http://bit.ly/2qkp3yT

Researchers may have found first polluted river from before Bronze Age

Industrial pollution may seem like a modern phenomenon, but in fact, an international team of researchers may have discovered what could be the world's first polluted river, contaminated approximately 7,000 years ago.

In this now-dry riverbed in the Wadi Faynan region of southern Jordan, Professor Russell Adams, from the Department of Anthropology at the University of Waterloo, and his colleagues found evidence of early pollution caused by the combustion of copper. Neolithic humans here may have been in the early stages of developing metallurgy by learning how to smelt.

The research findings, published in Science of the Total Environment, shed light on a turning point in history, when humans began moving from making tools out of stones to making tools out of metal. This period, known as the Chalcolithic or Copper Age, is a transitional period between the late Neolithic or Stone Age and the beginning of the Bronze Age.

"These populations were experimenting with fire, experimenting with pottery and experimenting with copper ores, and all three of these components are part of the early production of copper metals from ores," said Adams. "The technological innovation and the spread of the adoption and use of metals in society mark the beginning of the modern world."

People created copper at this time by combining charcoal and the blue-green copper ore found in abundance in this area in pottery crucibles or vessels and heating the mixture over a fire. The process was time-consuming and labour-intensive and, for this reason, it took thousands of years before copper became a central part of human societies.

Many of the objects created in the earliest phase of copper production were primarily symbolic and fulfilled a social function within society. Attaining rare and exotic items was a way in which individuals attained prestige.

As time passed, communities in the region grew larger and copper production expanded. People built mines, then large smelting furnaces and factories by about 2600 BC.

"This region is home to the world's first industrial revolution," said Adams. "This really was the centre of innovative technology."

But people paid a heavy price for the increased metal production. Slag, the waste product of smelting, remained. It contained metals such as copper, lead, zinc, cadmium, and even arsenic, mercury and thallium. Plants absorbed these metals, people and animals such as goats and sheep ate them, and so the contaminants bioaccumulated in the environment.

Adams believes the pollution from thousands of years of copper mining and production must have led to widespread health problems in ancient populations. Infertility, malformations and premature death would have been some of the effects. Researchers have found high levels of copper and lead in human bones dating back to the Roman period.

Adams and his international team of researchers are now trying to expand the analysis of the effects of this pollution to the Bronze Age, which began around 3200 BC. The Faynan region has a long history of human occupation, and the team is examining the extent and spread of this pollution at the time when metals and their industrial scale production became central to human societies.

https://uwaterloo.ca/news/news/researchers-may-have-found-first-polluted-river-bronze-age

http://bit.ly/2qkztyD

Neolithic Syrians were first to domesticate cereals

The results of the CSIC-led study appear in the latest edition of PNAS magazine

11,000 years ago, a Syrian community began a practice which would change man's relationship with his surroundings forever: the initiation of cereal domestication and, with it, the commencement of agriculture,

a process which lasted several millennia. The discoveries, made at the Tell Qarassa North archaeological site, situated near the city of Sweida in Syria, are the oldest evidence of the domestication of three species of cereal: one of barley and two of wheat (spelt and farrow).

The team from the Spanish National Research Council (CSIC) and the Universities of Cantabria and the Basque Country (both in northern Spain) was led by CSIC's Juan José Ibáñez, and excavated in the area between 2009 and 2010. Scientific investigators from the Universities of Copenhagen and London also collaborated in the study which is published in the latest edition of the magazine Proceedings of the National Academy of Sciences (PNAS).

The Neolithic man in question lived at a time of huge changes. They gathered wild wheat and barley and gradually began the process of domesticating them. That is to say, they began to build a local economy based around controlling the reproduction of the foods they ate.

The origins of agriculture

Although it was already known that cereal breeding took place in the Near East, it was not known whether the first domesticated cereals appeared in one region or in several regions simultaneously, or, if the first case were true, in which region. "The process began when hunter gatherer communities started collecting wild cereals, leading in turn to these wild cereals being sown, then reaped using sickles. This initial crop husbandry led to the selective breeding of cereal grains. Gradually, domestic traits became more and more dominant", explains Ibáñez.

To be precise, it is this work at Tell Qarassa which allows samples of cereals from the very first phase in the domestication process to be identified. Of all the cereals which were grown at the site, around 30% show domestic traits whilst the remainder continue to show traits which are characteristic of wild cereals.

"We now know that the cereals from Tell Qarassa were sown in autumn and harvested in February and March, before reaching full maturity to prevent the risk- given that they were still partially wild- of heads breaking off and being lost at harvest. The crop was cut close to the ground so as to make full use of the straw and, once collected, it would be thrashed and the grain cleaned in the courtyards outside their homes before being stored inside. Prior to being eaten, the grain was crushed in a mortar and pestle then ground in hand mills", explains the CSIC investigator.

The information obtained at Tell Qarassa shows both the advanced level of technical development of these first farming communities and also that the domestication process of cereals unfolded at varying rates in the different regions of the Near East. "It has yet to be discovered whether the later appearance of domesticated cereals in these regions was due to the use of those cereals originating in the south of Syria which we have been studying, or whether other independent domestication processes took place elsewhere", concludes Ibáñez.

The project was funded with subsidies from the Spanish Ministry of the Economy, Industry and Competitiveness, as well as from the Ministry of Education, Culture and Sport. Further support came from the Regional Governments of the Basque Country and Cataluña, and it also received funding from three private foundations: The Shelby White-Leon Levy, The Gerda Henkel, and the Palarq.

http://bit.ly/2hmZehQ

Researchers uncover how hippocampus influences future thinking

Hippocampus plays an important role in imagining events in the future

(Boston) - Over the past decade, researchers have learned that the hippocampus--historically known for its role in forming memories--is involved in much more than just remembering the past; it plays an important role in imagining events in the future. Yet, scientists still do not know precisely how the hippocampus contributes to episodic imagining--until now. Researchers from Boston University School of Medicine (BUSM) have determined the role of the hippocampus in future imaging lies in the process of constructing a scene in one's mind.

The findings, which appear in the journal Cerebral Cortex, shed important light on how the brain supports the capacity to imagine the future and pinpoints the brain regions that provide the critical ingredients for performing this feat.

The hippocampus is affected by many neurological conditions and diseases and it also can be compromised during normal aging. Future thinking is a cognitive ability that is relevant to all humans. It is needed to plan for what lies ahead, whether to navigate daily life or to make decisions for major milestones further in the future.

Using functional Magnetic Resonance Imaging, BUSM researchers performed brain scans on healthy adults while they were imagining events. They then compared brain activity in the hippocampus when participants answered questions pertaining to the present or the future. After that, they compared brain activity when participants answered questions about the future that did or did not require imagining a scene.

"We observed no differences in hippocampal activity when we compared present versus future imaging, but we did observe stronger activity in the hippocampus when participants imagined a scene compared to when they did not, suggesting a role for the hippocampus in scene construction but not mental time travel," explained corresponding author Daniela Palombo, PhD, postdoctoral fellow in the memory Disorders Research Center at BUSM and at the VA Boston Healthcare System.

According to the researchers the importance of studying how the hippocampus contributes to cognitive abilities is bolstered by the ubiquity of hippocampal involvement in many conditions. "These findings help provide better understanding of the role of the hippocampus in future thinking in the normal brain, and may eventually help us better understand the nature of cognitive loss in individuals with compromised hippocampal function," she added.

Palombo believes that once knowledge about which aspects of future imagining are and are not dependent on the hippocampus, targeted rehabilitation strategies can be designed that exploit those functions that survive hippocampal dysfunction and may provide alternate routes to engage in future thinking.

Funding for this study was provided by the National Institutes of Mental Health (grant number H093431) and the Department of Veterans Affairs (Clinical Science Research and Development Service and Rehabilitation Research & Development Service grant number E7822W). Co-author D.J.P. was supported by a postdoctoral fellowship from the Canadian Institutes of Health Research (CIHR). This work was further supported with resources and the use of facilities at the Neuroimaging Research for Veterans Center, VA Boston Healthcare System.

http://bit.ly/2gkCQWj

Cancer drug may cause women to grow new eggs, study suggests

Women treated with a common chemotherapy drug combination have more young eggs in their ovaries afterwards, research has found.

A small study indicates that a therapy commonly used to target Hodgkin's lymphoma appears to increase the number of non-growing eggs in women's ovaries. Researchers say it is too soon to link the outcome to fertility, but believe more research is needed to better understand the findings and their implications.

Scientists from the University of Edinburgh analysed samples of ovary tissue donated by 14 women who had undergone chemotherapy, and from 12 healthy women.

They found that the ovaries from eight of the cancer patients, who had been treated with a drug combination known as ABVD, had a much greater incidence of immature, or non-growing, eggs compared with tissue from women who had received a different chemotherapy, or from healthy women of a similar age.

The ovary tissue was seen to be in healthy condition, appearing similar to tissue from young women's ovaries.

If further research can reveal the mechanism by which treatment with ABVD results in increased production of eggs, this would aid understanding of how women might be able to produce more eggs during their lifetime, which was until recently thought to be impossible.

Researchers had set out to better understand why treatment with ABVD is one of the few cancer drug combinations that does not impact on women's fertility.

Future studies will examine the separate impact of each of the four drugs that combine to make ABVD - known as adriamycin, bleomycin, vinblastine and dacarbazine - to better understand the biological mechanisms involved. The study, published in Human Reproduction, was supported by the Medical Research Council.

Lead researcher Professor Evelyn Telfer of the University of Edinburgh's School of Biological Sciences, said: "This study involves only a few patients, but its findings were consistent and its outcome may be significant and far-reaching. We need to know more about how this drug combination acts on the ovaries, and the implications of this."

http://bbc.in/2qkaq2b

Scottish fossils tell story of first life on land

Fossils of what may be the earliest four-legged backboned animals to walk on land have been discovered in Scotland.

By Helen Briggs BBC News

The lizard-like creatures lived about 355 million years ago, when the ancestors of modern reptiles, birds and mammals emerged from swamps. The discovery plugs a 15 million-year gap in the fossil record.

Artist's impression of how the animals might have looked **Mark Witton/National Museums Scotland**

There are five complete fossils and many more fragments of bones that have yet to be classified. Some resemble lizards or newts, while others are larger, with almost crocodile-like proportions.

"We're lifting the lid on a key part of the evolutionary story of life on land," said Prof Jennifer Clack of the University of Cambridge.

"What happened then affects everything that happens subsequently - so it affects the fact that we are here and which other animals live with us today."

Critical step

The fossils suggest that the first backboned animals to crawl around on land may have lived in what is now the Scottish borders.

Alternatively, there may be many more similar fossils in other parts of the world that have yet to be discovered.

Dr Nick Fraser, of National Museums Scotland, who worked on the fossils, said they represent a "critical step in the evolution of life on Earth". "Without this step of vertebrates - animals with backbones - coming on to land, we wouldn't be here, birds wouldn't be here, crocodiles wouldn't be here, lizards, frogs, dinosaurs would never have roamed the Earth - all these things would not have evolved," he told BBC News.

Around 360 million years ago, many life forms, including early fish, were wiped out in a mass extinction. For the next 15 million years or so, a key time in tetrapod evolution, there is a gap in the fossil record.

This means we know very little about how fish-like animals grew the limbs that could support them on land.

Dr Fraser said the focus of attention is on Scotland, as it may be the place where these animals "first colonised land". "These are the oldest animals with four legs that were able to move around on land," he said.

"If you want to draw the analogy to Neil Armstrong's first step on the Moon - it was one small step for man but a giant leap for mankind, well, this in some ways is a small step out of the water for these animals but it's a giant leap forward for the future evolution of life on land."

Only a handful of sites in the world have yielded similar fossils from this time period. One is in Scotland - in Dumbarton, west of Glasgow, where only a single fossil (Pederpes) has been unearthed. Fragments of fossils have been found in the US and Canada. Details of the latest discoveries are published in the journal Nature Ecology & Evolution.

Dr Per Ahlberg, of Uppsala University, Sweden, said the fossils "substantially change our picture of early tetrapod evolution".

And Dr Mike Coates, of the University of Chicago, said "they predict more diversity, earlier in the fossil record" and suggest "a greater range of extinction survivors among the early tetrapods".

Dr Jason Anderson, of the University of Calgary, said the fossils show that the apparent gap in the fossil record "is due to a lack of fossil collection, and not because there were no fossils because of low atmospheric oxygen".

http://nyti.ms/2hddxSQ

Achoo! What's That About?

Q. I belong to a group with Achoo Syndrome, also known as photic sneezing. Is there any new research on it?

By C. CLAIBORNE RAY DEC. 5, 2016

A. The protective reflex of sneezing when exposed to bright light has not been heavily researched, even though it affects an estimated 18 percent to 35 percent of the population. That is because most people do not find it to be a serious problem, with many ignoring it, assuming that everyone reacts the same way they do.

The syndrome is known to be genetic, scientists reported in 1964.

