during the follow up period (between 4 and 13 years) in the surviving 23 patients (figure 2). These clinical outcomes were mirrored by freedom from detectable new disease activity on MRI images taken after the treatment. The initial 24 MRI scans revealed 93 brain lesions, and after the treatment only one of the 327 scans showed a new lesion (figure 2).

Furthermore, progressive brain deterioration typical of MS slowed to a rate associated with normal aging in 9 patients with the longest follow-up, and 8 (35%) of 23 patients had a sustained improvement in their EDSS score at 7.5 years after treatment. At 3 years, 6 patients (37%) were able to reduce or stop receiving disability insurance and return to work or school. Eight (33%) of the 24 patients had a moderate toxic effect and 14 (58%) patients had only a mild toxic effect related to transplantation.

Dr Freedman highlights the need to interpret the results with caution: "The sample size of 24 patients is very small, and no control group was used for comparison with the treatment group. Larger clinical trials will be important to confirm these results. Since this is an aggressive treatment, the potential benefits should be weighed against the risks of serious complications associated with aHSCT, and this treatment should only be offered in specialist centres experienced both in multiple sclerosis treatment and stem cell therapy, or as part of a clinical trial. Future research will be directed at reducing the risks of this treatment as well as understanding which patients would best benefit from the treatment."[2]

Writing in a linked Comment, Dr Jan Dörr, from the NeuroCure Clinical Research Center, Charité-Universitätsmedizin, Berlin, Germany, says: "These results are impressive and seem to outbalance any other available treatment for multiple sclerosis. This trial is the first to show complete suppression of any inflammatory disease activity in every patient for a long period...However, aHSCT has a poor safety profile, especially with regards to treatment-related mortality."

He adds: "So, will this study change our approach to treatment of multiple sclerosis? Probably not in the short term, mainly because the mortality rate will still be considered unacceptably high. Over the longer term (and) in view of the increasing popularity of using early aggressive treatment, there may be support for considering aHSCT less as a rescue therapy and more as a general treatment option, provided the different protocols are harmonised and optimised, the tolerability and safety profile can be further improved, and prognostic markers become available to identify patients at risk of poor prognosis in whom a potentially more hazardous treatment might be justified."

This study was funded by the Multiple Sclerosis Scientific Research Foundation.

[1] The Expanded Disability Status Scale is a method of quantifying disability in multiple sclerosis and monitoring changes in the level of disability over time. Patients enrolled in this study had EDSS scores between 3 and 6 https://www.mstrust.org.uk/a-z/expanded-disability-status-scale-edss.

http://www.eurekalert.org/pub_releases/2016-06/nu-ndc060916.php

New drug clears psoriasis in clinical trials

Improvement persists for more than a year

CHICAGO - About 80 percent of patients with moderate to severe psoriasis saw their disease completely or almost completely cleared with a new drug called ixekizumab, according to three large, long-term clinical trials led by Northwestern Medicine. The results of these phase III trials were compiled in a paper published in the New England Journal of Medicine.

"This group of studies not only shows very high and consistent levels of safety and efficacy, but also that the great majority of the responses persist at least 60 weeks," said Dr. Kenneth Gordon, a professor of dermatology at Northwestern University Feinberg School of Medicine and first author of the paper.

Affecting about 3 percent of the world's population, psoriasis is an immune-mediated inflammatory disease that causes itchy, dry and red skin. It is also associated with an increased risk for depression, heart disease and diabetes, among other conditions. Ixekizumab works by neutralizing a pathway in the immune system known to promote psoriasis.

To test the drug's efficacy over time - and to help clinicians determine whether its benefits outweigh any risks - the three studies enrolled a total of 3,736 adult patients at more than 100 study sites in 21 countries. All participants had moderate to severe psoriasis, which is defined as covering 10 percent or more of the body. Patients were randomly assigned to receive injections of ixekizumab at various doses or a placebo over a period of more than a year.

The investigators assessed whether the drug reduced the severity of psoriasis symptoms compared to the placebo and evaluated safety by monitoring adverse events. By the 12th week, 76.4 to 81.8 percent of patients has their psoriasis classified as "clear" or "minimal" compared to 3.2% of patients on the placebo. By the 60th week, 68.7 to 78.3 percent of patients had maintained their improvement.

"Based on these findings, we expect that 80 percent of patients will have an extremely high response rate to ixekizumab, and about 40 percent will be completely cleared of psoriasis," Gordon said. "Ten years ago, we thought complete clearance of this disease was impossible. It wasn't something we would even try to do. Now with this drug, we're obtaining response levels higher than ever seen before."

Adverse events associated with ixekizumab included slightly higher rates of neutropenia (low white blood cell count), yeast infection and inflammatory bowel disease compared to the placebo. The safety of therapy longer than 60 weeks will need to be monitored in the future. The drug has been approved by the Food and Drug Administration since the trials were completed.

