

<http://bit.ly/2hGDTR3>

Bat Banter is Surprisingly Nuanced

Egyptian fruit bats' calls contain information about food, sleeping arrangements and mating attempts

By [Ramin Skibba](#)

The high-pitched squeals of the humble bat may be as complex as the calls of dolphins and monkeys, researchers have found. A [study](#) published on 22 December in *Scientific Reports*¹ reveals that the fruit bat is one of only a few animals known to direct its calls at specific individuals in a colony, and suggests that information in the calls of many social animals may be more detailed than was previously thought.



[MinoZig Wikimedia](#)

Bats are noisy creatures, especially in their crowded caves, where they make calls to their neighbours. “If you go into a fruit-bat cave, you hear a cacophony,” says Yossi Yovel, a neuroecologist at Tel Aviv University in Israel who led the study.

Until now, it has been difficult to separate this noise into distinct sounds, or to determine what prompted the individual to make a particular call. “Animals make sounds for a reason,” says Whitlow Au, a marine-bioacoustics scientist at the University of Hawaii at Manoa. “Most of the time, we don’t quite understand those reasons.”

Bat chat

To find out what bats are talking about, Yovel and his colleagues monitored 22 captive Egyptian fruit bats (*Rousettus aegyptiacus*) around the clock for 75 days. They modified a voice-recognition program to analyse approximately 15,000 vocalizations collected during this time. The program was able to tie specific sounds to

different social interactions captured by video, such as when two bats fought over food.

Using this tool, the researchers were able to classify more than 60% of the bats’ sounds into four contexts: squabbling over food, jostling over position in their sleeping cluster, protesting over mating attempts and arguing when perched in close proximity to each other.

The algorithm allowed researchers to identify which bat was making the sound more than 70% of the time, as well as which bat was being addressed about half the time. The team found that the animals made slightly different sounds when communicating with different individuals.

This was especially true when a bat addressed another of the opposite sex — perhaps in a similar way, the authors say, to when humans use different tones of voice for different listeners. Only a few other species, such as dolphins and some monkeys, are known to specifically address other individuals rather than to broadcast generalized sounds, such as alarm calls.

Cave quarrels

The bats seemed to be particularly vocal when annoyed with other bats. They might be communicating such things as “Hey, get out of my way!” or “Stop, that’s my food!”, suggests Sonja Vernes, a neurogeneticist and bat researcher at the Max Planck Institute for Psycholinguistics in Nijmegen, the Netherlands, who was not involved in the study.

Bats may have a lot more to tell us, Yovel says. Most communication research has been performed on songbirds, because the vocalizations of dolphins, whales and monkeys are more difficult to study. But in the past few years, scientists have begun adopting bats as another model organism for this research.

“The bat vocal communication field is like where the songbird field was 60 years ago,” says Michael Yartsev, a neurobiologist at the University of California, Berkeley, who studies neural circuits in bats.

Yovel says his group is now trying to determine how well bats respond to the different types of call. The team's findings, he says, suggest that communication researchers should look deeper into the context when analysing the sounds of animals — their everyday chit-chat might be much more sophisticated than it seems.

<http://bit.ly/2hGjnOL>

Single protein may hold secret to treating Parkinson's disease and more

A new way to regulate protein levels and functions could be the answer to treating devastating neurological conditions

New details learned about a key cellular protein could lead to treatments for neurodegenerative diseases, such as Parkinson's, Huntington's, Alzheimer's, and amyotrophic lateral sclerosis (ALS).

At their root, these disorders are triggered by misbehaving proteins in the brain. The proteins misfold and accumulate in neurons, inflicting damage and eventually killing the cells.

In a new study, researchers in the laboratory of Steven Finkbeiner, MD, PhD, at the Gladstone Institutes used a different protein, Nrf2, to restore levels of the disease-causing proteins to a normal, healthy range, thereby preventing cell death.

The researchers tested Nrf2 in two models of Parkinson's disease: cells with mutations in the proteins LRRK2 and α -synuclein. By activating Nrf2, the researchers turned on several "house-cleaning" mechanisms in the cell to remove excess LRRK2 and α -synuclein.

"Nrf2 coordinates a whole program of gene expression, but we didn't know how important it was for regulating protein levels until now," explained first author Gaia Skibinski, PhD, a staff research scientist at Gladstone. "Overexpressing Nrf2 in cellular models of Parkinson's disease resulted in a huge effect. In fact, it protects cells against the disease better than anything else we've found."

In the study, published in the Proceedings of the National Academy of Sciences, the scientists used both rat neurons and human neurons created from induced pluripotent stem cells.

They then programmed the neurons to express Nrf2 and either mutant LRRK2 or α -synuclein. Using a one-of-a-kind robotic microscope developed by the Finkbeiner laboratory, the researchers tagged and tracked individual neurons over time to monitor their protein levels and overall health. They took thousands of images of the cells over the course of a week, measuring the development and demise of each one. The scientists discovered that Nrf2 worked in different ways to help remove either mutant LRRK2 or α -synuclein from the cells. For mutant LRRK2, Nrf2 drove the protein to gather into incidental clumps that can remain in the cell without damaging it. For α -synuclein, Nrf2 accelerated the breakdown and clearance of the protein, reducing its levels in the cell.

"I am very enthusiastic about this strategy for treating neurodegenerative diseases," said Finkbeiner, a senior investigator at Gladstone and senior author on the paper.

"We've tested Nrf2 in models of Huntington's disease, Parkinson's disease, and ALS, and it is the most protective thing we've ever found. Based on the magnitude and the breadth of the effect, we really want to understand Nrf2 and its role in protein regulation better."

The scientists say that Nrf2 itself may be difficult to target with a drug because it is involved in so many cellular processes, so they are now focusing on some of its downstream effects. They hope to identify other players in the protein regulation pathway that interact with Nrf2 to improve cell health and that may be easier to drug.

Other Gladstone scientists on the study include Vicky Hwang, D. Michael Ando, Aaron Daub, Alicia Lee, Abinaya Ravisankar, Sara Modan, and Mariel Finucane. Benjamin Shaby from Penn State University also took part in the research.

Funding was provided by the National Institutes of Mental Health, National Institute of Neurological Disorders and Stroke, National Human Genome Research Institute, California Institute of Regenerative Medicine, Taube/Koret Center, Michael J. Fox Foundation, ALS Association, National Center for Research Resources, and the Betty Brown family. The work is dedicated to the memory of Nita Hirsch.

<http://bit.ly/2ilHd2P>

Study: Hospital readmission rates decrease after passage of ACA financial penalties

Lowest performing hospitals -- penalized the most under the law -- achieved greatest reductions

BOSTON - The Affordable Care Act (ACA) instituted financial penalties against hospitals with high rates of readmissions for Medicare patients with certain health conditions. A new analysis led by researchers at Beth Israel Deaconess Medical Center (BIDMC), Harvard T.H. Chan School of Public Health and Massachusetts General Hospital has found that the penalties levied under the law's Hospital Readmissions Reduction Program were associated with reduced readmissions rates and that the poorest performing hospitals achieved the greatest reductions. The research appears online in *The Annals of Internal Medicine* on December 27, 2016.

The Hospital Readmissions Reduction Program was enacted into law in 2010 and implemented in 2012 in response to the high numbers of patients who were readmitted within 30 days of their initial discharge from the hospital after treatment for several common conditions -- including heart failure, pneumonia and acute myocardial infarction (heart attack). While some readmissions may be unavoidable, there was evidence of wide variation in hospitals' readmission rates before the ACA, suggesting that patients admitted to certain hospitals were more likely to experience readmissions compared to other hospitals.

"Hospital readmissions represent a significant portion of potentially preventable medical expenditures, and they can take a physical and emotional toll on patients and their families," said co-senior author Robert W. Yeh, MD, MBA, Director of the Smith Center for Outcomes Research in Cardiology at BIDMC and Associate Professor of Medicine at Harvard Medical School. "The Affordable Care Act sought to introduce financial incentives to motivate hospitals, especially the poorest performing ones, to reduce their readmission rates, and only the data could tell us if and how well it worked."

"We know that the national hospital readmission rate has been declining since passage of the Affordable Care Act, and our team wanted to assess whether this improvement was driven by the best-performing hospitals alone, or if all groups improved," said first author Jason H. Wasfy, MD, MPhil, who is Director of Quality and Analytics at the Massachusetts General Hospital Heart Center and Instructor in Medicine at Harvard Medical School.

The researchers examined Medicare fee-for-service hospitalization data from more than 2,800 hospitals across the country between 2000 and 2013. Based on 30-day readmission rates after initial hospitalization for acute myocardial infarction, congestive heart failure or pneumonia, the researchers categorized hospitals into one of four groups based on the penalties they had incurred under the Hospital Readmissions Reduction Program: highest performance (0% penalty), average performance (greater than 0% but less than 0.5% penalty), low performance (equal to or greater than 0.5% but less than 0.99% penalty), and lowest performance (equal to or greater than 0.99% penalty).

"We analyzed data from more than 15 million Medicare discharges," said co-senior author Francesca Dominici, PhD, Professor of Biostatistics and Senior Associate Dean for Research at Harvard T.H. Chan School of Public Health. "We implemented Bayesian hierarchical models to estimate readmission rates for each hospital, accounting for differences in each hospital's patient population. We then used pre-post analysis methods to assess whether there were accelerated reductions in readmission rates within each group after the passage of the reform. It turned out that all groups of hospitals improved to some degree. Notably, we found that it was the hospitals that were the lowest performers before passage of the Affordable Care Act that went on to improve the most after being penalized financially."