Among the most recent research on the syndrome was a Spanish study this year published in The Archives of the Spanish Society of Ophthalmology, which found that 67 percent of the sufferers who were examined had prominent corneal nerves to some degree, an anomaly that could play a role in the reaction. The study was very small, however, involving 12 members of one family, and further research is needed, the authors said.

A 2005 study of electroencephalograms of brain activity, in the journal PLOS One, suggested that the reflex is unusual in involving specific higher brain areas governing vision and sensation, rather than a classical reflex that happens at the level of the brainstem or spinal cord.

One group for whom photic sneezing is not benign is fighter pilots, a 1993 study found. The reflex does not seem to be a reaction to specific wavelengths of light, but to changes in light intensity, which could set off an unexpected sneezing fit during critical periods of flight, the researchers said.

http://bbc.in/2hi77EO

Caesarean births 'affecting human evolution'

The regular use of Caesarean sections is having an impact on human evolution, say scientists.

By Helen Briggs BBC News

More mothers now need surgery to deliver a baby due to their narrow pelvis size, according to a study. Researchers estimate cases where the baby cannot fit down the birth canal have increased from 30 in 1,000 in the 1960s to 36 in 1,000 births today.

Historically, these genes would not have been passed from mother to child as both would have died in labour. Researchers in Austria say the trend is likely to continue, but not to the extent that non-surgical births will become obsolete.

Dr Philipp Mitteroecker, of the department of theoretical biology at the University of Vienna, said there was a long standing question in the understanding of human evolution.

"Why is the rate of birth problems, in particular what we call fetopelvic disproportion - basically that the baby doesn't fit through the maternal birth canal - why is this rate so high?" he said. "Without modern medical intervention such problems often were lethal and this is, from an evolutionary perspective, selection. "Women with a very narrow pelvis would not have survived birth 100 years ago. They do now and pass on their genes encoding for a narrow pelvis to their daughters."

Opposing forces

It has been a long standing evolutionary question why the human pelvis has not grown wider over the years. The head of a human baby

is large compared with other primates, meaning animals such as chimps can give birth relatively easily.

The researchers devised a mathematical model using data from the World Health Organization and other large birth studies. They found opposing evolutionary forces in their theoretical study. One is a trend towards larger newborns, which are more healthy.

However, if they grow too large, they get stuck during labour, which historically would have proved disastrous for mother and baby, and their genes would not be passed on.

"One side of this selective force - namely the trend towards smaller babies - has vanished due to Caesarean sections," said Dr Mitteroecker.

"Our intent is not to criticise medical intervention," he said. "But it's had an evolutionary effect. "

Future trends

The researchers estimated that the global rate of cases where the baby could not fit through the maternal birth canal was 3%, or 30 in 1,000 births. Over the past 50 or 60 years, this rate has increased to about 3.3-3.6%, so up to 36 in 1,000 births. That is about a 10-20% increase of the original rate, due to the evolutionary effect.

"The pressing question is what's going to happen in the future?" Dr Mitteroecker said. "I expect that this evolutionary trend will continue but perhaps only slightly and slowly. "There are limits to that. So I don't expect that one day the majority of children will have to be born by [Caesarean] sections."

The research is published in the journal, Proceedings of the National Academy of Sciences.

Commenting on the study, Smithsonian paleoanthropologist Dr Briana Pobiner said there are "probably many other biological and cultural issues that factor into the Caesarean sections rate, which varies widely across the developed and developing world".

And Daghni Rajasingam, a consultant obstetrician and a spokesman for the Royal College of Obstetricians, said factors such as diabetes and obesity, are having an impact on the number of Caesarean sections.

"I think what is important to take into the [question of] evolution is that things like diabetes are much more common at a younger age so we see many more women of reproductive age who have diabetes," she said.

"That has consequences as to whether or not they may need a caesarean section.

"In addition, the rates of obesity are increasing so more and more women of reproductive age have a higher body mass index and this again has an impact on caesarean section rates."

http://bit.ly/2qoeh5V

Protein that promotes 'cell-suicide' could revolutionize eye cancer treatment

Specific protein can help prevent the survival and spread of eye cancer, by initiating cancer apoptosis

New research from the University of Liverpool has identified the role of a specific protein in the human body that can help prevent the survival and spread of eye cancer, by initiating cancer 'cell-suicide'.

The new findings may help revolutionise the approach to metastatic uveal melanoma (UM) - a cancer that arises from the pigment cells (melanocytes) in the eye, and for which there is currently no effective treatment.

Metastasis is the spread of a cancer or other disease from one organ or part of the body to another without being directly connected with it. This occurs in about half of the patients with UM.

Although rare, UM is the most common primary eye cancer in adults. While the primary tumour can often be treated very effectively, up to 50% of patients develop metastases most often in the liver, for whom no effective therapy is available.

Programmed cell death

Apoptosis, or programmed cell death, is a rapid and irreversible process to efficiently eliminate dysfunctional cells. A hallmark of cancer is the ability of malignant cells to evade apoptosis.

Dr Luminita Paraoan, from the University's Department of Eye and Vision Science in the Institute of Ageing and Chronic Disease, has published new findings in the British Journal of Cancer that identify the requirement of a protein called p63 for the initiation of apoptosis in UM. Chromosome 3 is one of the 23 pairs of chromosomes in humans. People normally have two copies of each chromosome. One part of chromosome 3 contains the gene for the protein p63.

Unfortunately people with aggressive (resistant to apoptosis) UM do not have this part and therefore do not have the p63 protein.

Dr Paraoan's research found that if the p63 gene is used in combination with another gene, called p53, they can effectively target UM and start the process of apoptosis in the cancerous cells.

Tumour suppressor genes

The p53 gene is from a class of genes called tumour suppressors which are mutated in cases of cancer. Tumour suppressor genes are protective genes. Normally, they limit cell growth by monitoring how quickly cells divide into new cells, repairing damaged DNA, and controlling when a cell dies.

When a tumour suppressor gene is mutated, for example in cancer cases, cells grow uncontrollably and may eventually form a mass called a tumour. Therefore p53 itself is ineffective in starting the process of apoptosis of cancer calls in UM.

Of her research Dr Luminita said: "The study highlights for the first time the requirement of p63 in the initiation of apoptosis in UM".

"Our findings have broad-ranging implications for other cancers in which apoptosis is evaded or is problematic. They will hopefully prove advantageous in designing therapeutic approaches to cancerous tumours that are currently resistant to chemotherapy and radiotherapy."

The paper, entitled 'p63 is required beside p53 for PERP-mediated apoptosis in uveal melanoma', can be found here.

http://bit.ly/2hzJMef

Our brains record and remember things in exactly the same way

You might think your memories are unique, but a study involving a Sherlock Holmes drama suggests the opposite.

By Andy Coghlan

When people describe the episode, their brain activity patterns are almost exactly the same as each other's, for each scene. And there's also evidence that, when a person tells someone else about it, they implant that same activity into their brain as well.

That's the implication of a groundbreaking experiment which, for the first time, has revealed that when we record and recount a shared experience, we use practically the same brain activity as each other, rather than everyone remembering and recalling events in random, individual ways."We feel our memories are unique, but we see now that there's a lot in common between us in how we see and remember the world, even at the level of brain activity patterns," says Janice Chen at Princeton University.

Detective story

Aptly, the legendary detective Sherlock Holmes and his sidekick, Dr Watson, played a key part in the discovery. That's because the phenomenon came to light when 17 volunteers had their brains scanned as they watched, then immediately recalled, a 50-minute episode of the BBC drama, Sherlock.

Chen and her colleagues broke down the episode into 50 distinct scenes, and analysed the brain activity of each individual while they viewed and recalled them.

"We were very surprised how good people's memories were, with many people speaking for over 30 minutes, hitting most of the scenes in mostly the right order and giving lots of detail," says Chen.

Incredibly, brain activity while watching, and later recalling, each scene was strikingly similar across all 17 volunteers. Chris Bird at the University of Sussex, UK, says this discovery is "extremely

surprising". The patterns of brain activity for particular sections of the drama appear to create a "signature" that is common across individuals.

During their verbal accounts of the episode, the volunteers even appeared to edit their memories in an identical way, in terms of which parts of the original brain patterns were cut and which retained. This editing meant that even though the volunteers used diverse words, sentences and recollections to articulate their accounts of what happened in the episode, the brain activity patterns during recall across the 17 viewers closely matched each other.

"It's a kind of whittling down to the gist of what happened," says Bird. "Once you've edited it, there's a clearer thing to pass on."

Implanting memories

Chen says the experiment was far more ambitious and sophisticated than many previous attempts to interrogate memory circuitry, as these often rely on recall of simple objects. "We're showing here that there's a distinct brain pattern for each movie scene," she says. "Usually, memory experiments use single words or static pictures, so we're excited to show it's possible to do all this during a much more realistic experience, watching an hour-long movie and talking freely about it for many minutes."

But Chen dismisses the idea that the discovery could be exploited to artificially implant memories into people's brains, as has been done in mice. However, in ongoing research in which people who haven't seen a movie listen to someone else's description of it, Chen and her colleagues have found that the listener's brain activity looks much like that of the person who has seen it.

"I would say that you implant your thoughts into another person's brain quite easily, simply by telling them what you are thinking or remembering," says Chen. "You remember it and, at the same time, they imagine it."

A key implication of the discovery, says Chen, is that this "universal recording network" evolved to enable us and our evolutionary ancestors to instantly understand and empathise with one another, essentially implanting memories in each other's brains by recounting stories and information crucial to survival.

"I think this is no accident, because having a common framework for remembering makes it easier to communicate our memories to others, and that's a powerful thing human beings can do," says Chen. "If I direct a stranger to a train station, for example, that stranger would be using my brain to process information from the world, taking a shortcut to acquiring knowledge."

Journal reference: Nature Neuroscience, DOI: 10.1038/nn.4450

http://bit.ly/2gOa5gD

Reason why farm kids develop fewer allergies explained

Scientists have discovered why growing up on a farm might protect children from developing allergies.

Using studies in both mice and humans, they found that exposure to farm dust increases expression of a protective protein that suppresses the inflammatory immune system by modifying the communication between the lining of the lungs and the immune system. The findings are presented today (07/12/16) at the Joint Congress of the British and Dutch Societies for Immunology, taking place in Liverpool, UK.

Rates of allergies are increasing in the UK and Europe, with approximately one in four people suffering from a seasonal allergy, such as hay fever or allergic asthma; however, the reasons behind this are unclear. We know that children growing up on farms have fewer allergies than their urban counterparts, but there has been little evidence to show how the farm environment might protect against allergy.

A team, including Martijn Schuijs, a PhD student at the VIB-UGent Inflammation Research Center in Belgium, carried out several experiments to look at this question. Firstly, mice were exposed to a low dose of either LPS (a component of the bacterial cell wall that is found in farm dust), farm dust, or a control substance every other day for two weeks. The mice were then sensitised with house dust mite

extracts (HDM), which caused them to mount an allergic response when later confronted with a high dose of HDM.

Mice exposed to farm dust or LPS showed significantly lower asthmatic responses to the HDM than controls. This protection appeared to be mediated by a protein called A20 which modifies communication between the cells lining the lungs and the immune system. The researchers found that exposure to LPS or farm dust induced A20 expression in mice, which suppresses the inflammatory immune response.

These findings were then validated in human cells, using cells from the lining of the airways in the lungs taken from patients with mild, severe, or no asthma. The immune response to HDM was weakened in cells pre-exposed with LPS, compared to controls.

Finally, the researchers examined the relationship between common genetic mutations in the gene encoding A20 (called Tnfaip3), and prevalence of asthma in 1,707 European children aged 6-12 years. Children with a mutation that altered one amino acid in the A20 protein showed higher levels of asthma; however, growing up on farms had a protective effect on those with the mutation compared to those that had not been brought up on a farm.

Altogether, these results provide the first evidence of the biological mechanisms behind why children who grow up on farms develop fewer allergies. The researchers' next step is to understand the mechanism by which farm dust induces the expression of A20 in cells. They hope that this work can lead to the development of new asthma therapies by stimulating A20 production in cells lining the airways.

Researcher Martijn Schuijs, from the VIB-UGent Inflammation Research Center in Ghent, Belgium, said:

"Rates of allergies are increasing but we know relatively little about the factors that predispose an individual to develop these conditions. Our study has shone a light on why kids who grow up on farms appear to develop fewer allergies. Breathing in dust from farms seems to stimulate the production of a protein called A20, which limits inflammation in the lungs leading to lower rates of asthma.