This research was funded by Eli Lilly and Company, the manufacturer of ixekizumab. Dr. Gordon is a paid consultant for Eli Lilly and Company.

http://www.livescience.com/55035-lung-cancer-breath-test.html

Cancer Clues in the Breath: Test Could Ease Screening

A simple breath test can detect changes in people who have undergone surgery for lung cancer, a new study reports.

By Cari Nierenberg, Live Science Contributor | June 9, 2016 03:47pm ET

Researchers found that three chemical markers known as carbonyl compounds, which are gases released when people exhale, were reduced in patients with lung cancer after they had an operation to remove their tumors, compared with before their operations. The findings were published online today (June 9) in the journal The Annals of Thoracic Surgery.

This study demonstrated that levels of certain chemical markers associated with a tumor went down in people after they had surgery for lung cancer, said Dr. Victor van Berkel, a thoracic surgeon at the University of Louisville School of Medicine in Kentucky, who was a co-author of the study.

Researchers don't yet know why the compounds detected in the breath samples were reduced. It could be because the tumor that was removed made the compounds, or because the inflammatory process in the body associated with the tumor made them, van Berkel told Live Science. But the findings suggest that scientists may be able to use these markers in the future as a screening method when they monitor patients after surgery for lung cancer, he said.

Lung cancer is the leading cause of cancer deaths among men and women in the U.S., van Berkel said. "More people die from lung cancer each year than from breast, prostate and colon cancers combined," he said. If cancer returns in a patient who had surgery, it is helpful to identify this right away, when treatment can be most effective, he explained.

The current screening test used for lung cancer is a chest computed tomography (CT) scan, which involves being exposed to a small amount of radiation. The CT scan can show whether a person has any nodules present on his or her lungs. But if the scan reveals nodules, then follow up invasive testing, such as a biopsy procedure, is needed to figure out whether the nodules are benign or malignant, van Berkel said.

Breath analysis

Unlike a CT scan, taking the breath test used in this new study required each person to give one big exhalation into a balloon-like bag, which collected a 1-liter (34 ounces) sample of air. The bag was connected to a pump that passed the

breath over a computer chip that trapped certain chemicals that were present in the air.

The computer chip was then sent to a lab where the chemicals from the breath were analyzed and quantified. The breath test is not FDA-approved. But someday, it could be a less expensive way to screen for lung cancer compared with a CT scan, and it could be done in a doctor's office, van Berkel told Live Science. The estimated cost of breath test is between $20 and $30 per test, he said.

The breath analysis test was patented in 2010, said van Berkel, who is one of the patent owners.

In this new study, the researchers asked 31 people with lung cancer to take the breath test before and after they had surgery to remove their lung tumors. The researchers compared these patients' results to those of 187 healthy people who were also given the breath test, but who did not have lung cancer.

The breath analysis showed that after the surgery, the average levels for three out of four tumor markers in people who had lung cancer were reduced, and these levels were near the average of those seen in people without lung disease.

Future studies of the device will look at whether it can detect a recurrence of lung cancer — that is, whether the breath test can quickly catch when levels of these tumor markers go back up in people, signaling that the cancer has returned, van Berkel said.

Lung cancer screening

To obtain FDA approval for the test as screening tool for lung cancer, a very large multicenter trial of approximately 7,000 people needs to be done, to show that the breath test is as good a method of identifying lung cancer as CT scans are, van Berkel said. He and his colleagues are in the process of arranging such a clinical trial, which means the breath test is optimistically at least five years away from being used in doctors' offices, he said.

If this technology does get introduced to the market, people with positive breath tests for lung cancer would still need to undergo a CT scan, van Berkel said.

This study brings doctors one step closer to a better test that could help refine lung cancer screening, said Dr. Inga Lennes, director of the pulmonary nodule clinic at Massachusetts General Hospital Cancer Center in Boston, who was not involved in the research.

The problem with existing lung-screening methods, such as CT scans, is that up to 30 percent of people who get the tests are found to have lung nodules, but only a small percentage of those nodules turn out to be cancerous, Lennes said.

The results from this new study still constitute an early finding, and much more work needs to be done before the breath analysis test could be useful in everyday medical practice, Lennes told Live Science. That work includes gaining a better understanding of how the test performs in different circumstances, to determine its best use in different populations, she explained. For example, doctors need to evaluate it as a general screening tool to initially diagnose lung cancer, or as a way to monitor people in both the short and long term after surgery for lung cancer.

The public wants researchers to develop cancer screening methods that are noninvasive and don't involve unnecessary procedures, needles or surgeries, Lennes said. "Anything that moves us forward to finding lung cancer earlier is a step forward for the whole field," Lennes said.

http://bit.ly/1U2rsqu

Ancient enzyme resurrected from the ancestor of all bacteria

The ancestor of all bacteria may have had sophisticated enzymes 3.4 billion years ago – just 600 million years after the origin of life on Earth.

