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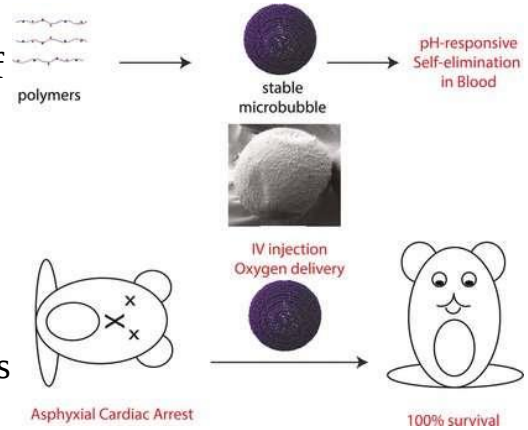
Stable, self-disrupting microbubbles as intravenous oxygen carriers

Air-filled microbubbles could be used as an intravenous oxygen carrier to increase the survival rate of cardiac arrest patients

January 23, 2018, Wiley



Severe oxygen deficiency eventually leads to cardiac arrest. If the blood's oxygen content cannot be rapidly re-established, the patient may die within minutes. In the journal *Angewandte Chemie*, American scientists have introduced air-filled microbubbles that could be used as an intravenous oxygen carrier to increase the survival rate of such patients. Because they rapidly dissolve in blood, the risk of embolism is minimal.

Credit: Wiley

Whether it results from a swimming accident, a piece of food in the trachea, an asthma attack, pertussis, or heart failure: In the United States alone, about 100,000 in-hospital patients die every year from cardiac arrest resulting from asphyxia.

The microbubbles developed by researchers working with Brian D. Polizzotti and John N. Kheir at Boston Children's Hospital and Harvard University (Boston, Massachusetts, USA) may be able to save many, because they give doctors some time to remedy the cause of the oxygen deprivation or to perform a tracheotomy to re-establish air flow.

The idea of using microbubbles as a way to carry substances, such as drugs or contrast agents, is not new.

However, their intravenous injection always involved a high risk of life-threatening pulmonary embolism because they remained in the blood for too long. Other problems included low stability, components that couldn't be broken down, and poor control over morphology and size.

The new microbubbles do not have these disadvantages. Their success is due to a special production method involving the nanoprecipitation of biocompatible polymers at the interface between air and liquid.

The starting material is dextran, a branched polymer made of glucose units. Functional groups such as acids are attached to give the polymer surface-active properties.

When the polymer is dissolved in an organic solvent and water, in which it is not soluble, is added, it forms micelles. Homogenization with air forms a foam containing air bubbles surrounded by micelles. When more water is added, more and more micelles come together. These form solid nanoaggregates that form a shell around the air bubble.

When these microbubbles are added to blood, its pH value makes the acid groups form charged COO- groups. This allows water to penetrate the shell and release the oxygen. The electrostatic repulsion between the charges causes the shells to fall apart and the components dissolve completely.

The researchers blocked the airways of rodents to induce asphyxial cardiac arrest. After 10 minutes, they removed the blockage to simulate a doctor re-establishing the airway.

While all of the animals in the control group died, the rapid and repeated injection of the microbubbles during cardiac arrest saved all animals. There were no signs of embolism.

Comparison with other oxygen carriers also demonstrated that the self-disrupting microbubbles were the only method by which the rodents were able to receive large amounts of oxygen, up to 12 mL without complications.

More information: *Yifeng Peng et al, Interfacial Nanoprecipitation toward Stable and Responsive Microbubbles and Their Use as a Resuscitative Fluid, Angewandte Chemie International Edition (2017).* *DOI: 10.1002/anie.201711839*

http://bit.ly/2BuTacv

Brain chemical differences suggest possible reason for humans having social edge over other primates

Key differences in brain chemicals between humans and other primates

January 23, 2018 by Bob Yirka, Phys.org report

A team of researchers affiliated with several institutions in the U.S. has found some key differences in brain chemicals between humans and other primates. In their paper published in *Proceedings of the National Academy of Sciences*, the group suggests these differences could explain the social edge humans have over other primates.

Credit: CC0 Public Domain

Scientists have studied the anatomy of humans and other primates for many years as part of an effort to understand why we humans came to be so dominant. Many assume that it is not just brain size, because prior research has shown that our early ancestors began engaging in advanced activities before our brains grew larger. This, the researchers note, suggests that our ancestors developed different brain chemistry. Brain chemicals play a role in such behaviors as socializing, which logically could lead to better language and other skills. To test this theory, the researchers studied brain chemistry in six species: humans, macaques, baboons, capuchins, chimpanzees and gorillas. Samples for the non-humans were gathered from animals that had died naturally in zoos.

The team studied nerve cells from the striatum, which serves as a relay for chemicals in the brain, looking for neurotransmitters, most specifically serotonin, dopamine and neuropeptide Y—they have all been tied to social and cooperative behavior. Doing so revealed brain levels of each when the animal was alive.

The researchers found that humans and great apes had higher levels of neuropeptide Y and serotonin in their basal ganglia than the other primates. They also found that humans had more dopamine in the striatum than the apes but less acetylcholine than chimps or gorillas. It is these differences, the group claims, that sets us apart from other primates. They suggest such differences would have made our ancestors more social, leading to a host of evolutionary changes.

Interestingly, a separate study was done recently by a team at Kent State—they were looking to explain the demographic success of humans and as part of that research found that female survivorship was a key component. They suggested differences in female brain chemistry led to females mating more often with males who were more outgoing but who were not too aggressive. Such males, they further suggest, would have been better providers because by that point in history, hunting was done in groups.