"While this is an exciting first step, we now need to carry more studies to find out the mechanisms behind this relationship and to see if some of the functional findings from the studies using mouse models translate to humans. By targeting the A20 protein in the cells that line the airways, we hope this will lead towards the development of more effective medication for people with allergic asthma."

http://bit.ly/2grucFj

Pavlov's plants: new study shows plants can learn from experience

Monica Gagliano's experiments are extending the concept of cognition to the plant world

Prudence Gibson Art writer and Tutor, UNSW Australia

The first time I met the Australian evolutionary ecologist Monica Gagliano, she was wearing colourful paisley trousers and was giving an animated talk at a 2014 environmental humanities conference in Canberra. Despite her passionate presentation, trouble was brewing. Something was not right in the room. A woman beside me in the audience kept shifting her weight. A man to my left had crossed his arms and released several voluble sighs.

Why? Because Gagliano was using phrases such as "plant cognitive ecology", "learning and communication". And because she was, and is, opening up areas of knowledge that some might feel threaten the sovereignty of humans over nature.

That day in Canberra three years ago, Gagliano's time frames were questioned. The frequency of her experiments were interrogated. Her apparatus was cross-examined. Yet, despite resistance, I believe her work is ground-breaking and opens up debate about plant subjectivity and ethics.

Sensitive plants

In a famous 2013 New Yorker article by Michael Pollan, The Intelligent Plant, Gagliano was introduced to readers as someone

whose experiments are extending the concept of cognition to the plant world. The problem she is addressing is that if plants have brain-like functions and make sentient-like decisions, our existing perception of nature and ourselves must change.

These implications need further analysis. But, first: the experiments. What Gagliano did with her Mimosa pudica plants – also called "sensitive" plants – was to custom-build an apparatus whereby the plants could be suddenly dropped a foot or so on a regular basis.

Initially, on dropping, the plant retracted and curled its leaves, but after repeats, it stopped reacting. Not only did it appear to "learn" a behaviour (without a brain, mind you) but it also remembered.

Gagliano repeated the experiment at intervals and found that even after a break of a month or more, the Mimosa would still not retract its leaves after being dropped.

How does this work? According to Gagliano:

Plants may lack brains and neural tissues but they do possess a sophisticated calcium-based signaling network in their cells similar to animals' memory processes.

Mimosa pudica is also known as the 'sensitive plant', and appears to be able to learn from experience. Flickr/foam, CC BY-SA

Gagliano has published her findings and edited various scholarly books on plant research, ethical implications and changed perceptions. She has collaborated with environmental lawyer Alessandro Pelizzon and others on the language problems of writing about plant life.

There is no vocabulary that can be used to talk about brain-like plant structures beyond mere vascular and survival processes, nor about decision-making, sentience, intelligence, learning and memory in the plant world.

There is much more work to be done by artists and humanists to develop these vocabularies together. Scholars such as Michael Marder, Dalia Nassar, Natasha Myers and myself are working in this field where there may be a realm of sophisticated activity in plant life that humans have not yet even fully comprehended.

A forthcoming book titled The Language of Plants is edited by Gagliano and colleagues, and deals with this complex and provocative problem, following on from her book The Green Thread.

Pavlov's plants

Gagliano and her colleagues have just published a paper in Nature Scientific Reports that could rock our sense of human "self".

This is a major coup for the plant scientist, who has suffered rejection from journals, for moving plant physiology into the domain of philosophy, for extending animal studies concepts of sentience to plants and more. Does this caution by journal editors reflect a fearfulness about our human place in the world?

The new paper explains her recent experiments where she sought to show plants can "learn" via classical conditioning, similar to the classic Pavlov's dogs experiment. Instead of food as the reward (the unconditioned simulus) and a bell as a neutral cue (the conditioned stimulus), she used light as the reward and air flow as the cue.

Gagliano and her colleagues used the air flow caused by a fan to predict the location and time of light. They found that the plants conditioned by the fan would grow towards the source of the air flow even when the light was not present, but only if they were "trained" to do so. This is like Pavlov ringing the bell and the dogs salivating, even if there was no food around.

Gagliano's peas, Pisum sativum, also behaved according to a simulated circadian rhythm (temperature and light/dark control) and a sense of time of day, which is known to modulate behavioural processes such as learning in animals.

This experiment appears to show associative learning in plants. Gagliano has shown that plants don't just respond to light and food in order to survive. They also choose and predict.

These findings will get people asking some tough questions. Do plants, like animals, have consciousness? If plants learn, choose and associate, what does this mean for our ethical relationship with them? Can humans learn from the adaptive capacities of plants?

To respond to light, fans and temperature in this way suggests that plants have far more sophisticated abilities than previously thought. The philosophical and ethical implications of this information are confounding. It provokes further questions about the plant world that we have historically seen as inert and lacking in agency. With no brain, how can plants have cognition? Yet they exhibit functions we typically only associate with a brain.

Where does all this lead us? Well, into troubled waters, so grab your boat and paddle. We are in for a rough philosophical ride.

http://bit.ly/2hia5Gn

One specific gene explains many diseases

Genetic differences in the FADS1 gene determine the risk for many different diseases.

The ability to produce polyunsaturated fats like omega-3 and omega-6 differs between individuals and this affects the risk for disturbed metabolism, inflammatory diseases and several types of cancer. Scientists at Uppsala University/SciLifeLab in Sweden have clarified this in detail and the work is published in the journal Nucleic Acids Research.

"After detailed experiments we now know exactly which mutation in the region that is functional and directly involved in FADS1 regulation", says Gang Pan at the Department of Immunology, Genetics and Pathology, Uppsala University and one of the authors of the article.

In this new study the scientists show that the gene region which controls FADS1 appeared 6 million years ago and is present in human and chimpanzee but not in other species. Since increased production of omega-3 and omega-6 is favourable to brain development this event may have contributed to human evolution. A mutation happened 300 000 years ago which further increased the capacity of the gene to produce both omega-3 and omega-6 fatty acids. This mutation constituted an evolutionary advantage that has led to the more active variant of FADS1 being the common one in major parts of the world.

In historical times people ate equal amounts of omega-3, coming from fish and vegetables, and omega-6 coming from meat and egg.

"Since we now live longer and have changed our diet radically - modern food in the Western world has drastic excess of omega-6 - what was an advantage in historical times may have turned against us and become an increased risk for many diseases", says Gang Pan.

The genetic difference at FADS1 affects levels of LDL- and HDL-cholesterol, several other important fats, blood sugar and the metabolic syndrome, as well as how well we respond to treatment to control blood fat. It affects the risk for allergies and inflammatory diseases like rheumatism and inflammatory bowel disease. In addition it influences the risk for colon cancer and other types of cancer, as well as the heart rate.

"Polyunsaturated fats are involved in a surprising number of processes and the hope is that the new knowledge will make it possible to treat some of these diseases in a targeted way", says Claes Wadelius, Professor in Medical Genetics at Uppsala University and SciLifeLab, Sweden, and the main author of the study.

Reference: Gang Pan, Adam Ameur, Stefan Enroth, Madhusudhan Bysani, Helena Nord, Marco Cavalli, Magnus Essand, Ulf Gyllensten and Claes Wadelius, PATZ1 down-regulates FADS1 by binding to rs174557 and is opposed by SP1/SREBP1c, Nucleic Acids Research, 2016 1-15, doi: 10.1093/nar/gkw1186*

http://bit.ly/2hib5dQ

Dietary magnesium associated with reduced risk of heart disease, stroke and diabetes

Diet rich in magnesium may reduce the risk of diseases including coronary heart disease, stroke and type-2 diabetes

A diet rich in magnesium may reduce the risk of diseases including coronary heart disease, stroke and type-2 diabetes according to a new meta-analysis published in the open access journal BMC Medicine. This analysis of the evidence on dietary magnesium and health outcomes is the largest to date, involving data from more than one million people across nine countries.

The researchers, from Zhejiang University and Zhengzhou University in China, found that people in the highest category of dietary magnesium consumption had a 10% lower risk of coronary heart disease, 12% lower risk of stroke and a 26% lower risk of type-2 diabetes compared to those in the lowest category. Their results also indicate that an extra 100mg per day of dietary magnesium could also reduce risk of stroke by 7% and type-2 diabetes by 19%.

Dr Fudi Wang, lead author from the School of Public Health at Zhejiang University, said: "Low levels of magnesium in the body have been associated with a range of diseases but no conclusive evidence has been put forward on the link between dietary magnesium and health risks. Our meta-analysis provides the most up-to-date evidence supporting a link between the role of magnesium in food and reducing the risk of disease."

Dr Wang added: "The current health guidelines recommend a magnesium intake of around 300mg per day for men and 270mg per day for women. Despite this, magnesium deficiency is relatively common, affecting between 2.5% and 15% of the general population. Our findings will be important for informing the public and policy makers on dietary guidelines to reduce magnesium deficiency related health risks."

Magnesium is vital for human health and normal biological functions including glucose metabolism, protein production and synthesis of nucleic acids such as DNA. Diet is the main source of magnesium as the element can be found in foods such as spices, nuts, beans, cocoa, whole grains and green leafy vegetables.

In this analysis, data from 40 epidemiological studies covering a period from 1999 to 2016 were used to investigate associations between dietary magnesium and various diseases. In all the studies, levels of dietary magnesium were determined using a self-reported food frequency questionnaire or a 24-hour dietary recall. As the levels of magnesium used to define categories varied widely between the studies, the researchers performed a dose-response analysis for the effect of each 100mg per day increase of dietary magnesium.

This meta-analysis involves observational studies meaning that it is not possible to rule out the effect of other biological or lifestyle factors influencing the results. It is also not possible to determine if magnesium is directly responsible for reducing disease risk. However, the large size of this analysis provides robust data that were stable when adjusting for gender and study location. The authors state that their findings reinforce the notion that increased consumption of magnesium rich foods could be beneficial for overall health.

1. Research article: Dietary magnesium intake and risk of cardiovascular disease, type 2 diabetes, and allcause mortality: A dose-response meta-analysis of prospective cohort studies
Fudi Wang et al. BMC Medicine 2016 DOI: 10.1186/s12916-016-0742-z
https://bmcmedicine.biomedcentral.com/articles/10.1186/s12916-016-0742-z

http://bit.ly/2hcAbNh

Pitt-developed molecule could be first antidote for carbon monoxide poisoning

Discovery that could potentially lead to the creation of the first antidote in humans

PITTSBURGH - Researchers from the University of Pittsburgh School of Medicine and UPMC have engineered a protein that reverses carbon monoxide (CO) poisoning in mice, a discovery that could potentially lead to the creation of the first antidote in humans to the often deadly poisoning, according to research published today in the journal Science Translational Medicine.

CO poisoning is responsible for more than 50,000 emergency room visits in the United States annually, and is one of the leading global causes of poisoning death. A colorless, odorless gas, CO is extremely effective at replacing oxygen molecules in hemoglobin, the oxygen carrying protein in blood. CO exposure also results in debilitating effects on the body and the brain, including cognitive deficits that in some cases can persist months or years after a poisoning event.

"Despite being the most common poisoning worldwide, we still do not have an effective antidote for CO exposure," said Mark T. Gladwin,

M.D., chair of medicine, Pitt School of Medicine, Dr. Jack D. Myers Professor of Internal Medicine, and director of the Pittsburgh Heart, Lung, Blood and Vascular Medicine Institute. "Our protein is extraordinarily effective at scavenging CO from the blood, and could potentially prove to be a significant advance in the treatment of CO poisoning."

Current treatment options for CO poisoning--administering 100 percent oxygen or using a pressurized hyperbaric chamber to administer oxygen at greater than normal air pressure--focus on trying to replace CO in blood with oxygen as quickly as possible. However, both these treatments are only moderately effective. Moreover, transporting patients to a hyperbaric chamber requires a significant amount of time, and many poisoned patients may not be stable enough for this therapy.

When studying neuroglobin (Ngb), a hemoglobin-like protein present in the brain, Gladwin and his team discovered it could bind CO with an unusually high affinity. Based on prior knowledge of how the protein works, researchers engineered a mutant version of the protein, called Ngb H64Q, that was an even better scavenger of CO.

In a purified sample of red blood cells infused with CO, they found that Ngb H64Q was 1,200 times faster at forcing CO to release itself from being bound to hemoglobin than just air alone. When tested in a mouse model of non-lethal CO poisoning, they found that Ngb H64Q was significantly better at removing CO from hemoglobin than 100-percent oxygen treatment. The normal half-life of CO in humans after poisoning (time it takes for half of the CO to be eliminated from the body) is 320 minutes, and even with 100-percent oxygen therapy, that time is 74 minutes. With the antidote therapy, the CO half-life was reduced to only 23 seconds.

In a mouse model with lethal levels of CO poisoning, seven out of eight mice treated with Ngb H64Q (87.5 percent) survived the duration of the experiment, while 10 percent or less survived in the control groups. Additionally, the antidote restored blood pressure and improved the amount of oxygen that was present in tissues, suggesting that Ngb H64Q works by scavenging CO from hemoglobin and allowing oxygen to bind in its place, thus restoring normal oxygen delivery. Importantly, CO bound to Ngb H64Q was detected in the urine of mice shortly after treatment, which indicated that the rodents were able to excrete the antidote from the body without any major toxic effects.