By Conor Gearin

The discovery comes as a surprise since we had assumed they didn't evolve until much later – perhaps even for another billion years.

Modern enzymes fit the molecules they react with like a lock to a key. They normally only work for one reaction, but they perform that one job very well.

In contrast, the earliest enzymes were "sloppy", says Michael Harms of the University of Oregon – they didn't have a lock and key relationship with their molecules.

Instead, they had pockets in their structures that could grab a wide range of chemicals and control a number of reactions, but managed none of them very well.

Enzyme reconstruction

To find out when modern enzymes arose, Reinhard Sterner at the University of Regensburg and his colleagues reconstructed a four-part enzyme as it would have looked before modern bacteria and archaea groups split.

Called tryptophan synthase, the enzyme aids the creation of an amino acid crucial to bacteria, archaea, plants and fungi.

First they analysed the gene that codes for the enzyme in modern bacteria and archaea, before feeding the sequences into a computer program that searched for similarities between them. They then ran thousands of simulations of what the ancient DNA sequence the modern genes came from might have been.

The program landed on a sequence that was the most probable based on how the major groups of bacteria branched off from each other. The team inserted this resurrected gene into modern E. coli cells, which churned out an enzyme that behaved much like the modern versions.

This implies bacteria lost their sloppy proteins earlier than we expected, Harms says. A recent study, for example, claimed that simpler enzymes stuck around for

another billion years or more. “It stands counter to what a lot of people would have predicted,” says Harm. “It challenges some received wisdom in the field.”

Since no DNA remains from billions of years ago, reconstruction experiments like this are the only way to study ancient genes.

Origin of life

But the researchers could have had more confidence in their findings if they had reconstructed some of the other possible proteins instead of just the most probable one, says Mathieu Groussin at the Massachusetts Institute of Technology. This way, they would know if other possible sequences produced functioning proteins or not.

Two mysteries remain: exactly when the first specialised enzymes arose, and what kind of environments hosted those lifeforms that first evolved this cellular sophistication. When treated with heat, the reconstructed bacterial enzyme managed to keep its structure until about 70°C. This suggests it was probably part of a microbe that lived in scalding-hot water, Groussin says. “You can infer with strong confidence that the organism lived in a hot environment,” he says.

This confirms other scientists’ hypotheses about the first bacteria living in hot water, Groussin says.

While the first living cells probably lived in lukewarm habitats, things changed when more complex bacteria began evolving. It’s possible that asteroid bombardments caused Earth’s surface to sizzle during this phase of evolution, meaning that the species that survived had heat-resistant hardware.

Journal reference: Cell Chemical Biology, DOI: 10.1016/j.chembiol.2016.05.009

http://www.eurekalert.org/pub_releases/2016-06/cchm-mw060816.php

Many with migraines have vitamin deficiencies, says study

Researchers uncertain whether supplementation would help prevent migraines

A high percentage of children, teens and young adults with migraines appear to have mild deficiencies in vitamin D, riboflavin and coenzyme Q10 -- a vitamin-like substance found in every cell of the body that is used to produce energy for cell growth and maintenance.

These deficiencies may be involved in patients who experience migraines, but that is unclear based on existing studies.

"Further studies are needed to elucidate whether vitamin supplementation is effective in migraine patients in general, and whether patients with mild deficiency are more likely to benefit from supplementation," says Suzanne Hagler, MD, a Headache Medicine fellow in the division of Neurology at Cincinnati Children's Hospital Medical Center and lead author of the study.

Dr. Hagler and colleagues at Cincinnati Children's conducted the study among patients at the Cincinnati Children's Headache Center. She will present her findings at 9:55 am Pacific time Friday, June 10, 2016 at the 58th Annual Scientific Meeting of the American Headache Society in San Diego.

Dr. Hagler's study drew from a database that included patients with migraines who, according to Headache Center practice, had baseline blood levels checked for vitamin D, riboflavin, coenzyme Q10 and folate, all of which were implicated in migraines, to some degree, by previous and sometimes conflicting studies. Many were put on preventive migraine medications and received vitamin supplementation, if levels were low. Because few received vitamins alone, the researchers were unable to determine vitamin effectiveness in preventing migraines.

She found that girls and young woman were more likely than boys and young men to have coenzyme Q10 deficiencies at baseline. Boys and young men were more likely to have vitamin D deficiency. It was unclear whether there were folate deficiencies. Patients with chronic migraines were more likely to have coenzyme Q10 and riboflavin deficiencies than those with episodic migraines.