More information: *1. Mary Ann Raghanti et al. A neurochemical hypothesis for the origin of hominids, Proceedings of the National Academy of Sciences (2018). DOI: 10.1073/pnas.1719666115*

Abstract

It has always been difficult to account for the evolution of certain human characters such as language, empathy, and altruism via individual reproductive success. However, the striatum, a subcortical region originally thought to be exclusively motor, is now known to contribute to social behaviors and "personality styles" that may link such complexities with natural selection. We here report that the human striatum exhibits a unique neurochemical profile that differs dramatically from those of other primates. The human signature of elevated striatal dopamine, serotonin, and neuropeptide Y, coupled with lowered acetylcholine, systematically favors externally driven behavior and greatly amplifies sensitivity to social cues that promote social conformity, empathy, and altruism. We propose that selection induced an initial form of this profile in early hominids, which increased their affiliative behavior, and that this shift either preceded or accompanied the adoption of bipedality and elimination of the sectorial canine. We further hypothesize that these changes were critical for increased individual fitness and promoted the adoption of social monogamy, which progressively increased cooperation as well as a dependence on tradition-based cultural transmission. These eventually facilitated the acquisition of language by elevating the reproductive advantage afforded those most sensitive to social cues.

2. Richard S. Meindl et al. Early hominids may have been weed species, *Proceedings of the National Academy of Sciences* (2018). DOI: 10.1073/pnas.1719669115

Abstract

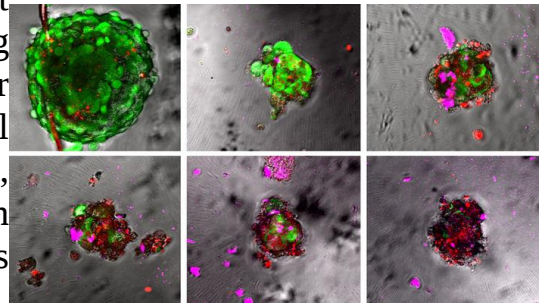
Panid, gorillid, and hominid social structures appear to have diverged as dramatically as did their locomotor patterns as they emerged from a late Miocene last common ancestor (LCA). Despite their elimination of the sectorial canine complex and adoption of bipedality with its attendant removal of their ready access to the arboreal canopy, Australopithecus was able to easily invade novel habitats after florescence from its likely ancestral genus, Ardipithecus sp. Other hominoids, unable to sustain sufficient population growth, began an inexorable decline, culminating in their restriction to modern refugia. Success similar to that of earliest hominids also characterizes several species of macaques, often termed "weed species." We here review their most salient demographic features and find that a key element is irregularly elevated female survival. It is reasonable to conclude that a similar feature characterized early hominids, most likely made possible by the adoption of social monogamy. Reduced female mortality is a more probable key to early hominid success than a reduction in birth space, which would have been physiologically more difficult.

http://go.nature.com/2ncIFXa

A sweet pill turns deadly for tumours

Glucose-based nano-pill delivers potent drug to cancer cells, then fades away.

Nanoparticles have been designed to sneak into tumour cells and blast them with anti-cancer drugs before degrading into harmless byproducts. Karen Wooley and Justin Smolen at Texas A&M University in College Station and their colleagues sought to develop a drug-carrying nanoparticle that could kill cancer cells but minimize collateral damage to healthy cells. To do this, the team based their nanoparticle on the sugar glucose, which breaks down into simple products.



Nano-pills loaded with a potent drug infiltrate simulated tumours (living cells in green) and kill them (dead cells in red). A control tumour (upper left) showed no change, but tumours treated with increasing concentrations of the drug (lowest, upper middle panel; highest, lower right) succumbed. **L. Su et al./J. Am. Chem. Soc.**

The team loaded the nanocarrier with a version of the potent cancer drug paclitaxel, which is activated by molecules that are found in greater quantities in cancerous cells than in normal cells. The nanoparticles are just the right size to penetrate cells in lung tissues. When mice with metastatic tumours in their lungs inhaled the nanoparticles, growth of the metastases slowed, raising hopes for future lung-cancer treatments. *J. Am. Chem. Soc.* (2018)

http://bit.ly/2nq9YPw

Expert behind new MH370 search hopeful of find within a month

Oceanographer David Griffin, who helped pinpoint the new search zone for missing Malaysia Airlines MH370, is optimistic the missing jet can be found in the next month

January 24, 2018 by Glenda Kwek

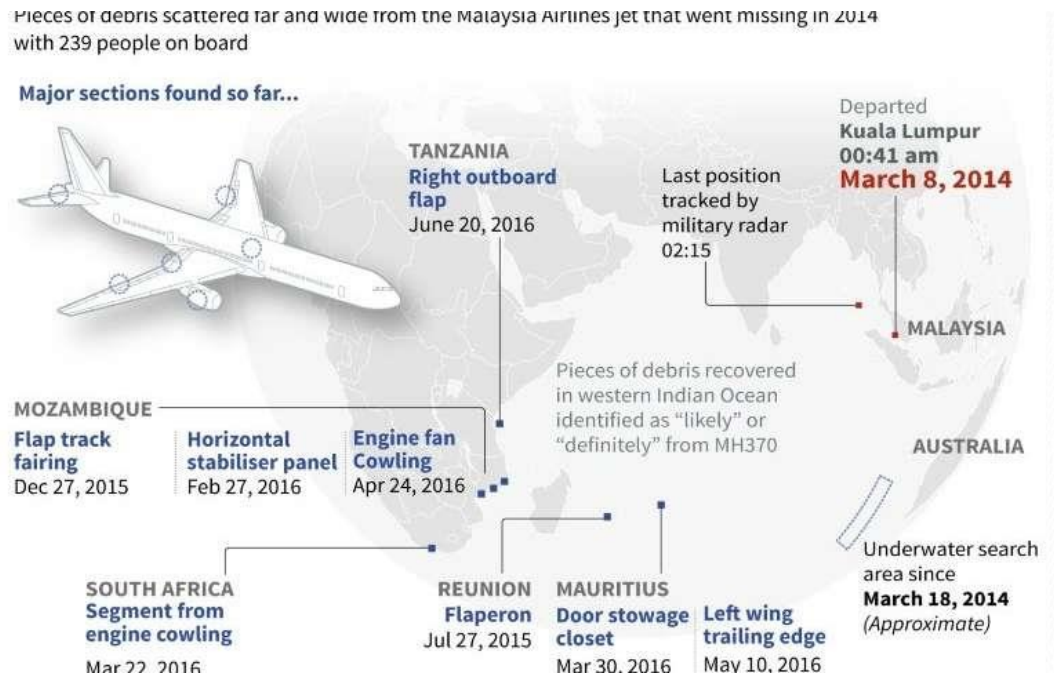
After years of futile efforts, a fresh hunt for MH370 has set off for the remote Indian Ocean—and the top Australian scientist who helped pinpoint the new search zone is hopeful the missing jet can be found within weeks.