"If approved, this antidote could be rapidly administered to victims in the field, eliminating costly delays that occur with current treatment options," Gladwin said. "We still need extensive safety and efficacy testing before an antidote is available on the shelf, but our early results are very promising."

Researchers plan to scale up their safety and efficacy testing in animal models and hope to advance to clinical trials within the next few years.

Ivan Azarov, Ph.D., Ling Wang, M.D., Ph.D., and Jason J. Rose, M.D., all from Pitt, were the study's lead authors. Additional contributors included Qinzi Xu, M.D., Xueyin N. Huang, Ph.D., Ying Wang, Ph.D., Lanping Guo, Ph.D., Charles F. McTiernan, Ph.D., Christopher P. O'Donnell, Ph.D., Sruti Shiva, Ph.D., and Jesús Tejero, M.D., Ph.D., all of Pitt; and Chen Liu, Ph.D., Kamil B. Ucer, Ph.D., Andrea Belanger, Ph.D., and Daniel B. Kim-Shapiro, Ph.D., of Wake Forest University.

The study was supported in part by the National Heart, Lung, and Blood Institute SMARTT (Science Moving towArd Research Translation and Therapy) Program, the Institute for Transfusion Medicine and the Hemophilia Center of Western Pennsylvania; and National Institutes of Health grants F32 HL132418, R01 HL111706, R01 GM113816, R21 ES027390, R01 HL058091, R01 HL098032, R01 HL125886, P01 HL103455, T32 HL110849 and T32 HL007563.

http://bit.ly/2hljHkc

Substance present in ayahuasca brew stimulates generation of human neural cells

A Brazilian study suggests that harmine increases the number of neural progenitors, cells that give rise to neurons

Ayahuasca is a beverage that has been used for centuries by Native South-Americans. Studies suggest that it exhibits anxiolytic and antidepressant effects in humans. One of the main substances present in the beverage is harmine, a beta-carboline which potential therapeutic effects for depression has been recently described in mice.

"It has been shown in rodents that antidepressant medication acts by inducing neurogenesis. So we decided to test if harmine, an alkaloid with the highest concentration in the psychotropic plant decoction ayahuasca, would trigger neurogenesis in human neural cells", said Vanja Dakic, PhD student and one of the authors in the study.

In order to elucidate these effects, researchers from the D'Or Institute for Research and Education (IDOR) and the Institute of Biomedical Sciences at the Federal University of Rio de Janeiro (ICB-UFRJ) exposed human neural progenitors to this beta-carboline. After four days, harmine led to a 70% increase in proliferation of human neural progenitor cells.

Researchers were also able to identify how the human neural cells respond to harmine. The described effect involves the inhibition of DYRK1A, which is located on chromosome 21 and is over activated in patients with Down syndrome and Alzheimer's Disease.

"Our results demonstrate that harmine is able to generate new human neural cells, similarly to the effects of classical antidepressant drugs, which frequently are followed by diverse side effects. Moreover, the observation that harmine inhibits DYRK1A in neural cells allows us to speculate about future studies to test its potential therapeutic role over cognitive deficits observed in Down syndrome and neurodegenerative diseases", suggests Stevens Rehen, researcher from IDOR and ICB-UFRJ.

This study, published Dec. 6 in PeerJ, was funded by Brazilian funding agencies FAPERJ, CNPq, CAPES, FINEP, BNDES e FAPESP.

http://bbc.in/2goIp0Y

DNA clue to how humans evolved big brains

Humans may in part owe their big brains to a DNA "typo" in their genetic code, research suggests.

By Helen Briggs BBC News

The mutation was also present in our evolutionary "cousins" - the Neanderthals and Denisovans. However, it is not found in humans' closest living relatives, the chimpanzees.

As early humans evolved, they developed larger and more complex brains, which can process and store a lot of information.

Last year, scientists pinpointed a human gene that they think was behind the expansion of a key brain region known as the neocortex.

They believe the gene arose about five or six million years ago, after the human line had split off from chimpanzees.

Now, researchers have found a tiny DNA change - a point mutation - that appears to have changed the function of the gene, sparking the process of expansion of the neocortex.

The human brain

Average weight of adult chimpanzee brain: 384g (0.85lb)

Average weight of modern human brain: 1,352g (2.98lb)

The modern human brain can store, collect and process lots of information, and deliver output, in split seconds; it can also solve problems and create abstract ideas and images

However, a big brain uses up lots of energy and makes childbirth more difficult

Source: Smithsonian Museum

It may have paved the way for the brain's expansion by dramatically boosting the number of brain cells found in this region.

Dr Wieland Huttner of the Max Planck Institute of Molecular Cell Biology and Genetics in Dresden, Germany, led the research.

"A point mutation in a human-specific gene gave it a function that allows expansion of the relevant stem cells that make a brain big," he told BBC News.

"This one, as it is fixed in the human genome - so all living humans have the gene - apparently gave a tremendous selection advantage, and that's why we believe it spread in the human population."

Between two and six million years ago, the ancestors of modern humans began to walk upright and use simple tools.

During this extended period of time, their brain size started to increase.

They began to spread around the world, encountering different environments.

From about 800,000 years ago, their brain size increased further, helping them to survive in a changing world. Still, many questions remain about how early humans evolved larger brains.

It is likely that the gene is one of many genetic changes that gave humans their unique intelligence and thinking ability.

The research is published in the journal, Science Advances.

http://bit.ly/2qs0BvB

New biomarker is higher in suicide attempters and associated with stress response

Researchers at Lund and Malmö universities in Sweden have measured a biomarker in cell-free blood plasma which can be linked to an overactive stress system in suicidal individuals.

This biomarker can hopefully be used in future psychiatric studies.

"We don't expect the marker to be able to predict who will try to commit suicide, but it may serve as a biological marker indicating greater stress exposure in vulnerable people suffering from various psychiatric conditions such as anxiety and depression. We would like to test the marker in future psychiatric studies and see how it is affected by, for example, lifestyle interventions, psychotherapy and pharmacological treatment", says Daniel Lindqvist, associate professor of experimental psychiatry at Lund University and psychiatry resident at Psykiatri Skåne.

The researchers compared 37 patients who had been hospitalised at a psychiatric clinic after attempting suicide with an equal number of healthy control subjects. About 70 per cent of both groups were female, and the average age of the patients was approximately 40.

Compared to the healthy control subjects, the suicidal patients had strikingly increased levels of mitochondrial DNA in their cell-free blood plasma.

The researchers also found that the large amount of mitochondrial DNA in the plasma was linked to higher levels of cortisol in the blood. Cortisol is an important hormone in the body's stress system and high levels of cortisol, which have been found in depressed and suicidal patients in previous studies, are a sign of an overactive stress system.

Previous studies have shown that depressed individuals have an increased level of mitochondrial DNA in their immune cells and that this is linked to stressful life events. Furthermore, studies on animals have shown that increased stress and cortisol levels are linked to higher mitochondrial DNA, but this is the first study to be tested on psychiatric patients.

"We believe the increased levels in suicidal patients are due to their exposure to severe stress for longer periods than the healthy subjects we compared them to. An increased level of cortisol can cause the body's cells to malfunction, which in turn contributes to increased levels of cell-free mitochondrial DNA in the blood", says Lars Ohlsson, senior lecturer at Malmö University.

"The amount of mitochondrial DNA in cell-free plasma is a new and interesting marker of stress that can be used in future psychiatric studies, but the results have to be replicated in other groups of patients as well. A key question will be how the biomarker changes over time in connection with the patient's symptoms improving or deteriorating", says Åsa Westrin, associate professor of clinical psychiatry at Lund University and senior physician at Psykiatri Skåne.

http://bbc.in/2hcPiGR

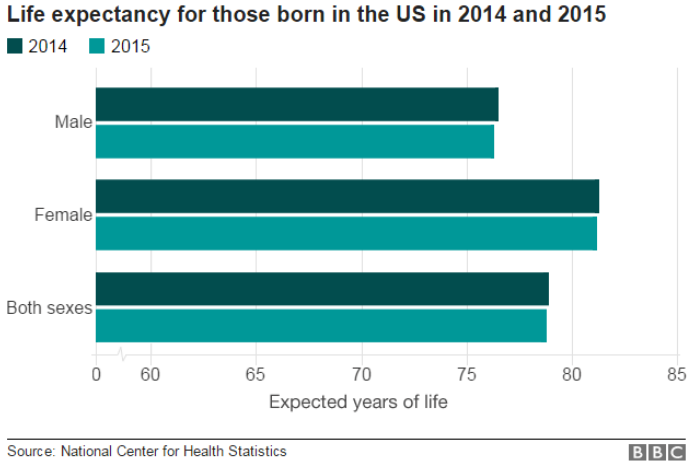
US life expectancy declines for first time in 20 years

Life expectancy in the United States has declined for the first time in more than two decades.

Data from the National Center for Health Statistics showed a drop for men from 76.5 years in 2014 to 76.3 in 2015, and from 81.3 to 81.2 for women.

The preliminary figures show rises in several causes of death, especially heart disease, dementia and accidental infant deaths. Life expectancy last fell during the peak of the HIV/Aids crisis in 1993.

It has improved slightly but steadily in most of the years since World War Two, rising from a little more than 68 years in 1950. It also fell in 1980, after a severe outbreak of flu. Overall life expectancy for men and women is now 78.8 years, a decrease of 0.1 year from 2014.



"This is unusual," lead author Jiaquan Xu, an epidemiologist at the NCHS, told AFP news agency. "2015 is kind of different from every year. It looks like much more death than we have seen in the last few years." The report is based mainly on 2015 death certificates.

How far has life expectancy declined?

A decline of 0.1 years in life expectancy means people are dying, on average, a little over a month earlier - or two months earlier for men.

To compare it with the two other declines in the past 30 years, the drop from 1992 to 1993 was 0.3 years, and the drop from 1979 to 1980 was 0.2%. What's also worrying some experts is that the trend had been largely flat for the preceding three years, rather than steady increase which has prevailed since the 1970s.

What's causing the drop?

The figures show a mixture of factors. Death rates have risen for eight out of 10 of the leading causes of death: heart disease (0.9% rise), chronic lower respiratory diseases (2.7% rise), unintentional injuries (6.7% rise), stroke (3% rise), Alzheimer's disease (15.7% rise), diabetes (1.9% rise), kidney disease (1.5% rise) and suicide (2.3% rise).

Heart disease is the biggest killer - accounting for more than four times as many deaths as each of the others - so even the relatively small 0.9% rise in the heart disease death rate is a major contributor.

Two of the biggest rises were deaths from Alzheimer's disease and also an 11.3% increase in the rate of death for babies under one due to unintentional injuries. Experts point to obesity levels, an ageing population and economic struggles as wider factors.

What's behind the rise in accidental infant deaths?

"Most of them died from accidental suffocation and strangulation in bed," said Jiaquan Xu.

Michael Grosso, medical director at Northwell Health's Huntington Hospital in New York, told AFP that these deaths would include car crashes, falls, suffocation and fires, and were therefore complex to explain.

He linked the rise to "social stressors", such as financial pressures and addiction. "The dramatic upswing in the use of opiates and narcotic use across our country is potentially a big factor in driving a phenomenon like accidental injury," he said.

The Centers for Disease Control and Prevention says the country is "in midst of an opioid overdose epidemic", with a record 28,000 people killed in 2014. No figures are yet available for 2015, though the 6.7% rise in deaths caused by "unintentional injuries" may be partly related.

Is there any good news?

The death rate for cancer has gone down 1.7%, which is significant as cancer is the second-biggest cause of death, causing almost as many fatalities as heart disease. But it seems that fast-developing research into cancer treatments, as well as campaigns on public education and early detection, are having an impact.

How does the US compare with other countries?

The US ranks 28th out of 43 OECD countries, according to 2014 figures - the most recent available. It is just behind the Czech Republic, Chile and Costa Rica, and just above Turkey, Poland and Estonia.

The world's highest life expectancy is in Japan, which is well known for the longevity of its elderly citizens. People there live, on average, to 83.7 years, which is followed by Switzerland and Spain on 83.3.

The world's lowest life expectancy is in Sierra Leone, at 50.1 years, according to the World Health Organization.

http://bit.ly/2hize6G

Fossilized evidence of a tumor in a 255-million-year-old mammal forerunner

When paleontologists at the University of Washington cut into the fossilized jaw of a distant mammal relative, they got more than they bargained for -- more teeth, to be specific.

As they report in a letter published Dec. 8 in the Journal of the American Medical Association Oncology, the team discovered evidence that the extinct species harbored a benign tumor made up of miniature, tooth-like structures. Known as a compound odontoma, this type of tumor is common to mammals today. But this animal lived 255 million years ago, before mammals even existed.