Previous studies have indicated that certain vitamins and vitamin deficiencies may be important in the migraine process. Studies using vitamins to prevent migraines, however, have had conflicting success.

http://www.eurekalert.org/pub_releases/2016-06/p-tpb060816.php

The primate brain is 'pre-adapted' to face potentially any situation

Primate brain anticipates all new situations that it may encounter in a lifetime by creating a neural network that is "pre-adapted" to face any eventuality

Scientists have shown how the brain anticipates all of the new situations that it may encounter in a lifetime by creating a special kind of neural network that is "pre-adapted" to face any eventuality. This emerges from a new neuroscience study published in PLOS Computational Biology.

Enel et al at the INSERM in France investigate one of the most noteworthy properties of primate behavior, its diversity and adaptability. Human and non-human primates can learn an astonishing variety of novel behaviors that could not have been directly anticipated by evolution -- we now understand that this ability to cope with new situations is due to the "pre-adapted" nature of the primate brain. This study shows that this seemingly miraculous pre-adaptation comes from connections between neurons that form recurrent loops where inputs can rebound and mix in the network, like waves in a pond, thus called "reservoir" computing. This mix of the inputs allows a potentially universal representation of combinations of the inputs that can then be used to learn the right behaviour for a new situation.

The authors demonstrate this by training a reservoir network to perform a novel problem solving task. They then compared the activity of neurons in the model with activity of neurons in the prefrontal cortex of a research primate that was trained to perform the same task. Remarkably, there were striking similarities in the activation of neurons in both the reservoir model and the primate.

This breakthrough shows that we have taken big step towards understanding the local recurrent connectivity in the brain that prepares primates to face unlimited situations. This research shows that by allowing essentially unlimited combinations of internal representations in the network of the brain, one of them is always on hand for the given situation.

Citation: Enel P, Procyk E, Quilodran R, Dominey PF (2016) Reservoir Computing Properties of Neural Dynamics in Prefrontal Cortex. PLoS Comput Biol 12(6): e1004967. doi:10.1371/journal.pcbi.1004967

Funding: The present work was funded by European research projects IST- 231267 (Organic), FP7 270490 (EFAA), FP7 612139 (WYSIWYD), and CRCNS NSF-ANR ANR-14-NEUC-0005-1 (Spaquence). EP is funded by the Agence Nationale de la Recherche ANR-06-JCJC-0048 and ANR- 11- BSV4-0006, and by the labex CORTEX ANR-11- LABX-0042. The authors declare no competing financial interests.

http://www.eurekalert.org/pub_releases/2016-06/uocf-dtt061016.php

Damage to tiny liver protein function leads to heart disease, fatty liver

When disrupted, tiny liver protein can lead to the nation's top killer - cardiovascular disease

A UCF College of Medicine researcher has identified for the first time a tiny liver protein that when disrupted can lead to the nation's top killer -- cardiovascular disease -- as well as fatty liver disease, a precursor to cancer. The chief culprit in disabling the protein's delicate mechanics is a fatty acid found in red meat and butter.

Dr. Shadab Siddiqi's discovery is the cover story of the June 10 edition of The Journal of Biological Chemistry. An associate professor in the medical school's Burnett School of Biomedical Sciences, Siddiqi's work focuses on how to prevent heart disease by regulating the secretion of very low density lipoproteins (VLDL) by the liver. These lipoproteins are known to increase cholesterol levels, a risk factor for plaque buildup in the arteries. His previous research has discovered how newly formed VLDLs are transported into the blood stream, forming plaque.

For healthy liver function, normal VLDL secretion must be kept in a delicate balance. Too little VLDL secretion causes fatty liver and, potentially, liver cancer. Identifying the protein and what activates it is the first step in finding ways to prevent its malfunction and disease.

Since changing diets is so difficult, Siddiqi hopes to find an easier alternative.

In a study funded by the National Institutes of Health, Siddiqi discovered a tiny protein -- called a Small Valosin-Containing Protein Interacting Protein (SVIP) -- that regulates how much VLDL is secreted into the blood. SVIP in the liver must be regulated properly to ensure optimum health, Siddiqi said.

He equates the operation of the tiny protein to a manually operated car. To run smoothly, the driver must synchronize the gas pedal and the clutch. If the two aren't synchronized, the car doesn't move easily; it has fits and starts and ultimately stalls.

After identifying the SVIP protein, Siddiqi's lab found that it contains a binding site for myristic acid, a saturated, 14-carbon fatty acid that occurs in butterfat and animal fats, especially red meat. Based on that finding, UCF researchers studied the effects of different dietary fats, including myristic acid, on the functioning of SVIP. They found that only myristic acid activated SVIP to secrete excess very low-density proteins into the blood. But if myristic acid was absent, they found the liver failed to secrete any VLDL. That caused fats to build up in the liver, which can lead to cancer.

The findings suggest that high levels of myristic acid in the diet - through animal and dairy fats -- keep SVIP from properly regulating the liver's secretion of VLDL.