"For every 10,000 patients discharged per year, the worst performing hospitals - which were penalized the most - avoided 95 readmissions

they would have had if they'd continued along their current trajectory before the implementation of the law," added Dominici. "It's a testament to the fact that hospitals do respond to financial penalties, in particular when these penalties are also tied to publicly reported performance goals." "Paying hospitals not just for what they do, but for how well they do - that's still a relatively new way of reimbursing hospitals, and it looks to be effective," Yeh added.

This work was funded, in part, by grants from the National Institutes of Health (P01 CA 134294, R01 GM111339, R01 ES024332 and K23 HL 118138-01), as well as support from the Massachusetts General Hospital Cardiology Division's Hassenfeld Scholars Program. Co-authors also include Corwin Matthew Zigler, PhD, Christine Choirat, PhD and Yun Wang, PhD, all of the Department of Biostatistics at the Harvard T.H. Chan School of Public Health.

<http://bbc.in/2ilQ0C4>

Hip pain may be 'hangover from evolution'

Scientists at the University of Oxford say a hangover from evolution could help explain why humans get so much shoulder, hip and knee pain.

By Smitha Mundasad Health reporter, BBC News

And if current trends continue they predict the humans of the future could be at even greater risk. They studied 300 specimens from different species spanning 400 million years to see how bones changed subtly over millennia.



Bones from the skeleton of the 3.2m-year-old hominid Lucy Science Photo Library

The changes came as man began standing up straight on two legs. Other researchers have noticed similar evolutionary quirks in humans. Some people prone to lower back problems, for example, could have [spines closer in shape to those of our nearest ape relative](#) - the chimpanzee.

'Bizarre arrangement'

Dr Paul Monk, who led the research at the Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, was

interested to explore why patients in his clinic came in with similar orthopaedic problems. "We see certain things very commonly in hospital clinics - pain in the shoulder with reaching overhead, pain in the front of the knee, arthritis of the hip, and in younger people we see some joints that have a tendency to pop out. "We wondered how on earth we have ended up with this bizarre arrangement of bones and joints that allows people to have these problems. "And it struck us that the way to answer that is to look backwards through evolution."

The team took detailed CT scans of 300 ancient specimens housed at the Natural History Museum in London, in Oxford, and the Smithsonian Institution in Washington. Bringing the data together, they were able to create a library of 3D models, and spot changes to the shapes of single bones over millions of years.

As species evolved from moving around on four legs to standing up on two, for example, researchers say the so-called neck of the thigh bone grew broader to support the extra weight. And studies show that the thicker the neck of the thigh bone, the more likely it is that arthritis will develop. Scientists say this is one potential reason why humans are susceptible to so much hip pain.

The team then used their data to hazard a guess at the shape of human bones 4,000 years in the future - although they admit there are many uncertainties in future times that could not be accounted for.

Dr Monk said: "What is interesting is if we try and move these trends forward, the shape that is coming has an even broader neck and we are trending to more and more arthritis."

In the shoulder, scientists found that a natural gap - which tendons and blood vessels normally pass through - got narrower over time. The narrower space makes it more difficult for tendons to move and might help explain why some people experience pain when they reach overhead, say the scientists.

Using these predictions, the researchers suggest joint replacements of the future will have to be re-designed to accommodate the evolving shapes. But they say it is not all bad news - the right physiotherapy

and working on maintaining a good posture can help mitigate some of the downsides of our design.

<http://nyti.ms/2iUobC0>

Newly Discovered Prehistoric Bird Lived Near a Balmey North Pole Trilobites

The North Pole wasn't always a winter wonderland. Rewind 90 million years, and scientists think it was probably as warm as parts of Florida.

By NICHOLAS ST. FLEUR DEC. 22, 2016

A new clue supporting that idea is a fossilized wing bone belonging to a newly discovered prehistoric bird found in the Canadian Arctic. The duck-size creature looked like a cross between a sea gull and a cormorant, but with a beak full of teeth. It could both fly and dive, and it most likely lived alongside turtles, crocodilelike reptiles and a whole lot of fish.



An artist's rendering of Tingmiatornis arctica, a newly discovered prehistoric bird that could fly and dive and had teeth. Michael Osadciw/University of Rochester

“This was a hyperwarm period, a real spike in temperatures where we think even during the winter there wasn't freezing water,” said John Tarduno, a geophysicist from the University of Rochester. “Tingmiatornis arctica adds to this picture that we have of this incredibly warm Arctic 90 million years ago.”

Dr. Tarduno and his team published their findings on Monday in the journal Scientific Reports.

Scientists aren't sure why Earth was stifling hot for several million years during the Cretaceous period, but according to Dr. Tarduno, the prevailing hypothesis is that the atmosphere was filled with heat-

trapping carbon dioxide, most likely the result of extraordinary volcanic activity. The resulting greenhouse effect would have transformed the polar ecosystem into a place where Tingmiatornis arctica and its prey could thrive.

The warming period, known as the Turonian age, is estimated to have lasted from 93.9 million to 89.8 million years ago. At its coldest, it is estimated that the Arctic got around 57 degrees Fahrenheit.

In his time exploring the snowcapped brown hills and thick glaciers of Nunavut, in the Canadian Arctic, Dr. Tarduno has come across two wing bones belonging to this species of bird. He uncovered the first humerus in 1999. It was relatively small and he didn't pay it much mind until he found a second, larger bone a few years later. But even the second humerus didn't catch his attention at first. Instead, he and his team were preoccupied with a large turtle shell that was on the other side of the same rock.

“We took it back to camp and went, ‘Oh, wait a minute, there's another spectacular fossil on the other side,’ ” Dr. Tarduno said.

After finding the bones, they turned to their colleague Julia Clarke, a paleontologist from the University of Texas at Austin, for further analysis. She knew the bones belonged to a group of birds called ornithurines, which includes all living birds and their closest extinct relatives. But by studying the unique marks on the points on the bone where it was once attached to muscle, she was able to determine that the fossil belonged to a prehistoric bird unlike any that had previously been discovered.

Dr. Clarke was also able to determine that the bird was a capable flier because of the size and shape of the bone, and that the bird most likely dove in the water because of the thickness of the outermost layer, known as the cortical bone. She said the finding might help paleontologists understand an even bigger mystery.

“We can't explain why some flying dinosaurs, which we call birds, went extinct right alongside all the other dinosaurs,” she said, “and why only parts of the ornithurines survived to the present day.”

By collecting more fossils of ornithurine birds like *Tingmiatornis arctica*, paleontologists can better understand what helped this lineage of birds survive the extinction event 66 million years ago when three-quarters of all animal and plant life perished.

<http://bit.ly/2iDmu8B>

Shoulder pain linked to increased heart disease risk

Individuals with symptoms that put them at increased risk for heart disease could be more likely to have shoulder problems

After all the lifting, hauling, and wrapping, worn out gift givers may blame the season's physical strain for any shoulder soreness they are feeling. It turns out there could be another reason. A new study led by investigators at the University of Utah School of Medicine finds that individuals with symptoms that put them at increased risk for heart disease could be more likely to have shoulder problems, including joint pain and rotator cuff injury.

"If someone has rotator cuff problems, it could be a sign that there is something else going on. They may need to manage risk factors for heart disease," says the study's lead author Kurt Hegmann, M.D., M.P.H., Professor of Family and Preventive Medicine and Director of the Rocky Mountain Center for Occupational and Environmental Health. The research was published in the *Journal of Occupational and Environmental Medicine*.

Repeated physical stress is most frequently blamed for aggravating shoulder joints and the muscles and tendons that surround them. Think about a pitcher who throws a baseball 100 times a day. While physical exertion can certainly be an irritant, accumulating evidence points to other factors that could also be at play. Previous research found that people who had an increased risk for heart disease also had a tendency toward carpal tunnel syndrome, Achilles tendinitis, and tennis elbow, all musculoskeletal disorders.

The current study by Hegmann and colleagues adds shoulder problems to the list and takes the connection one step further. The

more heart disease risk factors that each of the study participants had racked up - including high blood pressure, high cholesterol, diabetes - the more likely they were to have had shoulder trouble.

36 participants with the most severe collection of risk factors were 4.6 times more likely than those with none of the risk factors to have had shoulder joint pain. They were also nearly six times more likely to have had a second shoulder condition, rotator cuff tendinopathy. Participants with mid-level heart risk were less likely to have had either shoulder condition, at 1.5 to 3-fold. Shared trends bolster that there could be a relationship between heart risk and shoulder problems, but researchers will need to follow up with a prospective study to prove cause and effect.

It may seem like physical strain would be at least just as likely to cause shoulder pain but data from the 1,226 skilled laborers who took part in the study suggest otherwise. Ergonomists carefully monitored airbag manufacturers, meat processors, cabinet makers and skilled laborers. Every forceful twist, push, and pull was factored into a strain index assigned to each worker. But a more straining job did not translate to an uptick in shoulder difficulties. Nor did more time spent doing other physical activities.

"What we think we are seeing is that high force can accelerate rotator cuff issues but is not the primary driver," says Hegmann. "Cardiovascular disease risk factors could be more important than job factors for incurring these types of problems."

He says it's possible that controlling blood pressure and other heart risk factors could alleviate shoulder discomfort, too.

The research was supported by the National Institute on Occupational Safety and Health and published as "Association of Cardiovascular Disease Risk Factors and Rotator Cuff Tendinopathy".

In addition to Hegmann, co-authors include Kara Applegate, Matthew Thiese, Eric Wood, Richard Kendall and Andrew Merryweather from the University of Utah, Jay Kapellusch, James Foster and Arun Garg from the University of Wisconsin-Milwaukee, and David Drury from the Veterans Administration Medical Center, Milwaukee, Wisconsin.