This image is of a histological thin section of the gorgonopsid lower jaw, taken near the top of the canine root. The dark area on the right is bone. The backward C-shaped structure on the left is the canine root. The cluster of small circles resemble miniature teeth, indicative of compound odontoma. **Christian Sidor/Megan Whitney**

"We think this is by far the oldest known instance of a compound odontoma," said senior author Christian Sidor, a UW professor of biology and curator of vertebrate paleontology at the Burke Museum of Natural History and Culture. "It would indicate that this is an ancient type of tumor."

Before this discovery, the earliest known evidence of odontomas came from Ice Age-era fossils.

"Until now, the earliest known occurrence of this tumor was about one million years ago, in fossil mammals," said Judy Skog, program director in the National Science Foundation's Division of Earth Sciences, which funded the research. "These researchers have found an example in the ancestors of mammals that lived 255 million years ago. The discovery suggests that the suspected cause of an odontoma isn't tied solely to traits in modern species, as had been thought."

In humans and other mammals, a compound odontoma is a mass of small "toothlets" amalgamated together along with tooth tissues like dentin and enamel. They grow within the gums or other soft tissues of the jaw and can cause pain and swelling, as well as disrupt the position of teeth and other tissues. Since odontomas do not metastasize and spread throughout the body, they are considered benign tumors. But given the disruptions they cause, surgeons often opt to remove them.

Surgery was not an option for the creature studied by Sidor's team. It was a gorgonopsian, a distant mammal relative and the apex predator during its pre-dinosaur era about 255 million years ago. Gorgonopsians are part of a larger group of animals called synapsids, which includes modern mammals as its only living member. Synapsids are sometimes called "mammal-like reptiles" because extinct synapsids possess some, but not all, of the features of mammals. The first mammals evolved over 100 million years ago.

"Most synapsids are extinct, and we -- that is, mammals -- are their only living descendants," said Megan Whitney, lead author and UW biology graduate student. "To understand when and how our mammalian features evolved, we have to study fossils of synapsids like the gorgonopsians."

Paleontologists have categorized many "mammal-like" features of gorgonopsians. For example, like us, they have teeth differentiated for specialized purposes. But Whitney started studying gorgonopsian teeth to see if they had another mammalian feature.

"Most reptiles alive today fuse their teeth directly to the jawbone," said Whitney. "But mammals do not: We use tough, but flexible, string-like tissues to hold teeth in their sockets. And I wanted to know if the same was true for gorgonopsians."

A purely external examination of gorgonopsian fossils wouldn't answer this question. Whitney had to take the risky and controversial approach of slicing into a fossilized gorgonopsian jaw: looking at thin sections of jaw and tooth under a microscope to see how the tooth was nestled within its socket. Since this technique would damage the fossil, Whitney and Larry Mose, a UW undergraduate student working with her, used a solitary or "orphan" gorgonopsian lower jaw that Sidor had collected in southern Tanzania.

Mose prepared multiple thin slices from the gorgonopsian jaw -- each only about as thick as a sheet of notebook paper -- and mounted them onto slides. He and Whitney immediately noticed something unexpected within the jaw: embedded next to the root of the canine were irregular clusters of up to eight tiny, round objects.

At higher magnification under a microscope, Whitney discovered that the objects within each cluster resembled small, poorly differentiated teeth, or toothlets. The toothlets even harbored distinct layers of dentin and enamel.

"At first we didn't know what to make of it," said Whitney. "But after some investigation we realized this gorgonopsian had what looks like a textbook compound odontoma."

At 255 million years, this is by far the oldest reported evidence for an odontoma -- and possibly the first case in a non-mammal. According to Sidor, odontomas have been reported in archaeological specimens, as well as fossilized mammoths and deer. But those cases all date to within the last million years or so. Since this synapsid had an odontoma, it would indicate that this mammalian condition existed well before the first mammals had evolved.

"This discovery demonstrates how the fossil record can tell us a lot about our present-day lives -- even the diseases or pathologies that are part of our mammalian heritage," said Sidor. "And you could never tell that this creature had it from the outside."

The research was funded by the National Science Foundation and a University of Washington Mary Gates Research Fellowship.

http://bit.ly/2gOu6DO

Prostate cancer patients more likely to die of other diseases, say 15-year PLCO results

Could yearly screening catch cancers early and decrease cancer mortality?

Starting in 1993 and ending in 2001, ten academic medical centers in the United States screened 76,685 men and 78,216 women for prostate, lung, colorectal and ovarian cancers. The question was whether yearly screening could catch cancers early and thus decrease mortality from these diseases.

Fifteen-year follow-up results focusing on prostate cancer were published this month in the journal Cancer, and show little difference in mortality between men screened annually and the control group, some of whom chose to be screened occasionally.

According to researchers, the results don't necessarily negate the value of prostate cancer screening, but imply that within the data of this massive trial are clues that inform personalized decisions for subsets of this prostate cancer population.

"What we can see from these results is that most men diagnosed with prostate cancer will not die from their disease. In 15 years, people on the study died from lots of other things. However, we can also see that now we need to focus on discovering the men that will," says E. David Crawford, MD, investigator at the University of Colorado Cancer Center and study co-author.

Specifically, in the intervention arm that received annual prostate cancer screening, 255 men have died of prostate cancer since the start of the trial. In all, 244 men in the control arm, who did not receive annual screening (but may have received self-directed intermittent screening), died of prostate cancer. By comparison, 1,933 and 1,882

men in the experimental and control arms, respectively, died of other cancers. Slightly more in each group died of heart-related conditions.

According to Crawford, these data imply that some men need not be screened for prostate cancer.

"For example, we have since shown that men with PSA lower than one have only about a 0.5 percent chance of being diagnosed with prostate cancer within 10 years," Crawford says. Administering a PSA test first and then not screening men with PSA less than one would save billions of dollars in healthcare costs every year.

However, in addition to discovering no decreased mortality with yearly prostate cancer screening compared with intermittent screening, Crawford suggests that these results could be used to discover men who do, in fact, benefit from careful monitoring.

"I treated a guy who'd been diagnosed in his 40s," says Crawford. "We did surgery, but then a year later he was diagnosed with melanoma. It turned out that at the same time, his sister was diagnosed with triple-negative breast cancer and died within the year. Being diagnosed with prostate cancer in your 40s is a red flag that there might be a germline mutation to blame, predisposing these men and maybe family members who share the mutation to more, and more aggressive cancers. The PLCO shows that most men don't benefit from screening, but if we could have used the data to spot this guy, maybe we could have even tested his sister as well."

And so the takeaway from this retrospective on a massive study, 15 years after the completion of data gathering, is that despite what many have characterized as failure - after all, yearly screening did not result in overall lives saved - is that inside this data (or in related, follow-up studies) may still exist clues that could stratify prostate cancer risk.

Alongside the risks and costs of over-diagnosis and over-treatment that come with screening the entire population of men for prostate cancer still exists hope that screening only those with higher risk, at the right schedule, could save lives.

http://bit.ly/2hgL0vl

Neuroimaging categorizes 4 depression subtypes

Patients with depression can be categorized into four unique subtypes defined by distinct patterns of abnormal connectivity in the brain, according to new research from Weill Cornell Medicine.

In a collaborative study published Dec. 5 in Nature Medicine, Dr. Conor Liston, an assistant professor of neuroscience in the Feil Family Brain and Mind Institute and an assistant professor of psychiatry at Weill Cornell Medicine, has identified biomarkers in depression by analyzing more than 1,100 functional magnetic resonance imaging (fMRI) brain scans of patients with clinical depression and of healthy controls, gathered from across the country. These biomarkers may help doctors to better diagnose depression subtypes and determine which patients would most likely benefit from a targeted neuro-stimulation therapy called transcranial magnetic stimulation that uses magnetic fields to create electrical impulses in the brain.

"The four subtypes of depression that we discovered vary in terms of their clinical symptoms but, more importantly, they differ in their responses to treatment," Dr. Liston said. "We can now predict with high accuracy whether or not a patient will respond to transcranial magnetic stimulation therapy, which is significant because it takes five weeks to know if this type of treatment works."

Approximately 10 percent of Americans are diagnosed with clinical depression each year, and it is by some estimates the leading cause of disability in many developed countries.

Historically, efforts to characterize depression involved looking at groups of symptoms that tend to co-occur and then testing neurophysiological links. And while past pioneering studies have defined different forms of depression, the association between the various types and the underlying biology has been inconsistent. Further, diagnostic biomarkers have yet to prove useful in distinguishing depressed patients from healthy controls or in reliably predicting treatment response among individuals.

"Depression is typically diagnosed based on things that we are experiencing, but as in election polling, the results you get depend a lot on the way you ask the question," Dr. Liston said. "Brain scans are objective."

Researchers from Weill Cornell Medicine and seven other institutions derived the biomarkers by assigning statistical weights to abnormal connections in the brain and then predicting the probability that they belonged to one subtype versus another. The study found that distinct patterns of abnormal functional connectivity in the brain differentiated the four biotypes and were linked with specific symptoms. For example, reduced connectivity in the part of the brain that regulates fear-related behavior and reappraisal of negative emotional stimuli was most severe in biotypes one and four, which exhibited increased anxiety.

Going forward, Dr. Liston will seek to replicate and confirm the results of this research and discover if it is broadly applicable to studying the biology of depression and other forms of mental illness.

"Subtyping is a major problem in psychiatry," Dr. Liston said. "It's not just an issue for depression, and it would be really valuable to have objective biological tests that can help diagnose subtypes of other mental illnesses, such as psychotic disorders, autism and substance abuse syndromes."

http://bit.ly/2hqJedP

Personality traits and psychiatric disorders linked to specific genomic locations

Researchers also find correlations between traits and distinct disorders

A meta-analysis of genome-wide association studies (GWAS) has identified six loci or regions of the human genome that are significantly linked to personality traits, report researchers at University of California San Diego School of Medicine in this week's advance online publication of Nature Genetics. The findings also show correlations with psychiatric disorders.

"Although personality traits are heritable, it has been difficult to characterize genetic variants associated with personality until recent, large-scale GWAS," said senior author Chi-Hua Chen, PhD, assistant professor in the Department of Radiology at UC San Diego School of Medicine.

Five psychological factors are commonly used to measure individual differences in personality:

Extraversion (versus introversion) reflects talkativeness, assertiveness and a high activity level

Neuroticism (versus emotional stability) reflects negative affect, such as anxiety and depression

Agreeableness (versus antagonism) measures cooperativeness and compassion

Conscientiousness (versus undependability) indicates diligence and self-discipline

Openness to experience (versus being closed to experience) suggests intellectual curiosity and creativity

Psychologists and others define personality phenotypes -- sets of observable characteristics -- based upon quantitative scoring of these five factors. Past meta-analyses of twin and family studies have attributed approximately 40 percent of variance in personality to genetic factors. GWAS, which look for genetic variations across a large sampling of people, have discovered several variants associated with the five factors.

In their new paper, Chen and colleagues analyzed genetic variations among the five personality traits and six psychiatric disorders, using data from 23andMe, a privately held personal genomics and biotechnology company, the Genetics of Personality Consortium, a European-based collaboration of GWAS focusing on personality questions, UK Biobank and deCODE Genetics, an Iceland-based human genetics company.

The researchers found, for example, that extraversion was associated with variants in the gene WSCD2 and near gene PCDH15; neuroticism was associated with variants on chromosome 8p23.1 and

gene L3MBTL2. Personality traits were largely separated genetically from psychiatric disorders, except for neuroticism and openness to experience, which clustered in the same genomic regions as the disorders.

In addition, there were high genetic correlations between extraversion and attention deficit hyperactivity disorder (ADHD) and between openness and schizophrenia and bipolar disorder. Neuroticism was genetically correlated with internalized psychopathologies, such as depression and anxiety.

"We identified genetic variants linked to extraversion and neuroticism personality traits," said Chen. "Our study is in an early stage for genetic research in personality and many more genetic variants associated with personality traits are to be discovered. We found genetic correlations between personality traits and psychiatric disorders, but specific variants underlying the correlations are unknown."

The authors note that while the sample size of the meta-analyses was large (123,132 to 260,861 participants in different studies), they used only GWAS summary statistics and cannot estimate all genetic variance factors; some studies also used different methodologies.

Co-authors include: Min-Tzu Lo, Carol Franz, Chun-Chieh Fan, Andrew Schork, Dominic Holland, Nilotpal Sanyal, Linda K. McEvoy, and Anders M. Dale, UC San Diego; David A. Hinds, and Joyce Y. Tung, 23andMe; Yunpeng Wang, UC San Diego and University of Oslo; Olav B. Smeland, University of Oslo; Karolina Kauppi, UC San Diego and Umea University, Sweden; Valentina Escott-Price, and Michael O-Donavan, Cardiff University; Daniel J. Smith, University of Glasgow; and Hreinn Stefansson, Gyda Bjornsdottir, Thorgeir E. Thorgeirsson, and Kari Stefansson, deCODE Genetics/Amgen, Iceland.

http://bit.ly/2hjROZW

How to Give Better Gifts, According to Science

Most people have gotten bad gifts: that fruitcake you didn't ask for or that tie you'll never wear.