"These findings suggest that our diet modulates the complex molecular processes that have profound effects on our health and lifespan," Siddiqi explained. "The challenge will be in creating a therapy that does not impact the liver's many other functions."

Siddiqi is an associate professor at the UCF College of Medicine and earned his Ph.D. at Lucknow University in India. He did post-doctoral training at the National Institute of Immunology in India and the University of Tennessee Health Science Center. He joined UCF in 2009 after serving as an assistant professor of medicine in the Division of Gastroenterology at the University of Tennessee. Other authors of the study are Samata Tiwari, Shaila Siddiqi and Olga Zhelyabovska, all from Siddqi's lab at UCF.

http://www.eurekalert.org/pub_releases/2016-06/uot-uot060916.php

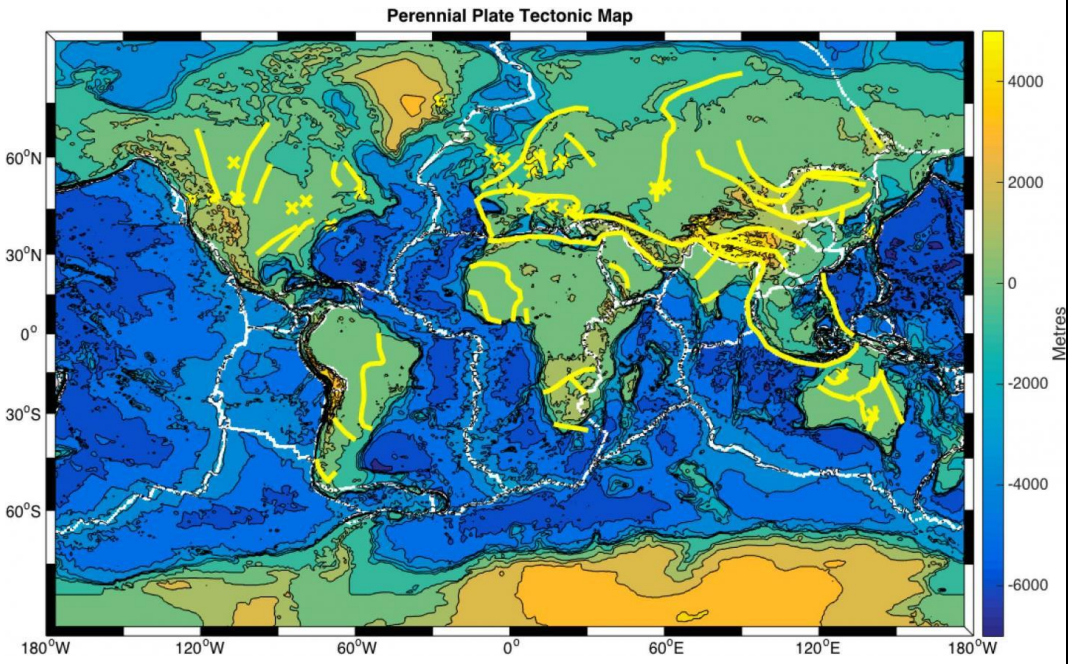
University of Toronto-led research suggests some major changes to geology textbooks

Super-computer modelling of Earth's crust and upper-mantle suggests that ancient geologic events may have left deep 'scars' that can come to life to play a role in earthquakes, mountain formation, and other ongoing processes on our planet.

TORONTO, ON - This changes the widespread view that only interactions at the boundaries between continent-sized tectonic plates could be responsible for such events.

A team of researchers from the University of Toronto and the University of Aberdeen have created models indicating that former plate boundaries may stay hidden deep beneath the Earth's surface. These multi-million-year-old structures, situated at sites away from existing plate boundaries, may trigger changes in the structure and properties at the surface in the interior regions of continents.

"This is a potentially major revision to the fundamental idea of plate tectonics," says lead author Philip Heron, a postdoctoral fellow in Russell Pysklywec's research group in U of T's Department of Earth Sciences. Their paper, "Lasting mantle scars lead to perennial plate tectonics," appears in the June 10, 2016 edition of Nature Communications.



A proposed perennial plate tectonic map. Present-day plate boundaries (white lines), with hidden ancient plate boundaries that may reactivate to control plate tectonics (yellow lines). Regions where mantle lithosphere heterogeneities have been located are given by yellow crosses. **Russell Pysklywec, Philip Heron, Randell Stephenson**

Heron and Pysklywec, together with University of Aberdeen geologist Randell Stephenson have even proposed a 'perennial plate tectonic map' of the Earth to help illustrate how ancient processes may have present-day implications.

"It's based on the familiar global tectonic map that is taught starting in elementary school," says Pysklywec, who is also chair of U of T's Department of Earth Sciences. "What our models redefine and show on the map are dormant, hidden, ancient plate boundaries that could also be enduring or "perennial" sites of past and active plate tectonic activity."