Armed with oceanographic analyses and a high-tech search vessel, the latest search for the Boeing 777, which vanished in March 2014 carrying 239 people, kicked off on Monday run by private exploration firm Ocean Infinity, in the hope of solving one of aviation's most enduring mysteries.

An earlier Australia-led search—the largest-ever in aviation history—scoured 120,000 square kilometres (46,000 square miles) far off the island continent's west coast for 28 months but found no trace of the aircraft, and the hunt was suspended last January.

"We're hopeful that they (Ocean Infinity) could find the aircraft within the first month of the search," oceanographer David Griffin of CSIRO, Australia's leading national agency for scientific research, told AFP.

"Malaysia has given them three months to complete the search. So we're into the first week now. We could hear something from them in the next couple of weeks," said Griffin, who met with the Ocean Infinity team in London last month.



Graphic on the debris so far discovered from Malaysia Airlines MH370 that went missing in 2014 with 239 people on board.

No find, no fee

Ocean Infinity has a huge incentive to find the plane. As part of the deal, the private team will only be paid if they find the jet or its black boxes, with up to US$70 million on offer if they are successful.

The search relies on a multitude of evidence and analysis that has allowed scientists over the past four years to zero in on likely crash sites.

The new findings also allowed Griffin and his team of experts to identify a specific starting point for the search ship Seabed Constructor some 2,000 kilometres west-southwest of Perth in Western Australia.

A new hunt for the aircraft using high-tech underwater drones has started, officials said Tuesday.

The remote site is just north of the former search zone and near the "seventh arc", a long stretch of water where the plane was calculated to have emitted a final satellite "handshake".

A 25,000-square-kilometre zone north of the previous probe area was first identified by experts in late 2016, and the team worked to reduce it further.

They used drift modelling to analyse where three confirmed MH370 fragments found on western Indian Ocean shores between 2015-16 may have originated.

But the light-bulb moment came when they realised the absence of debris washing up in Western Australia was also a key clue, Griffin said.

Only a Malaysia Airlines towelette was found on Australia's west coast in July 2014, but authorities said then it could not be conclusively linked to MH370.

"It's fairly specific advice about where the plane crashed (as) there aren't many places along that arc which are consistent with the absence of debris on the Australian coast," Griffin told AFP.

Ruling out areas north and south along or near the seventh arc that were already searched, they analysed the middle band of latitudes and found only 35 degrees south had a current flow that was to the west towards Africa.

One of the eight autonomous underwater vehicles being used in the latest hunt for missing Malaysia Airlines flight MH370

The refined search zone also fitted in with four French satellite images taken two weeks after the crash that showed at least 70 identifiable objects floating close by.

Although analyses of the satellite imagery did not conclusively identify the objects as coming from MH370, Griffin said it showed an unusually high number of large pieces of floating debris.

"We saw all these large white objects, some of them 60 square metres... right at the location where you would expect them to be if the aircraft had crashed at 35.6S 92.8E," he said.

High-tech hunt

The satellite analysis fuelled calls from grieving relatives for a new search, with the Malaysian government eventually commissioning Ocean Infinity.

Hopes that the new mission might finally find the wreckage have also been raised by the high-tech tools being used.

Seabed Constructor carries eight autonomous drones equipped with sonar and cameras that can operate in depths of up to 6,000 metres (20,000 feet).

They are "free flying" vehicles, allowing them to move deeper and collect higher quality data than the tethered drones used in the earlier search. This means the priority search areas are likely to be scoured and the data collected much faster.

But Griffin warned that even if the new search area contains the final resting place of MH370, the most visible parts of the wreckage such as the engines could be in areas that are difficult to see or embedded deep in the ocean floor.

Australia's former transport minister Darren Chester, who was in charge during the previous hunt, likewise cautioned that the difficult underwater conditions in treacherous waters could throw up challenges.

"I'm hopeful for a successful search in the weeks and months ahead but lets not pretend it's going to be easy," he told Sky News Australia.

http://theatln.tc/2ng2X11

When Your Eyes Move, So Do Your Eardrums

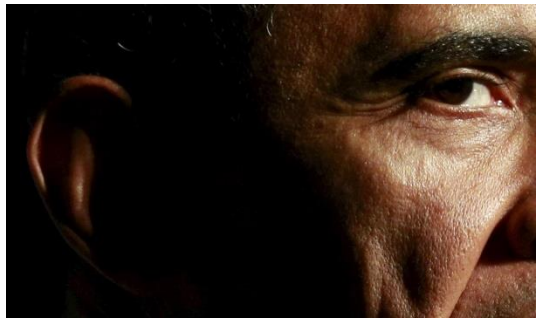
... and no one knows why.

- **Ed Yong**

Without moving your head, look to your left. Now look to your right. Keep flicking your eyes back and forth, left and right.

Even if you managed to keep the rest of your body completely still, your eyeballs were not the only parts of your head that just moved.

Your ears did, too. Specifically, your eardrums—the thin membranes inside each of your ears—wobbled. As your eyes flitted right, both eardrums bulged to the left, one inward and one outward. They then bounced back and forth a few times, before coming to a halt. When you looked left, they bulged to the right, and oscillated again.



The right ear and eye of Barack Obama **Kevin Lamarque / Reuters**

These wobbles happen every time you move your eyes, whether or not there's external noise. The bigger the movement, the bigger the wobble.

But no one knows *why* they happen. And until Jennifer Groh, from Duke University, discovered them, no one even knew that they happened at all.

Groh has long been interested in how the brain connects information from our eyes and ears. In a loud party, for example, we automatically read the lips of our conversational partners to interpret any unintelligible sounds. For that to work, the brain has to align visual and auditory information in space, so it knows that *those* sounds are coming from *those* lips. And that's easier said than done, because our ears are obviously fixed on our heads but our eyes are constantly moving. They flit all over the space in front of us, roughly three times a second. Every such movement changes the spatial relationships between what we see

and what we hear. So how does the brain unite those streams of information? And where?