<http://bit.ly/2iUp25u>

'Friendship Bench' program proves effective at alleviating mental illness symptoms

In Zimbabwe study, Friendship Bench therapy reduces prevalence of depression to <14%, compared to 50% in control group; First at-scale model of community mental health care in Africa has diagnosed & treated over 27,500 people for common mental disorders

Toronto / Harare - Their offices are simple wooden seats, called Friendship Benches, located in the grounds of health clinics around Harare and other major cities in Zimbabwe.

The practitioners are lay health workers known as community "Grandmothers," trained to listen to and support patients living with anxiety, depression and other common mental disorders.

But the impact, measured in a ground-breaking study, shows that this innovative approach holds the potential to significantly improve the lives of millions of people with moderate and severe mental health problems in countries where access to treatment is limited or nonexistent.

Funded by the Government of Canada through Grand Challenges Canada, the randomised controlled trial was conducted by the University of Zimbabwe, the London School of Hygiene & Tropical Medicine and King's College London. The study is published today in JAMA, the world's most widely-circulated medical journal.

Six months after undergoing six weekly "problem solving therapy" sessions on the Friendship Benches, participants showed significant differences in severity of depression, anxiety, and suicidal thoughts based on locally validated questionnaires for depression and anxiety: the Shona Symptom Questionnaire (SSQ), the Patient Health Questionnaire (PHQ) and the Generalised Anxiety Disorder scale (GAD). The results were striking.

Patients with depression or anxiety who received problem-solving therapy through the Friendship Bench were more than three times less

likely to have symptoms of depression after six months, compared to patients who received standard care. They were also four times less likely to have anxiety symptoms and five times less likely to have suicidal thoughts than the control group after follow-up.

50 percent of patients who received standard care still had symptoms of depression compared to 14 percent who received Friendship Bench (based on PHQ). 48 percent of patients who received standard care still had symptoms of anxiety compared to 12 percent who received Friendship Bench (based on the GAD), and 12 percent of patients who received standard care still had suicidal thoughts compared to 2 percent who received Friendship Bench (based on SSQ).

The Friendship Bench intervention was also shown to be well suited to improve health outcomes among highly vulnerable individuals. 86 percent of the study's participants were women, over 40 percent were HIV positive, and 70 percent had experienced domestic violence or physical illness.

Lead author of the study Dr. Dixon Chibanda, a consultant psychiatrist in Harare, co-founded the Friendship Bench network in response to the appalling shortage of evidence-based treatment for people with mental disorders in Zimbabwe, a problem common throughout Africa. While about 25 percent of the country's primary care patients suffer from depression, anxiety and other common mental disorders, Zimbabwe (population 15 million) has only 10 psychiatrists and 15 clinical psychologists.

"Common mental disorders impose a huge burden on all countries of sub-Saharan Africa," says Dr. Chibanda. "Developed over 20 years of community research, the Friendship Bench empowers people to achieve a greater sense of coping and control over their lives by teaching them a structured way to identify problems and find workable solutions."

With CDN \$1 million in funding from Grand Challenges Canada earlier this year, the Friendship Bench has since been scaled to 72 clinics in the cities of Harare, Gweru and Chitungwiza (total

population 1.8 million). Through collaborating with a Médecins Sans Frontières psychiatric program in Zimbabwe, the Friendship Bench is working to create the largest comprehensive mental health program in sub-Saharan Africa.

To date, over 27,500 people have accessed treatment.

"In developing countries, nearly 90 percent of people with mental disorders are unable to access any treatment," says Dr. Peter A. Singer, Chief Executive Officer of Grand Challenges Canada. "We need innovations like the Friendship Bench to flip the gap and go from 10 percent of people receiving treatment, to 90 percent of people receiving treatment."

"In many parts of Africa, if you are poor and mentally ill, your chances of getting adequate treatment are close to zero," says Dr. Karlee Silver, Vice President Programs at Grand Challenges Canada. "In Zimbabwe, that's changing thanks to the Friendship Bench, the first project with the potential to make mental health care accessible to an entire African nation."

In 2017, the team will focus on expanding the model to reach other vulnerable populations, including youth and refugees. In partnership with the Swedish NGO SolidarMed, the team intends to expand implementation of this model in Masvingo province and subsequently in the refugee centres of the eastern highlands on the border with Mozambique.

"The Friendship Bench team, working with the Zimbabwe Ministry of Health, has been able to substantially scale up services for some of the most deprived people in the community," says Dr. Shekhar Saxena, Director of Mental Health and Substance Abuse at the World Health Organization. "By supporting the uptake of mental health innovations like the Friendship Bench, Canada is helping to turn the tide in the global mental health challenge."

The study, published today in JAMA and supported by Grand Challenges Canada, was conducted from September 2014 to June 2015, and involved:

Identifying participants at 24 primary care clinics in Harare, divided into an intervention group (287 participants) and a control group (286). Total participants: 573.

Participants were all at least 18 years old (median age 33); All had been assessed at 9 or higher on a 14-level "Shona Symptoms Questionnaire" (SSQ-14), an indigenous measure of common mental disorders in Zimbabwe's Shona language . Changes in depression were measured using the PHQ-9 scale.

Excluded were patients with suicidal intent (those who were clinically depressed with suicidal thoughts and a plan for suicide), end-stage AIDS, were currently in psychiatric care, were pregnant or up to 3 months post-partum, presented with current psychosis, intoxication, and/or dementia (such patients were referred to a higher level clinic in Harare).

The control group received standard care (nurse assessment, brief support counselling, medication, referral to see a clinical psychologist and/or a psychiatrist, and Fluoxetine if warranted) plus education on common mental disorders.

Intervention group participants met on a wooden bench on the grounds of municipal clinics with trained, supervised lay health workers, popularly known as "grandmothers," (median age 53) who provided problem solving therapy with three components -- "opening up the mind, uplifting the individual, and further strengthening."

The 45-minute sessions took place weekly for six weeks, with an optional 6-session group support program available

The "grandmothers" used mobile phones and tablets to link to specialist support. They also used a cloud-based platform that integrated the Friendship Bench project's training, screening, patient referral and follow-up components

After three individual sessions, participants were invited to join a peer-led group called Circle Kubatana Tose, or "holding hands together," which provided support from men and women who had benefitted from the Friendship Bench earlier. At these weekly meetings, people shared personal experiences while crocheting purses made from recycled plastic materials, the latter being an income-generating skill for participants.

<http://bit.ly/2iUbHdp>

Treating cancer with drugs for diabetes and hypertension

A combination of a diabetes medication and an antihypertensive drug can effectively combat cancer cells.

The team of researchers led by Prof. Michael Hall at the Biozentrum of the University of Basel has also reported that specific cancer cells respond to this combination of drugs. The results of the study have now been published in Science Advances.

Metformin is the most widely prescribed drug for the treatment of type 2 diabetes. Besides its blood sugar lowering effect, it also displays anti-cancer properties. The usual therapeutic dose, however, is too low to effectively fight cancer. The research team led by Prof. Michael Hall, at the Biozentrum of the University of Basel, has now made an unexpected discovery: The antihypertensive drug syrosingopine potentiates the anti-cancer efficacy of metformin. Apparently, this drug combination drives cancer cells to programmed "suicide".

Drug cocktail kills tumor cells

At higher doses, the antidiabetic drug inhibits the growth of cancer cells but could also induce unwanted side effects. Therefore, the researchers screened over a thousand drugs for whether they can enhance the anticancer action of metformin. A favorite emerged from this screening: Syrosingopine, an antihypertensive drug. As the study shows, the cocktail of these two drugs is effective in a wide range of cancers.

"For example, in samples from leukemia patients, we demonstrated that almost all tumor cells were killed by this cocktail and at doses that are actually not toxic to normal cells", says the first author, Don Benjamin. "And the effect was exclusively confined to cancer cells, as the blood cells from healthy donors were insensitive to the treatment."

Drugs block "juice" supply to cancer cells

In mice with malignant liver cancer, enlargement of the liver was reduced after the therapy. Also the number of tumor nodules was less

- in some animals the tumors disappeared completely. A glance at the molecular processes in the tumor cells explains the drug combination's efficacy: Metformin lowers not only the blood glucose level, but also blocks the respiratory chain in the energy factories of the cell, the mitochondria. The antihypertensive drug syrosingopine inhibits, among other things, the degradation of sugars.

Thus, the drugs interrupt the vital processes which provide energy for the cell. Due to their increased metabolic activity and rapid growth, cancer cells have a particularly high energy consumption, which makes them extremely vulnerable when the energy supply is reduced.

Groundbreaking step towards clinical application

By testing a range of other compounds with the same mode of action, the scientists could demonstrate that the inhibition of the respiratory chain in the mitochondria is a key mechanism. These also reduced cancer cell growth in combination with the antihypertensive drug.

"We have been able to show that the two known drugs lead to more profound effects on cancer cell proliferation than each drug alone," explains Benjamin. "The data from this study support the development of combination approaches for the treatment of cancer patients." This study may have implications for future clinical application of combination scenarios targeting the energy needs of tumor cells.