To demonstrate the dominating effects that anomalies below the Earth's crust can have on shallow geological features, the researchers used U of T's SciNet - home to Canada's most powerful computer and one of the most powerful in the world- to make numerical models of the crust and upper-mantle into which they could introduce these scar-like anomalies.

The team essentially created an evolving "virtual Earth" to explore how such geodynamic models develop under different conditions.

"For these sorts of simulations, you need to go to a pretty high-resolution to understand what's going on beneath the surface," says Heron. "We modeled 1,500 kilometres across and 600 kilometres deep, but some parts of these structures could be just two or three kilometres wide. It is important to accurately resolve the smaller-scale stresses and strains."

Using these models, the team found that different parts of the mantle below the Earth's crust may control the folding, breaking, or flowing of the Earth's crust within plates - in the form of mountain-building and seismic activity - when under compression.

In this way, the mantle structures dominate over shallower structures in the crust that had previously been seen as the main cause of such deformation within plates.

"The mantle is like the thermal engine of the planet and the crust is an eggshell above," says Pysklywec. "We're looking at the enigmatic and largely unexplored realm in the Earth where these two regions meet."

"Most of the really big plate tectonic activity happens on the plate boundaries, like when India rammed into Asia to create the Himalayas or how the Atlantic opened to split North America from Europe," says Heron. "But there are lots of things we couldn't explain, like seismic activity and mountain-building away from plate boundaries in continent interiors."

The research team believes their simulations show that these mantle anomalies are generated through ancient plate tectonic processes, such as the closing of ancient oceans, and can remain hidden at sites away from normal plate boundaries until reactivation generates tectonic folding, breaking, or flowing in plate interiors.

"Future exploration of what lies in the mantle beneath the crust may lead to further such discoveries on how our planet works, generating a greater understanding of how the past may affect our geologic future," says Heron.

The research carries on the legacy of J. Tuzo Wilson, also a U of T scientist, and a legendary figure in geosciences who pioneered the idea of plate tectonics in the 1960's.

"Plate tectonics is really the cornerstone of all geoscience," says Pysklywec. "Ultimately, this information could even lead to ways to help better predict how and when earthquakes happen. It's a key building block."

http://bit.ly/25RvVXQ

'Monkey archaeology' reveals macaque's own Stone Age culture

The world's first archaeology dig of an old world monkey culture has uncovered the tools used by previous generations of wild macaques – a group of primates separated from humans by some 25 million years of evolution.

By Alex Kasprak

The discovery means humans aren't unique in leaving a record of our past culture that can be pried open through archaeology.

Only a few decades ago scientists thought that humans were the only species to have worked out how to turn objects in their environment into useful tools. We now know all sorts of animals can do the same – but the tools of choice are usually perishable materials like leafs and twigs.

This makes the origin of these behaviours difficult to study, especially when you consider that the record of hominin stone tool use stretches back more than 3 million years.

Burmese long-tailed macaques are a rare exception. They are renowned for their use of stone tools to crack open shellfish, crabs and nuts, making them one of the very few primates that have followed hominins into the Stone Age.

Now, for the first time, researchers have carried out a successful "monkey archaeology" dig to begin studying the origins of the behaviour.

"It's a very clever idea and it's something that was waiting to be done," says Michael Huffman at Kyoto University in Japan, a primatologist who studies rock handling behaviour in Japanese macaques. "It just took someone to go out and do it."

Michael Haslam of the University of Oxford and his team conducted their dig on the small island of Piak Nam Yai in Thailand, one of the islands where these monkeys live and use stone tools (see video above). They dug through the sandy sediments at the site and found 10 stone tools attributed to macaques, based on their wear patterns.

By dating the oyster shells found in the same sediment layers, they determined the tools could be as old as 65 years, going back two macaque generation.

We know from eyewitness accounts that these monkeys have been using tools for at least 120 years, so the study doesn't push the age of the behaviour back. But Haslam sees it as a first step towards digging deeper into the origins of the behaviour.

Chimpanzee dig

Exactly how far back in time the macaque's Stone Age extends is anyone's guess. A rare "chimpanzee archaeology" dig a decade ago showed this ape has been using stone tools for more than 4000 years.

A long record of ancient stone tools could tell us if the monkeys picked up tool use in response to an environmental stress, such as rapid sea level changes, for example. And it might even show how the practice may have been transferred between different island populations.

Just 150 years ago, archaeologists' claims about early human stone tools were met with scepticism, Haslam says. Since then, scientists have created a detailed and incremental record that shows how hominin stone technologically advanced over millions of years of innovation.

"We're at year zero for the primate world," he says. It may one day be possible to address questions about how and why tool use arises in animal populations, and about the extent to which that kind of behaviour is – or isn't – uniquely human, he adds.