"Historically, people have thought that information enters the ear and the eye separately, and that eventually it's combined," says Nina Kraus from Northwestern University. But Groh's experiment, she says, suggests that this act of combination happens much earlier. The eardrum, after all, is responsible for converting vibrations in the air around us into vibrations in the liquid within our heads. It's where hearing effectively begins. And if it wobbles as our eyes shift, then this suggests that vision might affect hearing "at the earliest possible point," says Kraus.

Kurtis Gruters and David Murphy, two members of Groh's team, detected the wobbling eardrums in the simplest possible way. They stuck microphones in the ears of several volunteers, and asked them to look at different targets. As their eyes moved, so did their eardrums. Like actual tiny drums, these vibrating membranes created small sounds, which the microphones could detect. That's how the team showed that the eardrum oscillations match the direction and strength of the eyes' movements.

They also found that the eardrums start to wobble about 10 milliseconds *before* the eyes. This suggest that the ears aren't *reacting* to what's happening in the eyes. Instead, Groh says, "the brain is saying: I am about to move the eyes; ears, get ready."

But *why*? Do these wobbles affect the ear's ability to process incoming sound? "We don't yet know," says Groh. But she suspects that the wobbles are helpful to the brain in some way, perhaps in helping to match up the information from the eyes and ears. "I find it compelling that the movements are so time-locked and specific to whatever eye movements are occurring. It's not just a little tic. It's an informative signal."

Barbara Shinn-Cunningham, from Boston University, also studies the neuroscience of hearing, and she is more circumspect. "It is a very interesting and previously unknown phenomenon, which may turn out to be incredibly important," she says, "But so far, there is no evidence it is. We just don't yet know why it happens or what it means."

Groh adds that it's not even clear if the wobbles themselves are important, or if they're the result of some other change in the inner structures of the ears. Still, it's clear that *something* is happening to the ears, and it's intimately connected to what the eyes are doing. "This suggests that there are no safe spaces in the brain," Groh says. "One sensory system is influenced by another right at the point where the physical energy is first detected."

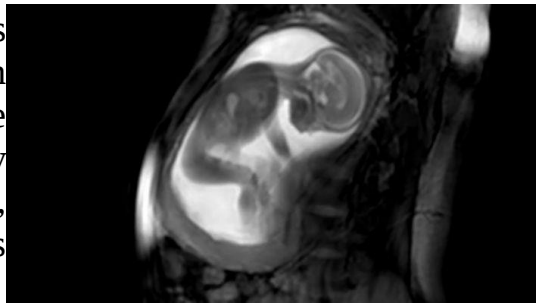
http://go.nature.com/2nq4l3J

Fetal kicks do more than make Mum jump

Movements in utero help to build a strong skeleton.

For the first time, researchers have calculated the forces generated by the movements of human fetuses, and the effects that these forces have on the growing skeleton.

When a fetus kicks and wriggles, its movements place stress and strain on its skeleton. These forces are thought to stimulate healthy development of muscles and bones, but directly measuring their effects has been difficult.



A fetus in the womb. **Credit: Division of Imaging Sciences & Biomedical Engineering, King's College London/CC BY**

Niamh Nowlan at Imperial College London and her colleagues analysed the kicks of 20- to 35-week old fetuses whose movements had been recorded using an advanced type of magnetic resonance imaging. After creating mathematical models of the uterine wall and the fetuses' limbs to infer muscle forces and skeletal impacts, the researchers found that kick forces rose between 20 and 30 weeks' gestation. Later in gestation, kick forces decreased. But stresses and strains on the fetal skeleton were high throughout the second half of pregnancy, the authors say, probably owing to crowding in the womb.

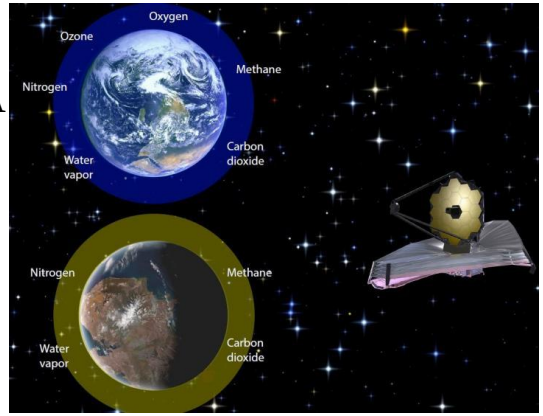
J. R. Soc. Interface (2018)

http://bit.ly/2nqV4ZX

A new 'atmospheric disequilibrium' could help detect life on other planets

New recipe for providing evidence that a distant planet harbors life

As NASA's James Webb Space Telescope and other new giant telescopes come online they will need novel strategies to look for evidence of life on other planets. A University of Washington study has found a simple approach to look for life that might be more promising than just looking for oxygen. The paper, published Jan. 24 in Science Advances, offers a new recipe for providing evidence that a distant planet harbors life.



Future telescopes like the James Webb Space Telescope (right) will observe the atmospheres of distant planets to seek evidence of life. Earth (top left) has several gases in its atmosphere that reveal the presence of life, primarily oxygen and ozone. The new study finds that for the early Earth (bottom left), the combination of abundant methane and carbon dioxide would provide an alternative sign of life. **NASA/Wikimedia Commons/Joshua Krissansen-Totton**

"This idea of looking for atmospheric oxygen as a biosignature has been around for a long time. And it's a good strategy -- it's very hard to make much oxygen without life," said corresponding author Joshua Krissansen-Totton, a UW doctoral student in Earth and space sciences. "But we don't want to put all our eggs in one basket. Even if life is common in the cosmos, we have no idea if it will be life that makes oxygen. The biochemistry of oxygen production is very complex and could be quite rare."

The new study looks at the history of life on Earth, the one inhabited planet we know of, to find times where the planet's atmosphere contained a mixture of gases that are out of equilibrium and could exist only in the presence of living organisms -- anything from pond scum to giant redwoods. In fact, life's ability to make large amounts of oxygen has only occurred in the past one-eighth of Earth's history.