By Rachael Rettner, Senior Writer | December 8, 2016 01:26pm ET

Now, a group of marketing researchers has investigated exactly what makes a bad gift and the reasons people buy such presents for their loved ones in the first place.

The researchers suggested that one reason for bad gifts is that the giver and the recipient focus on different things. The giver focuses on the moment of the exchange, wanting to surprise or impress the recipient, while the recipient focuses on the long-term usefulness or practicality of the gift.

"What we found was that the giver wants to 'wow' the recipient and give a gift that can be enjoyed immediately, in the moment, while the recipient is more interested in a gift that provides value over time," study researcher Jeff Galak, an assistant professor of marketing at Carnegie Mellon University's Tepper School of Business, said in a statement. "We are seeing a mismatch between the thought processes and motivations of gift givers and recipients."

For example, there are times when a vacuum cleaner, which doesn't typically have a "wow" factor, would actually be a really good gift, because it would be used for a long time, Galak said.

In a new paper, the researchers reviewed studies on gift-giving errors, looking for commonalities among them. The analysis showed that this tendency to focus on the moment of exchange versus the long-term usefulness of the gift explained many of the errors. Some of the mistakes included:

Giving unrequested gifts in an attempt to surprise the recipient, when in fact, the recipient would prefer a not-surprising gift that he or she had requested in a wish list

Focusing on tangible gifts that can be used immediately, when a recipient might really prefer an experiential gift, like theater tickets, that would result in more enjoyment later on

Choosing a socially responsible gift, like a donation to a charity in the recipient's name in the belief that the recipient will feel a "warm glow" from the donation, when in reality, the individual would prefer gifts he or she can use

Giving expensive gifts in an attempt to show thoughtfulness when, in fact, the price of a gift does not necessarily predict how much the recipient will use or enjoy the present

To choose better gifts, the researchers advised that people try to empathize with the gift recipient and think about gifts the individual would find useful over the long term, or during ownership of the gift.

"We exchange gifts with the people we care about, in part, in an effort to make them happy and strengthen our relationships with them," Galak said. "By considering how valuable gifts might be over the course of the recipient's ownership of them, rather than how much of a smile it might put on recipients' faces when they are opened, we can meet these goals and provide useful, well-received gifts."

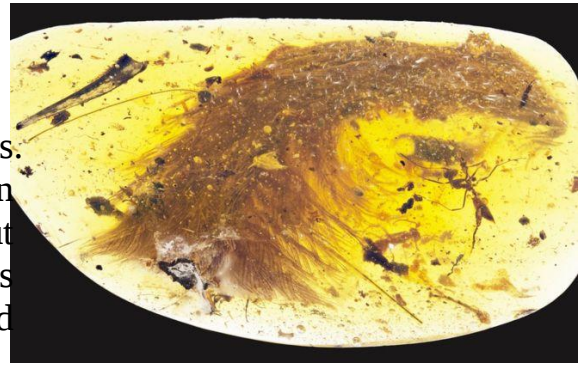
http://bbc.in/2hqBfhx

'Beautiful' dinosaur tail found preserved in amber

The tail of a feathered dinosaur has been found perfectly preserved in amber from Myanmar.

By Paul Rincon Science editor, BBC News website

The one-of-a-kind discovery helps put flesh on the bones of these extinct creatures, opening a new window on the biology of a group that dominated Earth for more than 160 million years.



Examination of the specimen suggests the tail was chestnut brown on top and white on its underside. The tail is described in the journal Current Biology.

The feathered tail was preserved in amber from north-eastern Myanmar
Current Biology

"This is the first time we've found dinosaur material preserved in amber," co-author Ryan McKellar, of the Royal Saskatchewan Museum in Canada, told the BBC News website.

The study's first author, Lida Xing from the China University of Geosciences in Beijing, discovered the remarkable fossil at an amber market in Myitkina, Myanmar. The 99-million-year-old amber had already been polished for jewellery and the seller had thought it was plant material.

On closer inspection, however, it turned out to be the tail of a feathered dinosaur about the size of a sparrow. Lida Xing was able to establish where it had come from by tracking down the amber miner who had originally dug out the specimen.

Image caption Artist's impression: the dinosaur was about the size of a sparrow
Cheung Chung-tat

Dr McKellar said examination of the tail's anatomy showed it definitely belonged to a feathered dinosaur and not an ancient bird.

"We can be sure of the source because the vertebrae are not fused into a rod or pygostyle as in modern birds and their closest relatives," he explained. "Instead, the tail is long and flexible, with keels of feathers running down each side."

Dr McKellar said there are signs the dinosaur still contained fluids when it was incorporated into the tree resin that eventually formed the amber. This indicates that it could even have become trapped in the sticky substance while it was still alive.

Co-author Prof Mike Benton, from the University of Bristol, added: "It's amazing to see all the details of a dinosaur tail - the bones, flesh, skin, and feathers - and to imagine how this little fellow got his tail caught in the resin, and then presumably died because he could not wrestle free."

Examination of the chemistry of the tail where it was exposed at the surface of the amber even shows up traces of ferrous iron, a relic of the blood that was once in the sample.

The findings also shed light on how feathers were arranged on these dinosaurs, because 3D features are often lost due to the compression that occurs when corpses become fossils in sedimentary rocks.

The feathers lack the well-developed central shaft - a rachis - known from modern birds. Their structure suggests that the two finest tiers of branching in modern feathers, known as barbs and barbules, arose before the rachis formed.

Kachin State, in north-eastern Myanmar, where the specimen was found, has been producing amber for 2,000 years. But because of the large quantity of insects preserved in the deposits, over the last 20 years it has become a focus for scientists who study ancient arthropods.

"The larger amber pieces often get broken up in the mining process. By the time we see them they have often been turned into things like jewellery. We never know how much of the specimen has been missed," said Dr McKellar.

"If you had a complete specimen, for example, you could look at how feathers were arranged across the whole body. Or you could look at other soft tissue features that don't usually get preserved."

Other preserved parts of a feathered dinosaur might also reveal whether it was a flying or gliding animal.

"There have been other, anecdotal reports of similar specimens coming from the region. But if they disappear into private collections, then they're lost to science," Dr McKellar explained.

Dr Paul Barrett, from London's Natural History Museum, called the specimen a "beautiful fossil", describing it as a "really rare occurrence of vertebrate material in amber".

He told BBC News: "Feathers have been recovered in amber before, so that aspect isn't new, but what this new specimen shows is the 3D arrangement of feathers in a Mesozoic dinosaur/bird for the first time, as almost all of the other feathered dinosaur fossils and Mesozoic bird skeletons that we have are flattened and 2D only, which has obscured some important features of their anatomy.

"The new amber specimen confirms ideas from developmental biologists about the order in which some of the detailed features of modern feathers, such as barbs and barbules (the little hooks that hold the barbs together so that the feather can form a nice neat vane), would have appeared also."

Earlier this year, scientists also described ancient bird wings that had been discovered in amber from the same area of Myanmar.

http://bit.ly/2qoOzhs

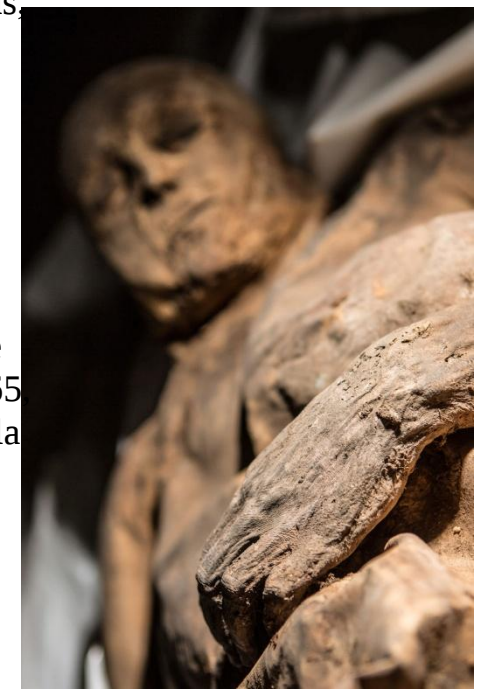
Smallpox Found in Lithuanian Mummy Could Rewrite Virus' History

The mummy of a child discovered in a crypt beneath a Lithuanian church harbors the oldest sample found to date of the virus that causes smallpox, a new report said.

By Laura Geggel, Senior Writer | December 9, 2016 05:57pm ET

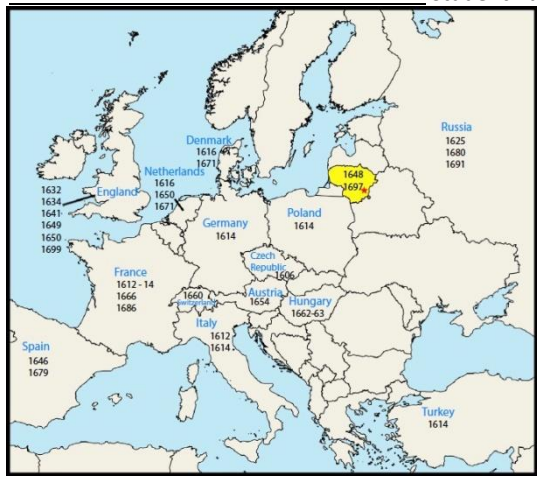
But the researchers' analysis of the virus, called the variola virus, suggests that smallpox first appeared in humans much more recently than thought, the researchers said. Scientists had thought that smallpox was an ancient disease that plagued humanity for millennia.

The researchers drew their conclusion by taking virus from the mummy of the child, who lived between 1643 and 1665, and comparing that strain against variola viruses that date to the mid-1900s. The differences, or mutations, that the researchers found suggest that the strains shared a common ancestor that first arose between 1588 and 1645, the researchers said.



***The child mummy with smallpox that researchers discovered in a Lithuanian Church. Credit: Kiril Cachovski* | Lithuanian Mummy Project, 2015**

That time period was filled with human exploration, migration and colonization — activities that could have spread the virus worldwide, the researchers noted.



More studies are needed to confirm that the smallpox virus indeed arose that recently, but if it did, this would cast doubt on the previously suggested idea that people in ancient Egypt had smallpox. Although 3,000- to 4,000-year-old Egyptian mummies have pockmark scarring, a symptom of smallpox, these scars could have also come from measles or chickenpox, said the study's first author, Ana Duggan, a postdoctoral fellow at the McMaster University Ancient DNA Centre in Canada.

If smallpox had arisen thousands of years ago, the researchers would have seen a high degree of diversity between the viruses that they compared, Duggan said. "We don't see that," she told Live Science.

In addition, the researchers' analysis of the mummy's virus also suggests that the two known forms of the virus — variola major and variola minor — likely split from each other after the English doctor Edward Jenner famously developed the first smallpox vaccine, in the late 1700s, the researchers said.

The finding about the major-minor split is "by no means conclusive, but it opens the idea that maybe this split between the major and the less virulent, minor strain was an evolutionary response to the vaccine," Duggan said.

Child mummy

Researchers have been studying several mummies found in the crypt of the Dominican Church of the Holy Spirit in Vilnius, Lithuania, since the 1930s. But the authors of the new study are the first to figure out that one mummy, of a child between ages 2 and 4, contained the smallpox virus.

It's unclear whether the child was male or female, but the researchers did establish, through radiocarbon dating, that the child lived about 360 years ago. Smallpox outbreaks were happening across Europe at that time.

Smallpox once killed about three out of every 10 people who got it. The illness could also lead to disfigurement and blindness. Smallpox is the first and so far only human disease eradicated by vaccination, Duggan said.

The researchers' sample of the variola virus taken from the mummy was badly disintegrated, but the scientists rebuilt it by comparing it to existing variola sequences, and also using DNA sequences from the mummy's skin, the scientists said.

Smallpox origins

The scientists said they are hopeful that the findings will help virologists trace the background of smallpox and other viruses. [27 Devastating Infectious Diseases]

"We still don't know when smallpox first appeared in humans, and we don't know what animal it came from. And we don't know that because we don't have any older historical samples to work with" study co-author Edward Holmes, a professor of evolutionary biology at the University of Sydney in Australia, said in the statement.

The new study puts "a new perspective on this very important disease, but it's also showing us that our historical knowledge of viruses is just the tip of the iceberg," Holmes said. The study was published online today (Dec. 8) in the journal Current Biology.

http://bbc.in/2hlx6sh

Vomiting bug 'at high level this winter'

The number of people falling ill with the vomiting bug norovirus in England this winter is at higher than average levels, figures suggest.

Lab testing has revealed there have been 1,704 cases so far - 9% higher than the average seen at this stage in the previous five winters.

This will be a fraction of the total number because it only captures people seeking NHS help.

In hospitals, there have been 100 outbreaks of the bug. These outbreaks cause hospitals to close down beds and whole wards at what is the busiest time of the year. According to latest figures, over 850 beds are closed because of norovirus out of a total of 100,000.