Journal reference: Journal of Human Evolution, DOI: 10.1016/j.jhevol.2016.05.002

http://bit.ly/1XPBGkm

Neuroscientists Discover a New Way to Cross the Blood–Brain Barrier

The harmless virus could deliver medicine throughout the brain

By Monique Brouillette on June 1, 2016

The brain presents a unique challenge for medical treatment: it is locked away behind an impenetrable layer of tightly packed cells. Although the blood-brain barrier prevents harmful chemicals and bacteria from reaching our control center, it also blocks roughly 95 percent of medicine delivered orally or intravenously. As a result, doctors who treat patients with neurodegenerative diseases, such as Parkinson's, often have to inject drugs directly into the brain, an invasive approach that requires drilling into the skull.

Some scientists have had minor successes getting intravenous drugs past the barrier with the help of ultrasound or in the form of nanoparticles, but those methods can target only small areas. Now neuroscientist Viviana Gradinaru and her colleagues at the California Institute of Technology show that a harmless virus can pass through the barricade and deliver treatment throughout the brain.

Gradinaru's team turned to viruses because the infective agents are small and adept at entering cells and hijacking the DNA within. They also have protein shells that can hold beneficial deliveries, such as drugs or genetic therapies. To find a suitable virus to enter the brain, the researchers engineered a strain of an adeno-associated virus into millions of variants with slightly different shell

structures. They then injected these variants into a mouse and, after a week, recovered the strains that made it into the brain. A virus named AAV-PHP.B most reliably crossed the barrier.

Next the team tested to see if AAV-PHP.B could work as a potential vector for gene therapy, a technique that treats diseases by introducing new genes into cells or by replacing or inactivating genes already there. The scientists injected the virus into the bloodstream of a mouse. In this case, the virus was carrying genes that encoded green fluorescent proteins. So if the virus made it to the brain and the new DNA was incorporated in neurons, the success rate could be tracked via a green glow on dissection. Indeed, the researchers observed that the virus infiltrated most brain cells and that the glowing effects lasted as long as one year. The results were recently published in Nature Biotechnology.

In the future, this approach could be used to treat a range of neurological diseases. "The ability to deliver genes to the brain without invasive methods will be extremely useful as a research tool. It has tremendous potential in the clinic as well," says Anthony Zador, a neuroscientist who studies brain wiring at Cold Spring Harbor Laboratory. Gradinaru also thinks the method is a good candidate for targeting areas other than the brain, such as the peripheral nervous system. The sheer number of peripheral nerves has made pain treatment for neuropathy difficult, and a virus could infiltrate them all.

http://nyti.ms/1OjuOIA

Doctor's Plan for Full-Body Transplants Raises Doubts Even in Daring China

Six years ago, Wang Huanming was paralyzed from the neck down after being injured wrestling with a friend. Today, he hopes he has found the answer to walking again: a new body for his head.

By DIDI KIRSTEN TATLOW JUNE 11, 2016

HARBIN, China - Mr. Wang, a 62-year-old retired gas company worker, is one of several people in China who have volunteered for a body transplant at a hospital in the northern Chinese city of Harbin.

The idea for a body transplant is the kind of thinking that has experts around the world alarmed at how far China is pushing the ethical and practical limits of science. Such a transplant is impossible, at least for now, according to leading doctors and experts, including some in China, who point to the difficulty of connecting nerves in the spinal cord. Failure would mean the death of the patient.

The orthopedic surgeon proposing the operation, Dr. Ren Xiaoping of Harbin Medical University, who assisted in the first hand transplant in the United States in 1999, said he would not be deterred. In an interview, Dr. Ren said that he was building a team, that research was underway and that the operation would take place "when we are ready."

His plan: Remove two heads from two bodies, connect the blood vessels of the body of the deceased donor and the recipient head, insert a metal plate to stabilize the new neck, bathe the spinal cord nerve endings in a gluelike substance to aid regrowth and finally sew up the skin.

Whether or not he performs the operation, leading medical experts have condemned the plan. "For most people, it's at best premature and at worst reckless," said Dr. James L. Bernat, a professor of neurology and medicine at the Geisel School of Medicine of Dartmouth College.

Dr. Huang Jiefu, a former deputy minister of health in China, said in an interview in November that when the spine is cut, the neurons "cannot be reconnected, so it's scientifically impossible." "Ethically it's impossible," Dr. Huang added. "How can you put one person's head on another's body?"

Critics attribute such medical experimentation in China to national ambition, generous state funding, a utilitarian worldview that prioritizes results, and a lack of transparency and accountability to the outside world.

"The Chinese system is not transparent in any way," said Arthur L. Caplan, a medical ethicist at New York University. "I do not trust Chinese bioethical deliberation or policy. Add healthy doses of politics, national pride and entrepreneurship, and it is tough to know what is going on."

Some Chinese researchers are also concerned that the experimentation is going too far, too fast.