Don Benjamin, Marco Colombi, Sravanth K. Hindupur, Charles Betz, Heidi A. Lane, Mahmoud Y. M. El-Shemerly, Min Lu, Luca Quagliata, Luigi Terracciano, Suzette Moes, Timothy Sharpe, Aleksandra Wodnar-Filipowicz, Christoph Moroni, Michael N. Hall. [Syrosingopine sensitizes cancer cells to killing by Metformin](https://doi.org/10.1126/sciadv.1601756) Science Advances, published online 23 December 2016 | DOI: 10.1126/sciadv.1601756

<http://bit.ly/2iUwkXd>

Low levels of manganese in welding fumes cause neurological problems

Current safety standards may not protect workers adequately

Welders exposed to airborne manganese at estimated levels below federal occupational safety standards exhibit neurological problems similar to Parkinson's disease, according to new research at Washington University School of Medicine in St. Louis. Further, the

more they are exposed to manganese-containing welding fumes, the faster the workers' signs and symptoms worsen. The findings, published Dec. 28 in *Neurology*, suggest that current safety standards may not adequately protect welders from the dangers of the job.

"We found that chronic exposure to manganese-containing welding fumes is associated with progressive neurological symptoms such as slow movement and difficulty speaking," said Brad A. Racette, MD, a professor of neurology and the study's senior author. "The more exposure you have to welding fumes, the more quickly those symptoms progress over time."

At high levels, manganese - a key component of important industrial processes such as welding and steelmaking - can cause manganism, a severe neurologic disorder with symptoms similar to Parkinson's disease, including slowness, clumsiness, tremors, mood changes, and difficulty walking and speaking. The risk of manganism drove the Occupational Safety and Health Administration (OSHA) decades ago to set standards limiting the amount of manganese in the air at workplaces. While these safety standards are widely believed to have eliminated manganism as an occupational hazard, researchers who study the effects of manganese exposure have long suspected that there may still be some health effects at levels much lower than what is allowable per OSHA standards.

"Many researchers view what's allowable as too high a level of manganese, but until now there really weren't data to prove it," said Racette, who also is executive vice chairman in the Department of Neurology. "This is the first study that shows clinically relevant health effects that are occurring at estimated exposures that are an order of magnitude lower than the OSHA limit."

Racette and colleagues studied 886 welders at three worksites in the Midwest - two shipyards and one heavy-machinery fabrication shop. Each welder filled out a detailed job history questionnaire, which the researchers used to calculate each participant's exposure by combining

the estimated manganese exposure for specific job titles with the amount of time spent in each job.

Each participant also underwent at least two standardized clinical evaluations of motor function spaced a year or more apart and using the Unified Parkinson's Disease Rating Scale. The evaluations were performed by trained neurologists looking for signs of neurological damage such as muscle stiffness, gait instability, reduced facial expressions and slow movement.

A score of 6 or lower was considered normal on the evaluation scale, and those with scores of 15 or higher were placed in the parkinsonism category. Parkinsonism is a set of neurological signs and symptoms similar to what is seen in Parkinson's disease. At their first evaluation, the welders had an average score of 8.8, and 15 percent of the welders fell into the parkinsonism category.

Moreover, participants' scores increased over time, and the welders exposed to the highest levels of manganese showed the biggest changes in their scores, an indication that their neurological problems were worsening faster than those of workers exposed to less manganese.

The scores for workers at the same sites who were not exposed to welding fumes did not change over time, suggesting that welding fumes, not aging, were responsible for the increasing scores.

Racette's team did not directly measure the participants' quality of life, but previous studies by his team have shown that higher parkinsonism scores in welders are associated with more difficulty with activities of daily life such as eating, mobility and writing. "This is not something we can ignore," Racette said. "I think a qualified neurologist would look at these clinical signs and say, 'There's something wrong here.' This would be having an effect on people's lives."

The most worrisome aspect of the study, Racette said, is that the neurological signs showed up in people with an estimated exposure of only 0.14 milligrams of manganese per cubic meter of air, far below the safety standard set by OSHA at 5 milligrams per cubic meter.

In 2013, the American Conference of Governmental Industrial Hygienists recommended a limit of 0.02 milligrams of manganese per cubic meter. Some companies already are attempting to keep their workers' exposures below that level by improving ventilation, mandating personal protective equipment and using low-manganese welding wire. However, only OSHA's standards are enforceable by law.

"We can make the workplace safer for welders," Racette said. "Reducing OSHA's allowable levels of manganese would probably make a big difference in terms of safety and help workers avoid such risks."

<http://bit.ly/2hYGSjE>

Tibetan Plateau Discovery Shows Humans May Be Tougher Than We Thought

Converging genetic and archaeological evidence hints that early migrants clung to the frigid, oxygen-starved "roof of the world" through the worst the climate could throw at them

By [Jane Qiu](#) on December 28, 2016

The first humans venturing onto the Tibetan Plateau, often called the "roof of the world," faced one of the most brutal environments our species can endure. At an average elevation of over 4,500 meters, it is a cold and arid place with [half the oxygen present at sea level](#).



[reurinkjan Flickr \(CC BY 2.0\)](#)

Science has long held that humans did not set foot in this alien place until 15,000 years ago, as suggested by archaeological evidence of the earliest known settlement on the northeastern fringe of the plateau

3,000 meters above sea level. But now new genetic data indicate this may have occurred much earlier—possibly as far back as the last ice age, 62,000 years ago.

A better understanding of modern Tibetans' genetic mix and diversity could help reconstruct the history of migration and population expansion in the region, and may help unravel the mystery of the ethnic origins of Tibetans—and of how humans have adapted to low-oxygen conditions at high altitudes.

For the new study, researchers sequenced the entire genomes of 38 ethnic Tibetans and 39 Han Chinese (the country's majority ethnic group), and compared the results with published genomic sequences of other ethnic groups around the world—information that allowed the team to pinpoint the common genetic origin of different populations and to get a better grasp on the history of migration in Tibet.

"Tibetan-specific DNA sequences can be traced back to ancestors 62,000-38,000 years ago... This represents the earliest colonization of the Tibetan Plateau," says Shuhua Xu, a population geneticist at the Chinese Institute of Sciences' Shanghai Institutes for Biological Sciences. Xu's [work](#) was published in September in the American Journal of Human Genetics, and presented at the American Society of Human Genetics' annual meeting in Vancouver. Since that initial migration, as the ice age tightened its grip on the plateau, genetic mixing between Tibetans and non-Tibetans probably ground to a halt for tens of thousands of years—suggesting that movement into Tibet dropped to the minimum. "The migration routes were probably cut off by ice sheets," Xu says. "It's simply too harsh even for the toughest hunter-gatherers."

But about 15,000 to 9,000 years ago—after the so-called last glacial maximum (LGM), during which the Earth's ice cover had reached its most extensive point and climate was at its harshest—people flocked into Tibet en masse. "It's the most significant wave of migration that shaped the modern Tibetan gene pool," Xu says. "We can really see rapid population expansion [on the plateau] during that time."

Interestingly, he adds, this was also when the common ancestor of Tibetans and Han Chinese split—contrary to a previous study suggesting that the divergence took place as late as 2,750 years ago.

“This is the first study to sequence the entire genome of Tibetans, and the resolution is really impressive,” says Mark Aldenderfer, an archaeologist at the University of California, Merced, who was not involved in Xu’s study. The much earlier divergence between Tibetans and Han Chinese makes sense because there are continuous material cultures on the plateau since 15,000 years ago, he says.

The study, Aldenderfer adds, “also provides fine details of how different populations from various directions may have combined their genes to ultimately create the people that we call Tibetans.” The data show that 94 percent of the present-day Tibetan genetic makeup came from modern humans—possibly those who ventured into Tibet in the second wave of migration—and the rest came from archaic hominins such as Denisovans, Neandertals and unknown groups. The modern part of the Tibetan genome shares 82 percent similarity with East Asians, 11 percent with Central Asians, and 6 percent with South Asians. “Among all ethnic groups, Han Chinese are most closely related to Tibetans,” Xu says.

The findings also reveal a startling genetic continuity since the plateau was first colonized 62,000 years ago. “This suggests that Tibet has always been populated—even during the toughest times as far as climate was concerned,” Xu says. That idea contradicts the commonly held notion that any early plateau dwellers would have been eliminated during harsh climate intervals such as LGM and another period known as the Younger Dryas between 12,900 and 11,600 years ago, says David Zhang, a geographer at the University of Hong Kong, who was not involved in Xu’s research.

In 2002 Zhang and a colleague published a controversial [study in *Geophysical Review Letters*](#) showing marks of hands and feet from at least six individuals in rocks that were once soft mud, which was dated to 20,000 years ago at 4,000 meters above sea level in the heart

of Tibet. Based on this they theorized that people were living in Tibet at the height of LGM, but the lack of archaeological finds near the site has cast doubt on this. “Many people don’t think it’s possible,” Aldenderfer says. “But there were plenty of places for [those early populations] to live where local conditions weren’t that bad, such as the big river valleys on the plateau.” The handprints and footprints were uncovered near one of the plateau’s many hot springs, which could have served as refuges for plants, animals and humans, he adds.

Two independent archaeological studies presented at the 33rd International Geographical Congress, held in August in Beijing, also support the antiquity of Tibet settlement as suggested by Xu’s genetic data. A team led by archaeologist Guanghui Dong of Lanzhou University in Gansu province unveiled the earliest archaeological evidence of human presence—dating to 39,000-31,000 years ago—on the southeastern fringe of the Tibetan Plateau. The site, rich with stone tools and animal bones, lies at 2,500 meters above sea level at the bank of the Salween River. “This may represent one of the first steps of human colonization on the plateau,” Dong says. “Those hunter-gathers might then expand to the inner plateau along the river valley.”