By taking a longer view, the researchers identified a new combination of gases that would provide evidence of life: methane plus carbon dioxide, minus carbon monoxide.

"We need to look for fairly abundant methane and carbon dioxide on a world that has liquid water at its surface, and find an absence of carbon monoxide," said co-author David Catling, a UW professor of Earth and space sciences. "Our study shows that this combination would be a compelling sign of life. What's exciting is that our suggestion is doable, and may lead to the historic discovery of an extraterrestrial biosphere in the not-too-distant future."

The paper looks at all the ways that a planet could produce methane -- from asteroid impacts, outgassing from the planet's interior, reactions of rocks and water -- and finds that it would be hard to produce a lot of methane on a rocky, Earth-like planet without any living organisms.

If methane and carbon dioxide are detected together, especially without carbon monoxide, that's a chemical imbalance that signals life. The carbon atoms in the two molecules represent opposite levels of oxidation. Carbon dioxide holds as many oxygen molecules as it can, while the carbon in methane lacks oxygen and instead has oxygen's chemical adversary, hydrogen.

"So you've got these extreme levels of oxidation. And it's hard to do that through non-biological processes without also producing carbon monoxide, which is intermediate," Krissansen-Totton said. "For example, planets with volcanoes that belch out carbon dioxide and methane will also tend to belch out carbon monoxide."

What's more, carbon monoxide tends not to build up in the atmosphere of a planet that harbors life.

"Carbon monoxide is a gas that would be readily eaten by microbes," Krissansen-Totton said. "So if carbon monoxide were abundant, that would be a clue that perhaps you're looking at a planet that doesn't have biology."

The authors agree that oxygen is a good way to look for signs of life, but think that this new combination is at least as likely to pop up through the new telescopes' sights.

"Life that makes methane uses a simple metabolism, is ubiquitous, and has been around through much of Earth's history," Krissansen-Totton said. "It's an easy thing to do so it's potentially more common than oxygen-producing life. This is definitely something we should be looking for as new telescopes come online."

The other co-author is Stephanie Olson at the University of California, Riverside. The research was funded by NASA.

http://bit.ly/2ngRNtT

Working in female-dominated workplaces means worse access to flexible working arrangements

Research provides evidence that low wages are accompanied by worse working conditions for many

Workers in female-dominated workplaces have worse access to flexible working arrangements than those in gender-neutral and even male-dominated workplaces, new research from the University of Kent has found.

It is commonly assumed that the low wages often found in female-dominated workplaces can be justified through better provision of family-friendly arrangements, but the research provides evidence that low wages are accompanied by worse working conditions for many.

The study looked at individuals in 27 countries across the EU. It found that the best workplaces for providing flexibility were gender-neutral - where men and women were equally represented.

Researcher Dr Heejung Chung, of the University's School of Social Policy, Sociology and Social Research, found that what she called a 'women's work penalty' existed in every country covered by her study.

She said her research provides the evidence to 'reject the assumption' that women have better access to flexible working arrangements and that female-dominated workplaces are better at providing them.

Further, she argues that the research puts into question the theory of 'compensating differentials' that claims that low wages found in female-dominated workplaces can be justified through the better provision of family-friendly arrangements, such as flexible working arrangements.

The implication for policy makers is that the group of the population that may be in most need of flexible work arrangements may be unable to gain access to them.

'Women's work penalty' in access to flexible working arrangements across Europe (Dr Heejung Chung) is published in the journal European Journal of Industrial Relations. See: http://journals.sagepub.com/eprint/XuK3U8Uk95pG2Bh3brMH/full

http://bit.ly/2ByAB7n

Tidal cycles could help predict volcanic eruptions, study suggests

A new study suggests that tidal cycles could be useful in predicting a particular type of volcanic eruption.

PROVIDENCE, R.I. [Brown University] -- Just before a surprise eruption of New Zealand's Ruapehu volcano in 2007, seismic tremor near its crater became tightly correlated with twice-monthly changes in the strength of tidal forces, a new study has found. The research, published in the journal *Scientific Reports*, suggests that signals associated with tidal cycles could potentially provide advanced warning of certain types of volcanic eruptions.

"Looking at data for this volcano spanning about 12 years, we found that this correlation between the amplitude of seismic tremor and tidal cycles developed only in the three months before this eruption," said Társilo Girona, the study's lead author. "What that suggests is that the tides could provide a probe for telling us whether or not a volcano has entered a critical state."

Girona, a NASA postdoctoral fellow at the Jet Propulsion Laboratory, led the research during a postdoctoral appointment at Brown University, working with Brown professor Christian Huber and Corentin Caudron, a postdoctoral researcher at the Ghent University in Belgium.

Earth's tides rise and fall daily due to the gravitational tug of the Moon as the Earth rotates. During full and new Moons, the lunar gravitational

pull lines up with that of the sun, which makes the daily tidal bulges a little larger during those Moon phases. During the first- and third-quarter Moons, the daily tidal bulge is a little smaller. This twice-monthly change in tidal amplitude is sometimes referred to as the fortnightly tide. While we normally think of tides in terms of rising and falling waters, these gravitational stresses also affect the planet's solid crust. The question of whether gravitational stresses may influence volcanic activity is longstanding in the Earth sciences.

"A lot of research has been focused on whether or not tidal forces can trigger eruptions, and there's no definitive evidence whatsoever that they do," Huber said. "We wanted to take a different angle with this study and look at whether there's some detectable signal associated with tidal forces that can tell us something about a volcano's criticality."

The researchers chose to study Ruapehu volcano in part because its activity has been closely monitored for years by GNS Science, a research institute in New Zealand. The mountain is a popular tourist attraction and home to two ski resorts, so officials want to be aware of any warning signs that it might erupt. That monitoring provided a long and continuous data set for the researchers to study.

In particular, the team was interested in data from seismic sensors located near the volcano's crater. Those sensors pick up volcanic tremor, a low-level seismic rumble that provides a persistent signal of activity within a volcanic system. Using a sophisticated statistical technique, the researchers combed through 12 years of seismic data, looking for any period when the seismicity was correlated with lunar cycles. They found that for most of those 12 years, there was no correlation between tremor and lunar cycles, except the few months before a steam-driven eruption on Sept. 25, 2007, when a strong correlation emerged.