"I don't want to see China's scholars, transplant doctors and scientists deepening the impression that people have of us internationally, that when Chinese people do things they have no bottom line — that anything goes," said Cong Yali, a medical ethicist at Peking University, referring to Dr. Ren's plans.

The Chinese government invested 1.42 trillion renminbi ($216 billion) in scientific research and development last year, compared with 245 billion renminbi in 2005, according to the National Bureau of Statistics.

Last year, researchers at Sun Yat-sen University, in the southern city of Guangzhou, altered a gene in the human embryo that causes thalassemia, a rare blood disease, using a technique developed in the United States. The experiment crossed an ethical line, some scientists in China and abroad said, because the changes would be inheritable if conducted on viable embryos. (The experiment used unviable embryos.) That could pave the way for permanent gene modification for qualities such as looks or intelligence.

Despite the concerns, in April another team in Guangzhou altered embryos to make them H.I.V. resistant. Internationally, some scientists criticized the experiment, citing a lack of consensus on the ethics of such work.

The team, from Guangzhou Medical University, said that "significant technical issues remain to be addressed." It added that on ethical grounds it would not advocate genome editing on viable lines "until after a rigorous and thorough evaluation and discussion are undertaken by the global research and ethics communities."

Ethical issues have long dogged Chinese researchers in the field of organ transplants, where China was an international pariah for using the organs of executed prisoners. While China says it no longer uses those, Chinese transplant doctors still sometimes submit research from prisoner organs to international conferences, which is not permitted under global ethical norms.

This year, the International Society for Heart and Lung Transplantation said it had rejected research by a Chinese team at its annual meeting, in Washington, on those grounds.

Some Chinese scientists and ethicists say the concerns of medical experts, especially those overseas, are overblown. They attribute them to envy at China's remarkable scientific and economic progress in recent decades.

"We see the reactions among Western commentators as a misunderstanding of the current situation," Zhai Xiaomei, the dean of the School of Humanities and Social Sciences at Peking Union Medical College, wrote in the journal Developing World Bioethics in January.

Critics were unwilling to acknowledge China "as an equal partner in the international debate about proper limits to the development of new biotechnologies," she wrote. Ms. Zhai declined to be interviewed.

Dr. Ren is not the only one exploring the science of body transplants. Dr. Sergio Canavero of the Turin Advanced Neuromodulation Group in Italy, is a prominent advocate, and scientists at the Institute of Theoretical and Experimental Biophysics at the Russian Academy of Sciences are also researching aspects of the procedure. Neither Dr. Canavero nor the Russian institute has plans to carry it out, though, they say.

Dr. Ren, a native of Harbin, spent 16 years in the United States before returning home in 2012. He was part of a team from the University of Louisville that assisted in the hand transplant. He later moved to the University of Cincinnati, according to the website of the university's Academic Health Center.

Dr. Ren has experimented with head transplants on mice, but they have lived only for a day. He said he had also begun practicing on human cadavers, but declined to give details.

The doctor and his supporters say the operation could help people with potentially fatal diseases affecting body function, such as spinal muscular atrophy, as well as those with paralysis like Mr. Wang.

Some aspects of the plan are technically possible, said Dr. Abraham Shaked, a professor of surgery and the director of the Penn Transplant Institute at the University of Pennsylvania. He said it could be possible to preserve the recipient's brain and the donor's body before transplant, attach many of the blood vessels and muscles, and control adverse immune reactions.

But it is still not possible to connect the nerves of the spinal cord, Dr. Shaked said. "At this stage, I would call the attempt stupid rather than crazy," he said in an email. "Crazy means it may be done. Stupid should not be done."

As for using the gluelike substance, polyethylene glycol, to facilitate the growth of nerve endings, Dr. Shaked said, "Put it this way: It is like if the trans-Atlantic phone cable is cut by half, and someone wants to put it together using Krazy Glue." Dr. Ren agrees that it would be stupendously difficult.

"I've been practicing medicine in China and overseas for more than 30 years," he said in an interview. "I've done the most complicated operations. But compared to this one, there's no comparison." "Whether it's ethical or not, this is a person's life," he added. "There is nothing higher than a life, and that's the core of ethics."

Asked to comment, China's Health Commission said surgeons were required to abide by ethical responsibilities outlined in the nation's human organ transplant regulations.

Amid the medical and ethical uncertainties, Mr. Wang and his family cling to hope. For three years, his daughter, Wang Zhi, 34, and her mother hand-pumped oxygen into his lungs. Today, they have an automatic pump paid for by donations. But medical bills have used up their savings, Ms. Wang said.

"He cannot live, and he cannot die," she said.

The family knows that if the operation fails, Mr. Wang will die. But it gives them hope amid their desperation. "A medical procedure that sounds impossible may save us," Ms. Wang said.