The second study pushes back the dates of human settlement above 4,000 meters by 4,000 years. Qinghai Normal University archaeologist Guangliang Hou and some of his colleagues recently excavated an archaeological site dated to 11,500 years ago, which is in line with the second and more important wave of migration that Xu’s study suggests. Hou said at the geographical congress that the site, close to a main tributary of the Yellow River, is teeming with charcoal—a telltale sign of fire use by humans. “This may have helped the plateau dwellers to survive the harsh conditions at such high elevations nearing the end of the Younger Dryas,” he says.

“It’s increasingly clear that there has been much earlier and much more persistent human occupation of the plateau than we previously thought,” Aldenderfer says. He stresses, however, that pieces are still

missing from the puzzle: "More excavations are required to close those gaps."

<http://bit.ly/2ivLibH>

New pharmacological agent allows testicular tumors to shrink

Study at the University of Bonn determines positive effects in mice

Testicular cancer is the most common malignant tumor disease in men between 20 and 40 years of age. It can usually be treated well. In some cases, however, the cancer hardly responds or does not respond at all to treatment. A substance that was originally destined to be an innovative contraceptive is offering new hope in these cases. An experimental drug with the cryptic name JQ1 blocks sperm maturation and was discussed to be a male contraceptive. Instead, it may be suitable for cancer therapy.

JQ1 belongs to a new class of drugs with far-reaching abilities: its members fundamentally influence which genes in the cell are active and which are not. The hereditary material DNA is similar to an extremely long strip of Morse code, on which the assembly instructions for the cellular molecules are found. To fit into the cell nuclei, this strip of Morse code is wrapped around small protein balls at regular intervals - the histones. Histones and DNA together resemble a string of pearls.

However, the histones do not only play a structural role. They also feature chemical tags - called methyl or acetyl groups. These tags signal to the synthesis machinery in the cell whether the strip of Morse code should be read at this point or not. "JQ1 inhibits those proteins that read these histone marks and thus changes the gene activity in the cell," explains Prof. Hubert Schorle from the Institute for Pathology at the University of Bonn.

The cancer cells react very sensitive to these changes: they activate a suicide program, called apoptosis. "In a testicular cancer mouse model, the tumors began to shrink after administering JQ1," explains the lead author of the study, Sina Jostes. "In contrast, healthy skin cells seem to tolerate JQ1 very well."

Especially effective in combination

Besides JQ1, other drugs that alter the marks of the histones are also known. One of these is romidepsin. The laboratory in Bonn was recently able to show that romidepsin is also very effective at fighting testicular cancer cells. Unlike JQ1, romidepsin is already approved for the treatment of patients with certain types of cancer.

"In our study, we treated mice with both JQ1 and romidepsin," explains Dr. Daniel Nettersheim, who helped in planning and performing the studies. "This way, we achieved a similar effect alike JQ1 or romidepsin treatment alone, but we could reduce the quantities of both substances. Such a combination therapy to treat testicular tumors may be much better tolerated. Chemotherapy-resistant patients could also benefit from this." However, clinical studies are now needed to move the treatment towards the clinics.

Besides scientists from the University of Bonn, the studies also involved researchers from the University of St. Gallen (Switzerland) and Harvard Medical School (USA).

Sina Jostes, Daniel Nettersheim, Martin Fellermeier, Simon Schneider, Francois Hafezi, Friedemann Honecker, Valerie Schumacher, Matthias Geyer, Glen Kristiansen and Hubert Schorle: The bromodomain inhibitor JQ1 triggers growth arrest and apoptosis in testicular germ cell tumours in vitro and in vivo; Journal of Cellular and Molecular Medicine; DOI: 10.1111/jcmm.13059

Daniel Nettersheim, Sina Jostes, Martin Fabry, Friedemann Honecker, Valerie Schumacher, Jutta Kirfel, Glen Kristiansen and Hubert Schorle: A signaling cascade including ARID1A, GADD45B and DUSP1 induces apoptosis and affects the cell cycle of germ cell cancers after romidepsin treatment; Oncotarget; DOI: 10.18632/oncotarget.11647

<http://bbc.in/2hGNCXy>

Art may reveal early signs of dementia

Despite living with dementia, her brushstrokes are measured and steady, the legacy of her years of painting as a talented amateur.

By Dominic Hughes Health correspondent, BBC News

Her work today is very different to the highly detailed pieces she used to produce - expert reproductions of Old Masters such as "Girl With the Pearl Earring" by the 17th century Dutch artist Johannes Vermeer.

Joyce's daughter, Hazel, says her mum still enjoys painting, but before the disease took hold her work was really striking.

"They were really good copies of the Old Masters and very detailed." She's not as detailed now. "She can remember things from years ago, but generally if you asked her what she had for breakfast this morning she can't remember."

But can art - more specifically, the way artists work - tell us something about the development of dementia and other degenerative brain diseases?

A minute analysis of the brushstrokes used by artists who developed neurological diseases reveals intriguing clues about changes in the brain that occurred years before any symptoms became obvious.

The mathematical method is called "fractal analysis", which is a way of looking at recurring patterns that occur both in maths and in nature. Trees and clouds are said to be "fractal", as are the recurring patterns of our brainwaves and heartbeats. The same applies to the individual brushstrokes of artists, which can be compared to their individual handwriting.

Psychologist Alex Forsythe from Liverpool University carried out a fractal analysis of more than two thousand works by seven famous artists and found tiny changes in those patterns. "In artists who went on to develop dementia or Parkinson's disease, the fractal patterns started to change in an unusual way.

"So what we found was that up to 20 years before they actually had a diagnosis of a neurological disorder, the fractal content in the paintings had started to decrease. "So anything that helps us understand more about the way in which the brain operates is a useful way to inform future directions for research."

The artist Willem de Kooning was diagnosed with Alzheimer's disease after his death in 1997. The brushstroke patterns seen in his earlier work were different when compared to later paintings.

But in artists like Monet and Picasso, who died free of any known neurological disease, the patterns remained constant throughout their

lives. It's striking that the even though Picasso in particular changed styles so often throughout his career, his fractal range was constant, regardless of the style in which he painted.

This research won't help diagnose dementia or similar diseases. But it does give a valuable insight into changes that are taking place in the brain years before the illness appears and so could help provide some answers to the hidden processes behind these devastating conditions.

<http://bbc.in/2hYQUBk>

Can you die from a broken heart?

There are medical reasons why it is possible to die of a broken heart.

By Stephen Evans BBC News

The poignancy is enough to make anyone weep. Just a day after a beloved daughter dies, the mother passes away. It is a tragedy with a hint of sweetness - the two who lived each other's lives, end those lives together.

And it is not uncommon. We do not know the cause of Debbie Reynolds' death but there are more instances of two people who love each other dying in short proximity than you might think. There are medical reasons why it is possible to die of a broken heart.

I once went to the joint funeral in Wales of a couple who died within a week of each other. Then I read a report in the news about a man in California who died hours after his wife. It made me wonder how often this happens - and what could be the reason.

In the first case, the widower selected a poem to be read at his wife's funeral - it talked of "two lovers entwined" and a journey "to the end of time's end". But before that funeral took place, the husband, Edmund Williams, also died. He and his wife, Margaret, had been married for 60 years and their love had endured. In their late 80s, they would still go into their garden holding hands. Parting broke his heart.

And about the same time [Don and Maxine Simpson died in Bakersfield](#) in California. He was 90 and she was 87, and they were as inseparable as they had always been after meeting at a bowling alley in 1952 and marrying that same year. Maxine died first and four hours

later, by her side, Don followed. It looks like a pattern, and perhaps it is.

Research [published two years ago in the journal JAMA Internal Medicine](#) found that, while it happened rarely, the number of people who had a heart attack or a stroke in the month after a loved-one died was double that of a matched control group who were not grieving (50 out of 30,447 in the bereaved group, or 0.16%, compared with 67 out of 83,588 in the non-bereaved group, or 0.08%).

One of the authors, Dr Sunil Shah of St George's at the University of London, told the BBC: "We often use the term a 'broken heart' to signify the pain of losing a loved-one and our study shows that bereavement can have a direct effect on the health of the heart."

Some people talk about "broken heart syndrome", known more formally as stress cardiomyopathy or takotsubo cardiomyopathy.

[According to the British Heart Foundation](#), it is a "temporary condition where your heart muscle becomes suddenly weakened or stunned. The left ventricle, one of the heart's chambers, changes shape."

It can be brought on by a shock. "About three quarters of people diagnosed with takotsubo cardiomyopathy have experienced significant emotional or physical stress prior to becoming unwell," the charity says. This stress might be bereavement but it could be a shock of another kind.

There are documented cases of people suffering the condition after being frightened by colleagues pulling a prank, or suffering the stress of speaking to a large group of people. It's speculated that the sudden release of hormones - in particular, adrenaline - causes the stunning of the heart muscle.

This is different from a heart attack, which is a stopping of the heart because the blood supply is constricted, perhaps by clogged arteries.

"Most heart attacks occur due to blockages and blood clots forming in the coronary arteries, the arteries that supply the heart with blood,"

says [an FAQ on broken heart syndrome](#) published by Johns Hopkins University.