During those three months, the amplitude of tremor rose and fell ever so slightly in lock step with the fortnightly tidal cycle. While the fluctuations in seismic amplitude were subtle, the strength of the correlation to the tidal cycle was not. The correlation was as strong as 5 sigma, the researchers say, meaning that the probability that pattern arose by chance is about one in 3.5 million.

To understand how tidal forces were affecting Ruapehu during those three months, the researchers used a model of seismic tremor that they had developed previously. Volcanoes like Ruapehu have a vertical conduit through which lava rises, and a solid rock plug at the top. Gases released from the lava form a pocket between the rocky plug and the lava pool. That gas pocket can resonate against the plug, which creates seismic tremor.

The model suggests that when the pressure of the gas pocket reaches a critical level -- a level at which a steam eruption is possible -- the differing stresses associated with changing tidal forces are enough to change the amplitude of tremor.

"That's what we think was happening in 2007," Huber said. "When the pressure in the system became critical, it became sensitive to the tides. We were able to show that the signal is detectable."

None of the other indicators geologists typically use to anticipate eruptions raised any warning flags in 2007. So a tidal signal could be a way of predicting steam-driven eruptions, which are otherwise hard to predict.

"We'd like to collect more data from other eruptions and other volcanos to see if this tidal signal shows up elsewhere," Huber said. "Then we can start to think about using it as a potential means of predicting future eruptions of this kind."

The research was funded by the National Science Foundation (1454821).

http://nyti.ms/2rNYYhG

New Findings Could Save Lives of More Stroke Patients

Many more stroke victims than previously thought can be saved from disability or death if doctors remove blood clots that are choking off circulation to the brain, a new study has shown.

By DENISE GRADY JAN. 24, 2018

"These striking results will have an immediate impact and save people from lifelong disability or death," Dr. Walter J. Koroshetz, director of

the National Institute of Neurological Disorders and Stroke, said in a statement. “I really cannot overstate the size of this effect.”

The key finding is that there is often more time than doctors realized in which brain cells can still be rescued by a procedure to remove the clot. Traditional guidelines have set a limit of six hours after stroke symptoms begin, and said after that it would be too late to help.

A doctor performing a thrombectomy on a patient with stroke symptoms. A new study found that doctors have more time than previously thought to rescue brain cells whose blood flow is cut off by clots. **Burger/Phanie/Science Source**

The study showed that the time window could be expanded to 16 hours. However, the findings do not apply to every stroke victim. The researchers used a special type of brain imaging to identify the patients who still had live brain tissue that could be saved if the blood supply was restored. Only about half the patients who were screened qualified for treatment, known as thrombectomy, which uses a mechanical device to pull clots out of a blood vessel.

The study, involving 182 patients at 38 hospitals in the United States, was stopped early because patients who had clots removed fared so much better than those who did not.

Ninety days after treatment, 45 percent of the thrombectomy patients were well enough to be “functionally independent,” as opposed to 17 percent of those who did not have the procedure. The death rates were 14 percent in the thrombectomy group, and 26 percent in those whose clots were not removed.

The results were published on Wednesday in The New England Journal of Medicine. The study was paid for by the National Institutes of Health, and led by researchers from Stanford University. The Stanford team said it expected the study would lead the American Heart Association to change the guidelines for stroke treatment, extending the time window for thrombectomy.

It is not uncommon for strokes to begin during sleep, and some of those patients miss out on treatment because it is not clear what time the stroke began. Medical practice has been to set the beginning of the time window as the last moment they were known to be well, and if they have slept most of the night the six-hour window may be over by the time they wake up. New guidelines may allow such patients to be treated.

About 750,000 people a year suffer strokes in the United States, and 85 percent of those are caused by clots — the same type treated in this study. Symptoms include speech difficulty, arm weakness and facial drooping. Experts urge patients or their families to call 911 immediately so that treatment can be started as soon as possible.

http://bit.ly/2neg9Va

Modern human brain organization emerged only recently

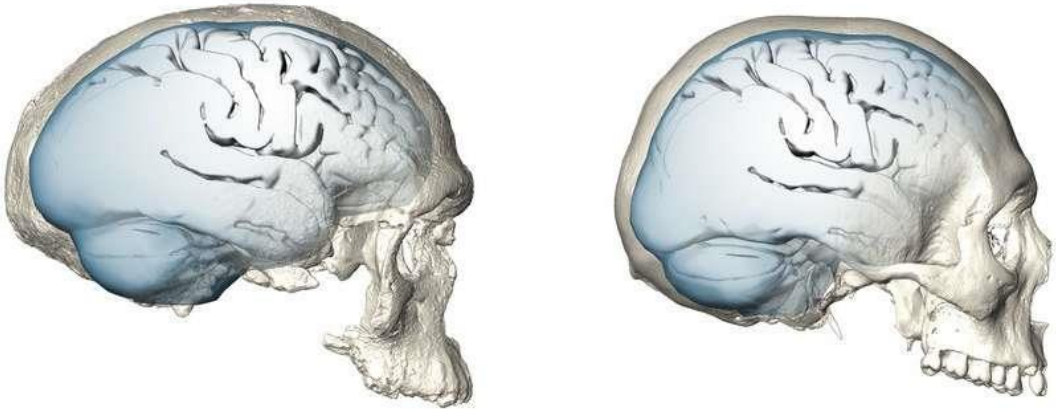
Brain organization, and possibly brain function, evolved gradually within our species and unexpectedly reached modern conditions only recently

January 25, 2018, Max Planck Society

Researchers from the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, reveal how and when the typical globular brain shape of modern humans evolved. Their analyses based on changes in endocranial size and shape in Homo sapiens fossils show that brain organization, and possibly brain function, evolved gradually within our species and unexpectedly reached modern conditions only recently.