But Public Health England warned people not to be alarmed, saying the levels being seen were still within an expected range and it may just be a sign that norovirus is peaking earlier this year than previous ones.

Nick Phin, of PHE, said continued outbreaks should be expected. "Norovirus is a common cause of illness during winter. "Exactly when the peak in activity occurs will be different each winter, but levels seen so far this year are not unexpected compared with the previous five years."

Hospitals declare major alerts

Meanwhile, NHS England has released it first winter statistics of the year. The figures, which cover the first four days of December, showed eight hospitals declared a major alert - or what used to be known as red and black alerts. This happens when hospitals have bed shortages, ambulances queuing outside and patients waiting longer inside A&E.

To cope, hospitals have to start calling in extra staff, cancelling routine treatments, such as knee and hip operations, and diverting ambulances away from their hospital. The ultimate step is a full closure of A&E, although none of them took this step.

It comes after the BBC revealed this week the number of so-called "trolley waits" - the long delays patients experience waiting for a bed after emergency admission - had risen five-fold over the past five years. Currently more than one in 10 patients face a wait of over four hours. John Abercrombie, of the Royal College of Surgeons, said it looked like it would be a "bleak winter" for the health service.

http://bit.ly/2hd1hUu

Oral bacterium related esophageal cancer prognosis in Japanese patients

Bacterium usually found in the human mouth has been found to be related to the prognosis of esophageal cancer

A type of bacterium usually found in the human mouth, Fusobacterium nucleatum (F. nucleatum), has been found to be related to the prognosis of esophageal cancer in Japanese patients by researchers from Kumamoto University, Japan. The bacteria are a causative agent of periodontal disease and though it can be found among the intestinal flora, it hasn't been the focus of much research until now.

There are hundreds of intestinal bacteria species numbering around 100 trillion in the human body and they play an important role in maintaining homeostasis. Recently, intestinal bacterial flora has been gaining the attention of researchers due to its association with various cancers, diabetes, obesity, inflammatory bowel disease, and nonalcoholic fatty liver disease. A well-known example of this is Helicobacter pylori, a bacterium residing in the stomach, which has been linked to stomach cancer.

It was recently reported that F. nucleatum was frequently detected in colon cancer tissue, and that it may have an effect on the development of colorectal cancer. This led researchers at Kumamoto University to suspect that F. nucleatum also played an important role in esophageal cancer, due to the proximity of the oral cavity to the esophagus, so they began researching that possibility.

Using real-time PCR analysis, they assessed DNA in the cancer tissue of 325 patients who underwent surgical removal of esophageal cancer at Kumamoto University Hospital and found that 74 out of 325 patients (nearly 23%) had F. nucleatum in their cancer tissues. Researchers then compared the after-surgery survival time between patients whose esophageal cancer tissues tested positive for F. nucleatum with those that didn't and controlled for survival factors

such as age, tobacco use, tumor stage. They found that the group with F. nucleatum in their cancer tissues had significantly shorter survival times.

The researchers further analyzed differences in the genes of patients with esophageal cancer using RNA extracted from the tissues of F. nucleatum positive and negative esophageal cancers. They found that a group of genes related to inflammatory cytokines (proteins that promote inflammation) was different in patients with F. nucleatum positive esophageal cancer. Detailed analysis of these data revealed that the number of genes of specific chemokines (proteins related to the transport of white blood cells, such as CCL20 and CXCL7) had increased.

"This study suggested that the oral cavity bacterium F. nucleatum may be involved in the development and progression of esophageal cancer via chemokines," said Professor Hideo Baba, who lead the research. "It should be noted that it is still unknown whether F. nucleatum itself causes esophageal cancer. Further analysis by more institutions, preferably world-wide, is desired since intestinal flora differs between individuals. In future research, after elucidating the role of F. nucleatum in esophageal cancer development in more detail, we should be able to develop new drugs to better treat this form of cancer." This finding was posted on line in "Clinical Cancer Research," on October 21st, 2016.

K. Yamamura, Y. Baba, S. Nakagawa, K. Mima, K. Miyake, K. Nakamura, H. Sawayama, K. Kinoshita, T. Ishimoto, M. Iwatsuki, Y. Sakamoto, Y. Yamashita, N. Yoshida, M. Watanabe, and H. Baba, "Human microbiome fusobacterium nucleatum in esophageal cancer tissue is associated with prognosis," Clinical Cancer Research, Oct 2016. DOI: 10.1158/1078-0432.CCR-16-1786

http://bit.ly/2hlHm41

Study: Running actually lowers inflammation in knee joints

Running may also slow the process that leads to osteoarthritis

We all know that running causes a bit of inflammation and soreness, and that's just the price you pay for cardiovascular health. You know; no pain, no gain. Well, maybe not. New research from BYU exercise science professors finds that pro-inflammatory molecules actually go down in the knee joint after running.

In other words, it appears running can reduce joint inflammation.

"It flies in the face of intuition," said study coauthor Matt Seeley, associate professor of exercise science at BYU. "This idea that long-distance running is bad for your knees might be a myth."

In a study recently published in the European Journal of Applied Physiology, Seeley and a group of BYU colleagues, as well as Dr. Eric Robinson from Intermountain Healthcare, measured inflammation markers in the knee joint fluid of several healthy men and women aged 18-35, both before and after running.

The researchers found that the specific markers they were looking for in the extracted synovial fluid--two cytokines named GM-CSF and IL-15--decreased in concentration in the subjects after 30 minutes of running. When the same fluids were extracted before and after a non-running condition, the inflammation markers stayed at similar levels.

"What we now know is that for young, healthy individuals, exercise creates an anti-inflammatory environment that may be beneficial in terms of long-term joint health," said study lead author Robert Hyldahl, BYU assistant professor of exercise science.

Hyldahl said the study results indicate running is chondroprotective, which means exercise may help delay the onset of joint degenerative diseases such as osteoarthritis.

This is potentially great news, since osteoarthritis--the painful disease where cartilage at the end of bones wears down and gradually worsens over time--affects about 27 million people in the United States.

"This study does not indicate that distance runners are any more likely to get osteoarthritis than any other person," Seeley said. "Instead, this study suggests exercise can be a type of medicine."

Researchers, which included then undergraduate (and now grad student) Alyssa Evans and PhD student Sunku Kwon, now plan to turn their attention to study subjects with previous knee injuries.

Specifically, they're looking to do similar tests on people who have suffered ACL injuries.

BYU professors Sarah Ridge and Ty Hopkins were also coauthors on the study.

http://bit.ly/2hcZBdK

Breast cancer patients could benefit from controversial hormone

"Harmful" hormone could be a game changer in the fight against recurring breast cancers

An international team of researchers involving the University of Adelaide is tackling the controversy over what some scientists consider to be a "harmful" hormone, arguing that it could be a game changer in the fight against recurring breast cancers that are resistant to standard treatments.

The controversy centers on the different effects in women of the naturally occurring sex steroid hormone progesterone compared with synthetic forms (i.e. progestins) designed to mimic its actions.

Some, but not all, progestins have been linked with increased breast cancer risk when used in menopausal hormone therapy, leading to concerns in the scientific community about the use of these drugs.

However, in a paper now published online ahead of print in the prestigious journal Nature Reviews Cancer, an international team - involving the University of Adelaide's Dame Roma Mitchell Cancer Research Laboratories (DRMCRL) and the Cancer Research UK (CRUK) Cambridge Institute - highlights that progesterone when used in menopausal hormone therapy does not increase breast cancer risk . Indeed, progesterone may have an important role to play in the safe and effective management of recurring breast cancer.

"Breast cancer arises because of abnormal hormone activity, with about 75% of these cancers being driven by the estrogen receptor. Unfortunately, despite good initial responses in many women, drug resistance is common, usually leading to a recurrence and lethal spread of the disease," says Professor Wayne Tilley, Director of the Dame Roma Mitchell Cancer Research Laboratories at the University of Adelaide, and a lead author of the paper.

"Moreover, current hormonal treatments that target the estrogen receptor in breast cancer, especially specific inhibitors that block estrogen production, can markedly impact quality of life, often leading women to stop taking the drugs or change their treatment."

Professor Tilley says the team's recent studies, including landmark research already published in Nature, suggest that a safe way of improving treatment - without having a deleterious effect on quality of life - does exist, through the use of natural progesterone and certain other progestins. "There is a natural 'crosstalk' between estrogen and progesterone receptors that we strongly believe can be exploited," he says.

"In particular, progesterone can reprogram estrogen action in the breast in a way that results in estrogen receptor action improving breast cancer outcomes. Because of this unique interaction of the two natural female sex hormones in the breast, we see great potential benefits in adding progesterone to existing drugs that target the estrogen receptor, thereby helping to switch off the growth of cancer cells. "This gives us a unique opportunity to develop a new hormonal treatment which, when used in conjunction with the current standard of care, would enhance and improve outcomes for many breast cancer patients.

"Unfortunately, there are some serious misconceptions about the role of progesterone in cancer biology that have so far prevented it from being widely used in the management of breast cancer. We hope to change that thinking," Professor Tilley says.

The team, which is highly regarded for its research into both breast and prostate cancer, believes this new paper will have a global impact on clinical, scientific and public opinion on the relative risks and benefits of using progesterone and certain progestins to treat women with breast cancer. "Ultimately, we hope this work will eventually result in saving women's lives," Professor Tilley says.

The real proof will come from two new clinical trials being conducted by the international team, with patients being recruited for the studies in the UK early next year.

One trial in collaboration with a UK group at the University of Liverpool will test the potential benefit of combining progesterone treatment with the breast cancer drug Tamoxifen in premenopausal women with breast cancer.

A second trial involving postmenopausal women with breast cancer has been initiated by collaborators at the CRUK Cambridge Institute and will evaluate whether a particular progestin, Megace, provides added therapeutic benefit when combined with a current estrogen receptor target treatment, compared to the target treatment alone.

Professor Tilley says the team's research has recently resulted in several substantial new sources of funding for Adelaide's Dame Roma Mitchell Cancer Research Laboratories to continue their ground-breaking research in breast cancer. These include:

$1 million National Health and Medical Research Council (NHMRC) Project Grant awarded to Professor Tilley and the team over four years, to better understand the clinical significance of sex hormone 'crosstalk' in the treatment of breast cancer

$400,000 four-year fellowship from Australia's National Breast Cancer Foundation, awarded to Dr Iza Denis, a postdoctoral researcher recruited to the Adelaide laboratories from France.

Professor Tilley was also awarded another NHMRC Project Grant of more than $946,000 to develop new and smarter therapies to inhibit the androgen receptor, which is the key driver of prostate cancer growth.

"Resistance to current therapies that target the androgen receptor is the main cause of lethal prostate cancer. Researchers in the Dame Roma Mitchell Cancer Research Laboratories are developing and testing a new drug that is effective against the androgen receptor in preclinical models of treatment resistant prostate cancer. It is hoped that this new drug will inhibit the growth of tumors that currently kill approximately 3,300 men in Australia each year," he says.

"Our recent funding success will ensure that South Australian research into breast and prostate cancer remains at the forefront of improving the health and quality of life for women and men afflicted by these diseases.

"More importantly, this funding will make significant inroads into improving survival rates for patients who develop resistance to current hormonal treatments for these cancer types, which are major killers of Australian women and men," Professor Tilley says.

http://bit.ly/2hcYOJR

Unique visual stimulation may be new treatment for Alzheimer's

Noninvasive technique reduces beta amyloid plaques in mouse models of Alzheimer's disease

Anne Trafton

Using LED lights flickering at a specific frequency, MIT researchers have shown that they can substantially reduce the beta amyloid plaques seen in Alzheimer's disease, in the visual cortex of mice.

This treatment appears to work by inducing brain waves known as gamma oscillations, which the researchers discovered help the brain suppress beta amyloid production and invigorate cells responsible for destroying the plaques.

Further research will be needed to determine if a similar approach could help Alzheimer's patients, says Li-Huei Tsai, the Picower Professor of Neuroscience, director of MIT's Picower Institute for Learning and Memory, and senior author of the study, which appears in the Dec. 7 online edition of Nature.

"It's a big 'if,' because so many things have been shown to work in mice, only to fail in humans," Tsai says. "But if humans behave similarly to mice in response to this treatment, I would say the potential is just enormous, because it's so noninvasive, and it's so accessible."

Tsai and Ed Boyden, an associate professor of biological engineering and brain and cognitive sciences at the MIT Media Lab and the

McGovern Institute for Brain Research, who is also an author of the Nature paper, have started a company called Cognito Therapeutics to pursue tests in humans. The paper's lead authors are graduate student Hannah Iaccarino and Media Lab research affiliate Annabelle Singer.

"This important announcement may herald a breakthrough in the understanding and treatment of Alzheimer's disease, a terrible affliction affecting millions of people and their families around the world," says Michael Sipser, dean of MIT's School of Science. "Our MIT scientists have opened the door to an entirely new direction of research on this brain disorder and the mechanisms that may cause or prevent it. I find it extremely exciting."