What becomes of the broken-hearted

- *"Broken heart" is referred to in the 1611 King James Version of the Bible: "The Lord is nigh unto them that are of a broken heart; and saveth such as be of a contrite spirit." (Psalms 34:18)*

- *Shakespeare features several characters who expire for love - King Lear perishes shortly after discovering the murder of his daughter Cordelia, and in Romeo and Juliet, Lady Montague is reported by her husband to have died of a broken heart: "Grief of my son's exile hath stopp'd her breath"*

- *Alfred Lord Tennyson's 1842 poem, The Lady of Shalott, relates how the tragic damsel of Arthurian legend lay down in a boat to die and be discovered by Lancelot, the knight she loved: "For ere she reach'd upon the tide/ The first house by the water-side,/ Singing in her song she died,/ The Lady of Shalott."*

By contrast, most patients who suffer from cardiomyopathy "have fairly normal coronary arteries and do not have severe blockages or clots", the website says. Many people simply recover - the stress goes away and the heart returns to its normal shape. But in some, like the old or those with a heart condition, the change in the shape of the heart can prompt a fatal heart attack.

The scientific name, takotsubo cardiomyopathy comes from the Japanese word for [a type of round-bottomed, narrow-necked vessel](#) used for catching octopuses. The sudden stress causes the left ventricle of the heart - the one that does the pumping - to balloon out into the shape of the pot.

There is also evidence of an increased risk of death after the hospitalisation of a partner, according to a study published in 2006 in the New England Journal of Medicine. Other research published in 2011, meanwhile, suggests that the odds of the surviving partner dying are [increased for six months](#) after their partner's death.

The researchers pointed out that a mutually supportive marriage acts as a buffer against stress. Partners also monitor each other and

encourage healthy behaviour - reminding each other to take their daily tablets, for example, and checking they don't drink too much.

Whatever the science behind "broken heart syndrome", the results are bitter-sweet. There is, of course, the grief of a bereaved family who have lost two people they love. But there is also often a relief that a couple deeply in love should have exited life together.

Edmund Williams' poem for his wife Margaret talked about "two lovers entwined" and a journey "to the end of time's end". If there is a benevolent heart condition, surely takotsubo cardiomyopathy is the one - but "dying of a broken heart" puts it better.

<http://bit.ly/2im09Pi>

The rhythm that makes memories permanent
Scientists at IST Austria identify mechanism that regulates rhythmic brain waves -- inhibition at synapses is the key to make memories permanent

Every time we learn something new, the memory does not only need to be acquired, it also needs to be stabilized in a process called memory consolidation. Brain waves are considered to play an important role in this process, but the underlying mechanism that dictates their shape and rhythm was still unknown. A study now published in *Neuron* shows that one of the brain waves important for consolidating memory is dominated by synaptic inhibition.

So-called sharp wave ripples (SWRs) are one of three major brain waves coming from the hippocampus. The new study, a cooperation between the research groups of Professors Peter Jonas and Jozsef Csicsvari at the Institute of Science and Technology Austria (IST Austria), found the mechanism that generates this oscillation of neuronal activity in mice. "Our results shed light on the mechanisms underlying this high-frequency network oscillation. As our experiments provide information both about the phase and the location of the underlying conductance, we were able to show that precisely timed synaptic inhibition is the current generator for sharp wave ripples." explains author Professor Peter Jonas.

When neurons oscillate in synchrony, their electrical activity adds together so that measurements of field potential can pick them up. SWRs are one of the most synchronous oscillations in the brain. Their name derives from their characteristic trace when measuring local field potential: the slow sharp waves have a triangular shape with ripples, or fast field oscillations, added on. SWRs have been suggested to play a key role in making memories permanent. In this study, the researchers wanted to identify whether ripples are caused by a temporal modulation of excitation or of inhibition at the synapse, the connection between neurons. For Professor Jozsef Csicsvari, a pooling of expertise was crucial in answering this question: "SWRs play an important role in the brain, but the mechanism generating them has not been identified so far - probably partly because of technical limitations in the experiments. We combined the Jonas group's experience in recording under voltage-clamp conditions with my group's expertise in analyzing electrical signals while animals are behaving. This collaborative effort made unprecedented measurements possible and we could achieve the first high resolution recordings of synaptic currents during SWR in behaving mice."

The neuroscientists found that the frequency of both excitatory and inhibitory events at the synapse increased during SWRs. But quantitatively, synaptic inhibition dominated over excitation during the generation of SWRs. Furthermore, the magnitude of inhibitory events positively correlated with SWR amplitude, indicating that the inhibitory events are the driver of the oscillation. Inhibitory events were phase locked to individual cycles of ripple oscillations. Finally, the researchers showed that so-called PV+ interneurons - neurons that provide inhibitory output onto other neurons - are mainly responsible for generating SWRs.

The authors propose a model involving two specific regions in the hippocampus, CA1 and CA3. In their model SWRs are generated by a combination of tonic excitation from the CA3 region and phasic inhibition within the CA1 region. Jian Gan, first author and postdoc in

the group of Peter Jonas, explains the implications for temporal coding of information in the CA1 region: "In our ripple model, inhibition ensures the precise timing of neuronal firing. This could be critically important for preplay or replay of neuronal activity sequences, and the consolidation of memory. Inhibition may be the crucial player to make memories permanent."

<http://bit.ly/2hCLcEq>

Languages still a major barrier to global science, new research finds

English is now considered the common language, or 'lingua franca', of global science. All major scientific journals seemingly publish in English, despite the fact that their pages contain research from across the globe.

However, a new study suggests that over a third of new scientific reports are published in languages other than English, which can result in these findings being overlooked - contributing to biases in our understanding.

As well as the international community missing important science, language hinders new findings getting through to practitioners in the field say researchers from the University of Cambridge.

They argue that whenever science is only published in one language, including solely in English, barriers to the transfer of knowledge are created.

The Cambridge researchers call on scientific journals to publish basic summaries of a study's key findings in multiple languages, and universities and funding bodies to encourage translations as part of their 'outreach' evaluation criteria.

"While we recognise the importance of a lingua franca, and the contribution of English to science, the scientific community should not assume that all important information is published in English," says Dr Tatsuya Amano from Cambridge's Department of Zoology.

"Language barriers continue to impede the global compilation and application of scientific knowledge."

The researchers point out an imbalance in knowledge transfer in countries where English is not the mother tongue: "much scientific knowledge that has originated there and elsewhere is available only in English and not in their local languages."

This is a particular problem in subjects where both local expertise and implementation is vital - such as environmental sciences.

As part of the study, published today in the journal PLOS Biology, those in charge of Spain's protected natural areas were surveyed. Over half the respondents identified language as an obstacle to using the latest science for habitat management.

The Cambridge team also conducted a litmus test of language use in science. They surveyed the web platform Google Scholar - one of the largest public repositories of scientific documents - in a total of 16 languages for studies relating to biodiversity conservation published during a single year, 2014.

Of the over 75,000 documents, including journal articles, books and theses, some 35.6% were not in English. Of these, the majority was in Spanish (12.6%) or Portuguese (10.3%). Simplified Chinese made up 6%, and 3% were in French.

The researchers also found thousands of newly published conservation science documents in other languages, including several hundred each in Italian, German, Japanese, Korean and Swedish.

Random sampling showed that, on average, only around half of non-English documents also included titles or abstracts in English. This means that around 13,000 documents on conservation science published in 2014 are unsearchable using English keywords.

This can result in sweeps of current scientific knowledge - known as 'systematic reviews' - being biased towards evidence published in English, say the researchers. This, in turn, may lead to over-representation of results considered positive or 'statistically significant', and these are more likely to appear in English language journals deemed 'high-impact'.

In addition, information on areas specific to countries where English is not the mother tongue can be overlooked when searching only in English.

For environmental science, this means important knowledge relating to local species, habitats and ecosystems - but also applies to diseases and medical sciences. For example, documents reporting the infection of pigs with avian flu in China initially went unnoticed by international communities, including the WHO and the UN, due to publication in Chinese-language journals.

"Scientific knowledge generated in the field by non-native English speakers is inevitably under-represented, particularly in the dominant English-language academic journals. This potentially renders local and indigenous knowledge unavailable in English," says lead author Amano.

"The real problem of language barriers in science is that few people have tried to solve it. Native English speakers tend to assume that all the important information is available in English. But this is not true, as we show in our study.

"On the other hand, non-native English speakers, like myself, tend to think carrying out research in English is the first priority, often ending up ignoring non-English science and its communication.

"I believe the scientific community needs to start seriously tackling this issue."

Amano and colleagues say that, when conducting systematic reviews or developing databases at a global scale, speakers of a wide range of languages should be included in the discussion: "at least Spanish, Portuguese, Chinese and French, which, in theory, cover the vast majority of non-English scientific documents."

The website conservationevidence.com, a repository for conservation science developed at Cambridge by some of the authors, has also established an international panel to extract the best non-English language papers, including Portuguese, Spanish and Chinese.

"Journals, funders, authors and institutions should be encouraged to supply translations of a summary of a scientific publication - regardless of the language it is originally published in," says Amano. The authors of the new study have provided a summary in Spanish, Portuguese, Chinese and French as well as Japanese.

"While outreach activities have recently been advocated in science, it is rare for such activities to involve communication across language barriers."

The researchers suggest efforts to translate should be evaluated in a similar way to other outreach activities such as public engagement, particularly if the science covers issues at a global scale or regions where English is not the mother tongue.

Adds Amano: "We should see this as an opportunity as well as a challenge. Overcoming language barriers can help us achieve less biased knowledge and enhance the application of science globally."

<http://wb.md/2irHpvN>

The Trends That Disrupted Medicine in 2016: Our Take Healthcare is ever-changing, it seems now more than ever. What trends are resonating with our colleagues and our patients?

Hansa Bhargava, MD

Whether it's emerging technologies, clinical changes, or the fast-paced transformation of the business of medicine, we hope to help you stay on top of it. Here are our picks for what most disrupted the health landscape as we knew it in 2016.