The evolutionary history of our own species can be traced back to fossils from Jebel Irhoud (Morocco) dated to about 300,000 years ago. Last year's analysis of these fossils by researchers from the Department of Human Evolution at the Max Planck Institute for Evolutionary Anthropology in Leipzig was highlighted as one of the top science stories of 2017 by a diverse range of print and online media. Together

with crania from Florisbad (South Africa, 260,000 years old), and Omo Kibish (Ethiopia) dated to 195,000 years ago, the Jebel Irhoud fossils document an early evolutionary phase of Homo sapiens on the African continent. Their face and teeth look modern, however their elongated braincase appears more archaic as in older human species and in Neandertals. In contrast, it is a globular braincase, which characterizes the skull of present-day modern humans together with small and gracile faces.



Brain shape evolution in Homo sapiens: brain shape of one of the earliest known members of our species, the 300,000 year-old cranium Jebel Irhoud 1 (left). Brain shape, and possibly brain function, evolved gradually. Brain morphology has reached the globularity typical for present day humans suprisingly recently (right). **MPI EVA/ S. Neubauer, Ph. Gunz (License: CC-BY-SA 4.0)**

In a new paper published in *Science Advances*, members of the same research team now reveal additional surprising findings about brain evolution in Homo sapiens. The paleoanthropologists Simon Neubauer, Jean-Jacques Hublin and Philipp Gunz used micro computed tomography scans to create virtual imprints of the internal bony braincase, so called endocasts that approximate brain size and shape. They used state-of-art statistics to analyze endocasts of various fossils and present-day humans.

Evolution of the parietal lobe and the cerebellum

Neubauer and colleagues document a gradual change within Homo sapiens, from an elongated endocranial shape towards a more globular one. Two features of this process stand out: parietal and cerebellar bulging. Parietal brain areas are involved in orientation, attention, perception of stimuli, sensorimotor transformations underlying planning, visuospatial integration, imagery, self-awareness, working and long-term memory, numerical processing, and tool use. The cerebellum is not only associated with motor-related functions like the coordination of movements and balance, but also with spatial processing, working memory, language, social cognition, and affective processing.

The Homo sapiens fossils were found to have increasingly more modern endocranial shapes in accordance with their geological age. Only fossils younger than 35,000 years show the same globular shape as present-day humans, suggesting that modern brain organization evolved some time between 100,000 and 35,000 years ago. Importantly, these shape changes evolved independently of brain size—with endocranial volumes of around 1,400 milliliters, even the oldest Homo sapiens fossils from Jebel Irhoud fell within present-day variation of brain size. "The brain is arguably the most important organ for the abilities that make us human," says Neubauer. But modern human brain shape was not established at the origin of our species together with other key features of craniodental morphology. Neubauer adds: "We already knew that brain shape must have evolved within our own species, but we were surprised to discover just how recent these changes to brain organization were."

Evolutionary changes in early brain development

In present-day humans, the characteristic globular shape of the braincase develops within a few months around the time of birth. Philipp Gunz explains, "The evolution of endocranial shape within Homo sapiens suggests evolutionary changes of early brain development – a critical period for neural wiring and cognitive development." The researchers therefore argue that evolutionary

changes to early brain development were key to the evolution of human cognition. Jean-Jacques Hublin, co-author and director of the Department of Human Evolution at the Max Planck Institute in Leipzig, says: "The gradual evolution of modern human brain shape seems to parallel the gradual emergence of behavioral modernity as seen from the archeological record."

The new findings are in agreement with recent genetic studies that show changes in genes related to brain development in our lineage since the population split between Homo sapiens and Neandertals. They add to the accumulating archeological and paleoanthropological evidence demonstrating that Homo sapiens is an evolving species with deep African roots and long-lasting gradual changes in behavioral modernity, brain organization, and potentially brain function.

More information: *Simon Neubauer et al. The evolution of modern human brain shape, Science Advances (2018). DOI: 10.1126/sciadv.aao5961*

Jean-Jacques Hublin et al. New fossils from Jebel Irhoud, Morocco and the pan-African origin of Homo sapiens, Nature (2017). DOI: 10.1038/nature22336

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http://bit.ly/2EkxZND

New research can put an end to allergic reactions

Researchers have found a new mechanism in which an antibody can prevent allergic reactions in a broad range of patients.

It is a scientific breakthrough, which could pave the way for a far more effective allergy medicine.

There was great excitement in the laboratory when researchers from Aarhus University recently discovered the unique mechanisms of an antibody that blocks the immune effect behind allergic reactions.

The team of researchers from the Departments of Engineering and Molecular Biology and Genetics together with German researchers from Marburg/Giessen has now described the molecular structure and mechanisms of action of the antibody, and the results are surprising.

They were hoping to find new methods to improve existing treatment, but instead they identified how a specific antibody is apparently able to completely inactivate the allergic processes.

The antibody interacts in a complex biochemical process in the human body by which it prevents the human allergy antibody (IgE) from attaching to cells, thus keeping all allergic symptoms from occurring.

"We can now describe the interaction of this antibody with its target and the conformational changes very accurately. This allows us to understand, how it interferes with the IgE and its specific receptors on the immune cells of the body, which are responsible for releasing histamine in an allergic reaction," says Edzard Spillner, associate professor at the Department of Engineering, Aarhus University.

Allergic effects of birch pollen and insect venom eliminated

Generally, an allergic person produces high levels of IgE molecules against external allergens when exposed to them. These molecules circulate in the blood and are loaded onto the effector cells of the immune system which triggers the production of histamine and thereby an immediate allergic reaction in the body.

The function of the antibody is that it interferes with binding of IgE to the two specific effector (CD23 and FceRI) on the immune cells, thereby making it impossible for the allergy molecule to bind.

Furthermore, the researchers have observed that the antibody also removes the IgE molecules even after binding to its receptors.

"Once the IgE on immune cells can be eliminated, it doesn't matter that the body produces millions of allergen-specific IgE molecules. When we can remove the trigger, the allergic reaction and symptoms will not occur," says Edzard Spillner.

In the laboratory, it took only 15 minutes to disrupt the interaction between the allergy molecules and the immune cells.

The researchers have conducted ex vivo experiments with blood cells from patients allergic to birch pollen and insect venom. However, the method can be transferred to virtually all other allergies and asthma.