Brain wave stimulation

Alzheimer's disease, which affects more than 5 million people in the United States, is characterized by beta amyloid plaques that are suspected to be harmful to brain cells and to interfere with normal brain function. Previous studies have hinted that Alzheimer's patients also have impaired gamma oscillations. These brain waves, which range from 25 to 80 hertz (cycles per second), are believed to contribute to normal brain functions such as attention, perception, and memory.

In a study of mice that were genetically programmed to develop Alzheimer's but did not yet show any plaque accumulation or behavioral symptoms, Tsai and her colleagues found impaired gamma oscillations during patterns of activity that are essential for learning and memory while running a maze.

Next, the researchers stimulated gamma oscillations at 40 hertz in a brain region called the hippocampus, which is critical in memory formation and retrieval. These initial studies relied on a technique known as optogenetics, co-pioneered by Boyden, which allows scientists to control the activity of genetically modified neurons by shining light on them. Using this approach, the researchers stimulated certain brain cells known as interneurons, which then synchronize the gamma activity of excitatory neurons.

After an hour of stimulation at 40 hertz, the researchers found a 40 to 50 percent reduction in the levels of beta amyloid proteins in the hippocampus. Stimulation at other frequencies, ranging from 20 to 80 hertz, did not produce this decline.

Tsai and colleagues then began to wonder if less-invasive techniques might achieve the same effect. Tsai and Emery Brown, the Edward Hood Taplin Professor of Medical Engineering and Computational Neuroscience, a member of the Picower Institute, and an author of the paper, came up with the idea of using an external stimulus -- in this case, light -- to drive gamma oscillations in the brain. The researchers built a simple device consisting of a strip of LEDs that can be programmed to flicker at different frequencies.

Using this device, the researchers found that an hour of exposure to light flickering at 40 hertz enhanced gamma oscillations and reduced beta amyloid levels by half in the visual cortex of mice in the very early stages of Alzheimer's. However, the proteins returned to their original levels within 24 hours.

The researchers then investigated whether a longer course of treatment could reduce amyloid plaques in mice with more advanced accumulation of amyloid plaques. After treating the mice for an hour a day for seven days, both plaques and free-floating amyloid were markedly reduced. The researchers are now trying to determine how long these effects last.

Furthermore, the researchers found that gamma rhythms also reduced another hallmark of Alzheimer's disease: the abnormally modified Tau protein, which can form tangles in the brain.

Tsai's lab is now studying whether light can drive gamma oscillations in brain regions beyond the visual cortex, and preliminary data suggest that this is possible. They are also investigating whether the reduction in amyloid plaques has any effects on the behavioral symptoms of their Alzheimer's mouse models, and whether this technique could affect other neurological disorders that involve impaired gamma oscillations.

Two modes of action

The researchers also performed studies to try to figure out how gamma oscillations exert their effects. They found that after gamma stimulation, the process for beta amyloid generation is less active. Gamma oscillations also improved the brain's ability to clear out beta amyloid proteins, which is normally the job of immune cells known as microglia. "They take up toxic materials and cell debris, clean up the environment, and keep neurons healthy," Tsai says.

In Alzheimer's patients, microglia cells become very inflammatory and secrete toxic chemicals that make other brain cells more sick. However, when gamma oscillations were boosted in mice, their microglia underwent morphological changes and became more active in clearing away the beta amyloid proteins.

"The bottom line is, enhancing gamma oscillations in the brain can do at least two things to reduced amyloid load. One is to reduce beta amyloid production from neurons. And second is to enhance the clearance of amyloids by microglia," Tsai says.

The researchers also sequenced messenger RNA from the brains of the treated mice and found that hundreds of genes were over- or underexpressed, and they are now investigating the possible impact of those variations on Alzheimer's disease.

Hannah F. Iaccarino, Annabelle C. Singer, Anthony J. Martorell, Andrii Rudenko, Fan Gao, Tyler Z. Gillingham, Hansruedi Mathys, Jinsoo Seo, Oleg Kritskiy, Fatema Abdurrob, Chinnakkaruppan Adaikkan, Rebecca G. Canter, Richard Rueda, Emery N. Brown, Edward S. Boyden, Li-Huei Tsai. Gamma frequency entrainment attenuates amyloid load and modifies microglia. Nature, 2016; 540 (7632): 230 DOI: 10.1038/nature20587

http://bit.ly/2hkNoEA

Graphene-Spiked Silly Putty Picks up Human Pulse

"G-putty" is so sensitive that it can track even the steps of a small spider

- **By Mark Peplow, Nature magazine on December 9, 2016**

A dash of graphene can transform the stretchy goo known as Silly Putty into a pressure sensor able to monitor a human pulse or even track the dainty steps of a small spider.

The material, dubbed G-putty, could be developed into a device that continuously monitors blood pressure, its inventors hope. It also demonstrates a form of self-repair that may herald smarter graphene composites.

Since graphene was first isolated in 2004, researchers have added these atom-thin sheets of carbon to a panoply of different materials, hoping to create composites that benefit from its superlative strength and electrical conductivity. But there have been surprisingly few attempts to blend it with 'viscoelastic' materials such as Silly Putty, which behaves as both an elastic solid and a liquid. Leave a lump on top of a hole, for example, and it will slowly ooze through.

Conor Boland, a researcher working in Jonathan Coleman's nanotechnology lab at Trinity College Dublin, wondered what would happen if he brought the two materials together. "I'd like to be able to say it was carefully planned, but it wasn't," laughs Coleman. "We've just got a tradition in my group of using household stuff in our science." (In 2014, his team found that they could make graphene by blitzing graphite in a kitchen blender).

Medical uses

The researchers mixed graphene flakes, roughly 20 atomic layers thick and up to 800 nanometers long, with homemade Silly Putty, a silicone polymer, to produce dark grey G-putty that conducted electricity. Crucially, its electrical resistance changed dramatically when the researchers applied even tiny amounts of pressure. The putty was at least ten times more sensitive than other nanocomposite sensors.

When they wired up a lump of G-putty and held it to a student's neck, the pulse from his carotid artery was clearly visible in those resistance changes. In fact, the pulse profile was so detailed that they could convert it into an accurate blood-pressure reading. The sensor could also monitor respiration when placed on the student's chest. And, as a slightly bizarre encore, it recorded the individual steps of a spider weighing just 20 milligrams.

"They did a really extensive demonstration of how versatile it can be," says Vincenzo Palermo, a materials scientist at the National Research Council of Italy in Bologna. "I think it's remarkable work, really original." The study is published in *Science*.

Mobile flakes

Coleman's team found that the graphene flakes form a conducting network within the putty, and deforming the material breaks that network apart, rapidly increasing its electrical resistance. G-putty's low viscosity then allows the graphene flakes to move back into position and reform the network. "It's a self-healing phenomenon," he says.

Coleman is already talking to medical-device companies who are interested in using G-putty for continuous physiological monitoring. Blood pressure measurements, for example, often rely on bulky cuffs around a patient's arm and offer only a snapshot reading. A cheap, small and non-invasive sensor could provide a simple way to monitor patients at home.

Companies such as Nokia are interested in graphene sensors for health applications, says Sanna Arpiainen, senior scientist for graphene research at VTT, a large contract research organization near Helsinki. But G-putty would have to clear a series of hurdles—including proving that it can be made in large-scale quantities, and real-world testing to assess its long-term performance—before it could be commercialized, she cautions. "For real applications, you need it to work the same way thousands of times," agrees Palermo.

One experiment with G-putty in the lab did hit an unexpected hitch. Boland had wanted to conduct a comparison test between two spiders, but after leaving them unattended he returned to discover that the larger spider had consumed its smaller cousin. "He didn't anticipate the difficulties of working with animals," Coleman says.

http://bit.ly/2hotKoC

Machine learning lets computer create melodies to fit any lyrics

Got words but no melody? A machine learning system turns poetry into song by composing a pop music score to suit the lyrics it's given.

"I was studying singing while I was doing my PhD in computer science," says Margareta Ackerman at San Jose State University in California, who developed the system with David Loker at technology advisory firm Orbitwerks. "Over time, I started to think of computers as creative partners instead of tools, which could maybe help me write songs."

The system, called ALYSIA, processes short lines of text and associates each syllable with a musical note. It chooses the pairing based on features including the syllable's position in the word and how it will fit with the previous five notes.

ALYSIA can write whole accompanying scores this way, or provide musicians with a variety of melody options for each segment of lyrics, acting like a co-creator. Ackerman and Loker developed the system to produce pop tunes, but say it could be adapted different genres. The system uses two models, one focused on rhythm and the other on pitch. These were trained on the melody line and lyrics of 24 different pop songs.

They then used the system to make melodies to accompany two sets of words written by Ackerman that involved it coming up with tunes for lyrics such as "Now that you're gone / I just realised that I'm all alone". They also fed it the lyrics to the vaudeville classic I'm Always Chasing Rainbows to see how it could reimagine the song in the pop genre.

Getting in tune

The idea of trying to automate musical composition is not new, but David Cope at the University of California, Santa Cruz, says ALYSIA is unusual in taking lyrics as its starting point. He is impressed that the system manages to match the metre of the melody with that of the

lyrics, but says the compositions show an “almost annoying” lack of harmony.

Rebecca Fiebrink, a researcher in machine learning and music at Goldsmiths, University of London, questions how useful the lyrics-to-melody approach is. “Is this really solving the compositional process for people who want to make music?” she says. “Creating a melody without additional accompaniment, like this system does, is the easiest thing to achieve.”

The songs admittedly aren’t about to win any Grammys, but Ackerman says this is just the start. She initially imagined targeting ALYSIA at the electronic music community, but is now working on repurposing it for professional songwriters with the help of classical composers.

Ultimately, Ackerman hopes to create a system capable of composing all aspects of a song on its own. “We want to design a program able to generate the music, the lyrics, and ideally even the production and the singing by itself,” she says.

Journal reference: arXiv: https://arxiv.org/pdf/1612.01058v1.pdf

http://bit.ly/2hDDZED

'Star in a Jar' Fusion Reactor Works and Promises Infinite Energy

"Star in a jar" technology would essentially provide Earth with limitless clean energy, forever

By Glenn McDonald, Seeker | December 9, 2016 11:40am ET

For several decades now, scientists from around the world have been pursuing a ridiculously ambitious goal: They hope to develop a nuclear fusion reactor that would generate energy in the same manner as the sun and other stars, but down here on Earth.

Incorporated into terrestrial power plants, this "star in a jar" technology would essentially provide Earth with limitless clean energy, forever. And according to new reports out of Europe this week, we just took another big step toward making it happen.

In a study published in the latest edition of the journal Nature Communications, researchers confirmed that Germany's Wendelstein 7-X (W7-X) fusion energy device is on track and working as planned. The space-age system, known as a stellerator, generated its first batch of hydrogen plasma when it was first fired up earlier this year. The new tests basically give scientists the green light to proceed to the next stage of the process.

It works like this: Unlike a traditional fission reactor, which splits atoms of heavy elements to generate energy, a fusion reactor works by fusing the nuclei of lighter atoms into heavier atoms. The process releases massive amounts of energy and produces no radioactive waste. The "fuel" used in a fusion reactor is simple hydrogen, which can be extracted from water.

However, to achieve fusion, scientists must generate enormously high temperatures to heat the hydrogen into a plasma state. The plasma is so hot, in fact, that it would instantly burn material used to contain it. That's where the stellerator design comes in. The W7-X device confines the plasma within magnetic fields generated by superconducting coils cooled down to near absolute zero. The plasma — at temperatures upwards of 80 million degrees Celsius — never comes into contact with the walls of the containment chamber. Neat trick, that.

The W7-X is the world's largest and most sophisticated stellerator and is currently operated by Max Planck Institute for Plasma Physics in Germany. But development of the W7-X has been an ongoing, international effort. The latest tests were conducted in collaboration with scientists from the U.S. Department of Energy's Princeton Plasma Physics Laboratory (PPPL).

David Gates, principal research physicist for the advanced projects division of PPPL, leads the agency's collaborative efforts in regard to the W7-X project. In an email exchange from his offices at Princeton, Gates said the latest tests verify that the W7-X magnetic "cage" is working as planned.

"This lays the groundwork for the exciting high-performance plasma operations expected in the near future," Gates said.

In terms of the big-picture goal, Gates said that nuclear fusion reactors, if properly developed and deployed, would provide the planet with safe, clean and virtually inexhaustible energy.

"The fuel source is found in seawater in quantities sufficient to last tens of thousands of years," he said. "The waste product is helium, an inert gas. A viable fusion reactor would provide a secure, plentiful and environmentally benign energy resource to all nations."

That last part is critical. Gates said he's encouraged by fact that the W7-X project, and nuclear fusion research in general, is the result of close collaboration among scientists from around the world.

'Fusion is a problem best solved by the peoples of all nations working together, since the entire world will benefit from it."