Trend 1: We Are Truly in the Tech Age

Rapidly changing technologies affect us now—and certainly with promises of even *more* change in the future. One of those is telehealth. In 2015, a total of 200 [state-level bills](#) were introduced revolving around telehealth. The government is clearly interested in this area, with its potential to address workforce shortages and reduce health disparities. The reimbursement issue is key—49 states and Washington, DC, are now providing some coverage under Medicaid,

and many private payers are mandated by state laws to reimburse "virtual visits" at the same rate as in-person visits.

But what happens when tests are needed? [Technology](#) seems to have the answer to that, too, with lab tests that can be conducted at home. Of interest, doctors are coming on board with virtual visits too: A recent [issue of] *Becker's Hospital Review* reported that 57% of doctors and 64% of patients were interested in telemedicine.^[1]

Telemedicine is not the only technology changing practice; a dizzying array of devices are now available to help our daily practice and are slowly gaining US Food and Drug Administration (FDA) approval as well. One such groundbreaking device is [Ahead 300](#), a technology that could help clinicians on the frontlines in emergency departments or urgent care centers assess the degree of traumatic brain injury in patients with a head injury.

Other examples? Handheld ultrasound that transmits images to smartphones, a virtual otoscope that allows parents to transmit an image to their pediatrician, and continuous glucose monitors. The list goes on. And we can expect more in 2017—devices that will help us to deliver better and more efficient care in all settings.

Trend 2: Old Medicine, or New Age Medicine?

Even though many of us may believe that alternative types of healthcare are not what patients need, the complementary and alternative (CAM) medicine field is quickly growing. Patients are voting for this new model with their healthcare dollars. In 2012, patients invested an overwhelming \$30 billion in complementary medicine and the supplement industry.^[2] This year, I had the opportunity to [interview](#) Dr Mark Hyman about functional medicine, an area that he has spearheaded. This blend of alternative with traditional medicine could be an interesting—and effective—fit for patients with chronic diseases.

But are other CAM modalities, from acupuncture to supplements, research-based? Some of them do indeed have [good evidence](#) of benefit. Unfortunately, some supplements don't have much research at

all; being aware of those products that do and do not have valid evidence can help us to deliver better-informed care.

Trend 3: The Evolving Doctor/Patient Relationship

The old-fashioned healthcare model, in which patients visited their family doctor, took his or her advice, and paid for the visit with medical insurance, is changing dramatically. Instead of fee-for-service, a growing number of practices are moving to direct primary care or [concierge](#) models, where patients pay providers directly in the form of a membership fee. Doctors who take part in these care models can afford to spend more time with each patient because they have smaller caseloads, and they are less bogged down by the burden of managing insurance claims. But what about those patients and practices where this is not an option? There will be many ethical questions to answer as this trend matures.

Medicine today is also shifting from a process-based to an outcome-based reward system, in which more of the responsibility and burden falls on patients. Will patients' growing desire to have input into their own treatment result in poorer outcomes—and could that reflect badly on physicians? In this new world of patient-centered care, one large healthcare system is now giving [refunds](#) for care that doesn't meet their standards. To improve patient adherence while maintaining patient satisfaction rates, doctors will need to gently steer patients to the treatments they need, while still letting them take part in the decision-making process—not necessarily an easy task. Patient portals, utilized by a large percentage of practices, do provide patients with access to the information they want; our job will be to help them understand that information so that they can take a more educated role in their own care.

The location in which patients receive their care is also evolving. As [retail](#) health clinics rapidly expand across the country, they add a new level of convenience for busy patients who impatiently want the gratification of an instant diagnosis. Since 2014, retail clinics have increased by 47% and are expected to handle 25 million patient visits

annually. Located in pharmacies, supermarkets, and other retail chains, these clinics often provide service at a lower cost than traditional primary care providers. Whether they reduce healthcare costs overall is still questionable. Some research indicates that retail clinics might cost [more](#), on average, than primary care providers.

These are only some of the ever-changing trends in healthcare today. Medicine is evolving, and as physicians, we need to keep an eye on the pulse.

For Medscape, I'm Hansa Bhargava.

Follow Dr Bhargava on Twitter: [@dr_hansa](#)

References

1. Wood M. Telemedicine to attract 7M patient users by 2018—12 statistics on the thriving market. *Becker's Health IT and CIO Review*. October 5, 2016.

<http://www.beckershospitalreview.com/healthcare-information-technology/telemedicine-to-attract-7m-patient-users-by-2018-12-statistics-on-the-thriving-market.html> Accessed

December 20, 2016.

2. Fox M. Americans spend \$30 billion a year on alternative medicine. *NBC News*. June 22, 2016. <http://www.nbcnews.com/health/health-news/americans-spend-30-billion-year-alternative-medicine-n596976> Accessed

December 20, 2016.

<http://wb.md/2hH05Kz>

Report: Demand for Hospitalists Continues to Outpace Supply

Demand for hospitalists continues to outpace supply, according to the Society of Hospital Medicine's (SHM's) recently released "State of Hospital Medicine" report.

Larry Beresford

On the basis of on a survey of 595 hospital medicine groups, along with compensation data from the Medical Group Management Association's Physician Compensation Survey, SHM reports that salaries are up an average of 9% from 2014. Median hospitalist physician compensation is now \$278,746, according to the biannual report, which was released in October.

Trends

One of the biggest findings is how this field continues to grow, says Andrew White, MD, MD, FACP, SFHM, associate professor of

medicine at the University of Washington, Seattle, and a member of the State of Hospital Medicine task force. "If you look back 10 years ago, not many thought we'd reach 50,000 hospitalists, but we just blew past that threshold," he says. Salary figures reflect the continued demand for hospitalists, which speaks to their continued value to hospitals and health systems, Dr White says.

Martin Buser, MPH, FACHE, consultant with Hospitalist Management Resources, LLC, says that among his clients, the demand curve is flattening somewhat owing to reduced turnover, although there still is a strong need for hospitalists.

But Roberta P. Himebaugh, MBA, SFHM, senior vice president with TeamHealth Acute Care Services, tells Medscape that recruiting hospitalists for TeamHealth's contract hospitals is, if anything, harder than it's ever been. "There just isn't a big enough pool of providers to draw upon," she says.

TeamHealth strives to recruit residents to choose a career in hospital medicine while they are still in training. According to the SHM report, 35% of new physicians joining hospital medicine groups are coming right out of residency, although this proportion is down from 48% in 2012.

Himebaugh also sees a growing role for family medicine physicians, who now represent almost one fifth of TeamHealth's hospitalist workforce. The company is using locum physicians to fill shifts more often than in the past. TeamHealth also has its own in-house locum company and special operations teams of hospitalists who can be mobilized to sites of greatest need.

Leslie Flores, MHA, SFHM, a consultant with Nelson Flores and a member of the SHM Task Force that developed the report, also sees a growing presence of family medicine in hospital medicine. The scope of practice for hospitalists continues to expand, with practices diversifying in various ways, she says.

Two-thirds of hospitalist groups are now using physician assistants and nurse practitioners, and the majority of practices employ full-time

nocturnists to fill after-hours shifts. Others have their members taking on a variety of other specialty roles, such as palliative care or cardiac code blue teams and managing patients in intensive care units or observation units.

At the same time, the postacute setting is growing in importance for hospitalist practice, whether with postacute specialists; hospitalists who divide their time between settings; or new services, such as postdischarge clinics where patients can come back to see a doctor on the hospital campus for one or more follow-up visits.

"I'm not sure we accurately captured what's happening in the postacute space in our report, but if current trends continue, more hospitalists are going to be involved in postacute care," Flores says.

Staffing models seem to be evolving away from the once common 7 days on/7 days off approach. Five-day workweeks supplemented by rotating or moonlighting weekend coverage now represent 31% of group practice, with 38% of groups still doing 7 on/7 off—a modest drop-off from prior surveys, according to the SHM report.

But this may just be a different group of survey respondents this year, Flores suggests. The trend may reflect evolving ideas about how best to preserve continuity of care, but also what an aging workforce is able to handle physically over the long run.

Pressures Accompanying Growth

Another way of viewing these pressures is what Himebaugh calls "mission creep... hospitals wanting, in fact needing, their hospitalists to do more," including quality improvement and committee work. In some hospitals, comanagement with such medical specialists as surgeons is becoming a thing of the past—replaced by the hospitalist as the attending and the surgeon as consultant.

SHM's report says hospitalists are now serving as admitting and attending physicians for surgical patients 64% of the time.

Despite these increased demands on hospitalists, the report identifies a leveling off for total average subsidy paid by hospitals to full-time hospitalists. In the 2012 survey, average subsidy was \$139,000; in

2014, \$156,000; and in 2016, \$157,500. If income has gone up and subsidy has not, that suggests hospitalists are generating on average more billing income, which also means providing more relative value units—and working harder, if not longer.

Dr White highlights the growing number of hospitalist groups that are using some sort of pay for performance or incentives, for example, based on patient satisfaction scores.

"Groups are recognizing the growing alignment between hospitals and their hospitalist groups," he says. But the downside is that it can be tough to construct fair metrics that reflect the doctor's true performance, because this often depends on the group's performance and other factors.

Ongoing pressure for performance and generation of billing income by the hospitalist may also be seen in lower morale and increased risk for burnout that Flores' clients report to her. "Morale is not really covered by SHM's data, but we have seen a downturn in morale as people struggle with balancing these demands."

Job satisfaction is based on caseload and competitive salary, among other factors. "Hospitalists have gotten more sophisticated in their expectations of their employers. They expect infrastructure and administrative back-up. They expect good leadership and fair compensation. It's not the Wild West anymore," Buser says.

Long-term, hospitals will not want to see their financial subsidy of hospitalist programs increase faster than the consumer price index. As a result, hospitalists will need to maintain quality and increase productivity by delegating nonphysician tasks to others.

"Can nurses do medication reconciliation? Can a case manager be assigned to the hospitalist? Can scribes help with completing computer notes? It looks to us like the field is ripe for more industrial engineering expertise. Our best programs are innovating like crazy in order to stay ahead of this volatile environment," Buser says.

<http://bit.ly/2irIWLb>

One Breath Into This Breathalyzer Can Diagnose 17 Diseases

From a single breath, researchers can test for 17 different diseases and health conditions that fall into three broad categories: cancerous, inflammatory and neurological diseases.

By Laura Geggel, Senior Writer | December 30, 2016 01:27am ET

A single breath into a newfangled breathalyzer is all doctors need to diagnose 17 different diseases, including lung cancer, irritable bowel syndrome and multiple sclerosis, a new study found.

Researchers invited about 1,400 people from five different countries to breathe into the device, which is still in its testing phases. The breathalyzer could identify each person's disease with 86 percent accuracy, the researchers said.

The technology works because "each disease has its own unique breathprint," the researchers wrote in the study.

The breathalyzer analyzes microscopic compounds — called volatile organic compounds (VOCs) — to detect each condition. Testing for VOCs isn't a new approach; in 400 B.C., physicians learned that smelling a patient's bodily emissions could help with diagnoses. For instance, doctors used to smell the stools and urine of infant noblemen daily, the researchers said.

But while excrement and other bodily substances, such as blood, contain VOCs, examining exhaled breath is the cheapest, easiest and least invasive way to test for the compounds, the researchers said.

Breath evaluation

To investigate using breath for diagnosis, the researchers developed a breathalyzer that had two nanolayers, one with carbon and the other without. The carbon-free layer contained modified gold nanoparticles and a network of nanotubes, both of which provide electrical conductivity, the researchers said.

Meanwhile, the carbon layer worked as a sensing layer to hold the exhaled VOCs, the scientists said. When a person breathed into the

breathalyzer, that individual's VOCs interacted with the organic sensing layer, which in turn changed the electrical resistance of the inorganic sensors. By measuring this resistance, the researchers could determine which VOCs were present, the scientists said.

There are hundreds of known VOCs in exhaled breath, but the researchers needed only 13 to distinguish among the 17 different diseases. For instance, the VOC nonanal is linked to several disorders, including ovarian cancer, inflammatory bowel disease and breast cancer, whereas the VOC isoprene is associated with chronic liver disease, kidney disease and diabetes, the researchers said.

Because each VOC is tied to several conditions, "These results support our finding that no single VOC can discriminate between different diseases," the researchers wrote in the study.

Exhale here

Once the breathalyzer was built, researchers administered it to 813 people who were diagnosed with one of the 17 diseases, as well as 591 controls. These were people from the same locations who did not have those diseases. All of the participants were in China, Israel, France, Latvia or the United States, the researchers said.

Next, the scientists used artificial intelligence to tally up the VOCs in each breath, search a database for diseases showing the same VOC concentration patterns and deliver a diagnosis.

The results were blinded, meaning that, during the analysis, the researchers did not know which condition the participants had. Moreover, the research team verified its results with another method that measured the VOCs in each sample.

The new breathalyzer isn't ready for the market yet — further testing and better accuracy are needed first — but the study is an encouraging development, the researchers said.

If it's made available to doctors, the device could be an "affordable, easy-to-use, inexpensive and miniaturized [tool] for personalized screening, diagnosis and follow-up," the researchers wrote in the study, which was published online Dec. 21 in the journal ACS Nano.

<http://bit.ly/2im6ytC>

NASA Might Build an Ice House on Mars

At first glance, a new concept for a NASA habitat on Mars looks like a cross between Mark Watney's inflatable potato farm from "The Martian" and the home of Luke's Uncle Owen on Tatooine from "Star Wars."

by Nancy Atkinson

The key to the new design relies on something that may or may not be abundant on Mars: underground water or ice.

The "Mars Ice Home" is a large inflatable dome that is surrounded by a shell of water ice. NASA said the design is just one of many potential concepts for creating a sustainable home for future Martian explorers. The idea came from a team at NASA's Langley Research Center that started with the concept of using resources on Mars to help build a habitat that could effectively protect humans from the elements on the Red Planet's surface, including high-energy radiation.

Langley senior systems engineer Kevin Vipavetz who facilitated the design session said the team assessed "many crazy, out of the box ideas and finally converged on the current Ice Home design, which provides a sound engineering solution," he said.

The advantages of the Mars Ice Home is that the shell is lightweight and can be transported and deployed with simple robotics, then filled with water before the crew arrives. The ice will protect astronauts from radiation and will provide a safe place to call home, NASA says. But the structure also serves as a storage tank for water, to be used either by the explorers or it could potentially be converted to rocket fuel for the proposed Mars Ascent Vehicle. Then the structure could be refilled for the next crew.

Other concepts had astronauts living in caves, or underground, or in dark, heavily shielded habitats. The team said the Ice Home concept balances the need to provide protection from radiation, without the drawbacks of an underground habitat. The design maximizes the thickness of ice above the crew quarters to reduce radiation exposure

while also still allowing light to pass through ice and surrounding materials.

"All of the materials we've selected are translucent, so some outside daylight can pass through and make it feel like you're in a home and not a cave," said Kevin Kempton, also part of the Langley team.

One key constraint is the amount of water that can be reasonably extracted from Mars. Experts who develop systems for extracting resources on Mars indicated that it would be possible to fill the habitat at a rate of one cubic meter, or 35.3 cubic feet, per day. This rate would allow the Ice Home design to be completely filled in 400 days, so the habitat would need to be constructed robotically well before the crew arrives. The design could be scaled up if water could be extracted at higher rates.

The team wanted to also include large areas for workspace so the crew didn't have to wear a pressure suit to do maintenance tasks such as working on robotic equipment. To manage temperatures inside the Ice Home, a layer of carbon dioxide gas — also available on Mars — would be used as in insulation between the living space and the thick shielding layer of ice.

"The materials that make up the Ice Home will have to withstand many years of use in the harsh Martian environment, including ultraviolet radiation, charged-particle radiation, possibly some atomic oxygen, perchlorates, as well as dust storms — although not as fierce as in the movie 'The Martian'," said Langley researcher Sheila Ann Thibeault.

<http://bit.ly/2iyulab>

The caves that prove Neanderthals were cannibals

Deep in the caves of Goyet in Belgium researchers have found the grisly evidence that the Neanderthals did not just feast on horses or reindeer, but also on each other.

Human bones from a newborn, a child and four adults or teenagers who lived around 40,000 years ago show clear signs of cutting and of fractures to extract the marrow within, they say.

"It is irrefutable, cannibalism was practised here," says Belgian archaeologist Christian Casseyas as he looks inside a cave halfway up a valley in this site in the Ardennes forest.

The bones in Goyet date from when Neanderthals were nearing the end of their time on earth before being replaced by Homo sapiens, with whom they also interbred.

Once regarded as primitive cavemen driven to extinction by smarter modern humans, studies have found that Neanderthals were actually sophisticated beings who took care of the bodies of the deceased and held burial rituals.

But there is a growing body of proof that they also ate their dead.

Neanderthal bone fragments

Cases of Neanderthal cannibalism have been found until now only in Neanderthal populations in southern Europe in Spain, at El Sidron and Zafarraya, and in France, at Moula-Guercy and Les Pradelles.

The caves at Goyet have been occupied since the Paleolithic era. The 250-metre- (820-feet-) long galleries were dug into the limestone by the Samson, a small stream that still flows a few metres below.

They began to reveal their secrets in the middle of the 19th century thanks to one of the fathers of palaeontology, Edouard Dupont (1841-1911).

A geologist and director of the Royal Museum of Natural History of Belgium, he searched several caves, including that of Goyet in 1867, and collected an enormous quantity of bones and tools.

Just a few years after Charles Darwin first expounded his theory of evolution, Dupont published the results of his own research in his book "Man During the Stone Age".

But his discoveries remained in the archives of the museum (now called the Brussels Institute of Natural Sciences) for more than a century.

That was until 2004, when the institute's head of anthropology Patrick Semal discovered, hidden in amongst the drawers of what Dupont

thought were human bones, a jaw tip that clearly belonged to a Neanderthal.

Scientists have since been painstakingly sorting through fragments that Dupont thought were animal bones to see if there are other traces of ancient man.

'Extract the marrow'

Now an international team led by Helene Rougier, an anthropologist at California State University Northridge in the United States, has proved from the bones found at Goyet that the Neanderthals there were cannibals.

The bones show traces of cutting, "to disarticulate and remove the flesh," said Christian Casseyas, who also leads tours for the public at the caves.

The Neanderthals "broke these bones in the same way that they broke those of the reindeer and horses found at the entrance of the cave, certainly to extract the marrow", he adds.

Rougier, whose work on the Belgian cave was published last July by Scientific Reports, a journal of the Nature group, told AFP that "indeed, we can conclude that some Neanderthals died and were eaten here", which is a first in Northern Europe.

"Some of these bones have also been used to make tools to touch up the edges of flints to re-sharpen them," says Rougier.

But the reasons for the cannibalism remain a mystery, as to the extent to which the Neanderthals ate their dead.

"Was it systematic? Was it only at certain particular moments?" she asks. "I don't know how to interpret the reason behind this cannibalism. It can be purely food, but it can also be symbolic ... The reason remains open," she says.