Hope for better medicine

Today, one in three Europeans suffer from allergic diseases, and the prevalence is steadily increasing. The treatment options are limited, but the researchers now expect that their scientific results will pave the way to developing completely new types of allergy medicine.

"We can now precisely map how the antibody prevents binding of IgE to its receptors. This allows us to envision completely new strategies for engineering medicine of the future, "says Nick Laursen, assistant professor at the Department of Molecular Biology and Genetics.

The antibody is particularly interesting because it is effective, and at the same time considerably smaller than therapeutic antibodies currently used to produce allergy medicine.

"It is a so called single domain antibody which easily produced in processes using only microorganisms. It is also extremely stable, and this provides new opportunities for how the antibody can be administered to patients," says Edzard Spillner.

Unlike most therapeutic antibodies already available on the market, the new antibody does not necessarily have to be injected into the body. Because of its chemical structure it might be inhaled or swallowed, and these new consumption methods will make easy, cheap and much and more comfortable for the patients to handle.

However, before new allergy medicine can be produced the researchers will have to conduct a wide range of clinical trials to document the effect and safety of the antibody.

http://bit.ly/2DQ6qxN

Humans expanded out of Africa 40,000 years earlier than we thought

The discovery sheds new light on the timing of early human migration.

Kiona N. Smith - 1/26/2018, 5:00 AM

There's not much left of this person who lived and died in a cave on the slopes of Israel's Mt. Carmel between 177,000 and 194,000 years ago. All that remains is the left half of an upper jaw, with some fragments of palate, cheekbone, and the floor of the nasal cavity still attached, along with a complete set of upper left teeth. But those fragments of bone mean that modern humans probably found their way to southwest Asia about 40,000 to 50,000 years earlier than fossil evidence previously suggested.

***Enlarge** / Not a lot to go on, but clearly human.* Israel Hershkovitz, Tel Aviv University

For early humans, the Levant was the gateway to everything beyond Africa. When the newly discovered fossil human, dubbed Misliya-1, and its companions arrived in the area, they would have found themselves living alongside Neanderthals. Both species were living in spaces once occupied by *Homo erectus*, an early human ancestor that had reached southern Eurasia by 1.75 million years ago. Understanding which species lived here—and when—is crucial to reconstructing the story of our ancestors' expansion.

Who, where, and when

And the Misliya-1 fossil is definitely human, not Neanderthal or an early hominin like *Homo erectus*. The shape of the jaw and the nasal floor look distinctly human, and so do the shape and arrangement of the teeth. Misliya-1's presence brings the fossil evidence into line with genetic studies, which suggest that modern humans first interbred with Neanderthals around 200,000 years ago somewhere outside of Africa.

"The fact that different lines of evidence (fossils, archaeology, and genetics) do not line up perfectly is in part due to the incompleteness of their respective records," said anthropologist Julia Galway-Witham of the UK's Natural History Museum. "However, it is reassuring, as in the case of the Misliya fossil, when new discoveries fit with other recent discoveries to add to our current understanding of the evolution of *Homo sapiens*."

Researchers used three different dating methods to arrive at the age. One lab tested the ratio of uranium to thorium in two of Misliya-1's incisors. Bone contains a small amount of uranium-234, which decays to thorium-230 at a predictable rate, so scientists can use the ratio to tell how old the bone is. Another lab combined that method with electron spin resonance, which measures how many atoms in a sample have unpaired electrons, or free radicals, to measure how long an object has been exposed to the normal background radiation in the environment. And a third lab used thermoluminescence, a method that measures how much radiation an object has absorbed since it was last exposed to heat or sunlight, on some burned flint buried near the fossil. All three methods said the same thing: Misliya-1 is surprisingly old.

Old but crafty

The tools found alongside Misliya-1 use a flint-knapping technique called "Levallois," which is a pretty sophisticated way to make stone tools. Levallois takes planning and forethought, and it produces sharper, more precisely shaped flakes than earlier methods, which mostly involved just chipping flakes off a core chunk of flint. Instead, Levallois involves carefully chipping small pieces off the core around the edges of the flake you actually want to shape. When it's done correctly, you strike just the right spot, and the carefully shaped flake comes right off. Archaeologists have found even older Levallois examples in Africa, at sites ranging from Kenya to Morocco, associated with modern human remains. Anthropologist Israel Hershkovitz of Tel Aviv University says the new find suggests that this tool-making method is a human innovation that may have been adopted by Neanderthals, although it's too soon to say for sure.

Neanderthals were already making stone tools this way well before Misliya-1's time, as part of what archaeologists call the Mousterian culture. In fact, older Levallois tools, dating to between 190,000 and 260,000 years ago, have been found in caves not far from Misliya. But because they weren't associated with any skeletal remains, it's hard to say for sure who made them.

"It is certainly of great interest to understand whether the Levallois was developed once and spread across many regions, or whether it was developed independently in several places," said Galway-Witham. "But archaeologists do not yet know whether this technique was developed by one species and then inspired the other or whether it was developed independently by both."

Waves of migration

Before Misliya-1, the oldest definitively human remains outside of Africa were 90,000- to 120,000-year-old sets of remains from two other Israeli caves, Qafzeh and Es-Skhul. A handful of teeth and a partial skull from two other caves in the area have dated to 400,000 years old, but they seem to belong to an earlier human relative.

The researchers suggest that these may actually have been different waves of human occupation in the region, where the climate varied tremendously over the Paleolithic. Between 244,000 and 190,000 years ago, several wetter periods may have made the Levant a hospitable place for migrating humans.

"But there were severe periods of aridity before and after this time, meaning that the region was probably more often a 'boulevard of broken dreams' than a stable haven for early humans," wrote Galway-Witham and anthropologist Christopher Stringer, also of the Natural History Museum, in a paper commenting on Hershkovitz's findings. That means that Misliya-1's people were probably not directly related to the people who later lived in the Qafzeh and Es-Skhul caves.

And Galway-Witham suggests that there may have been an even earlier wave of human migration into the region that we just haven't found evidence of yet. "Certainly, however, now that we have evidence of modern human occupation in the Levant about 180,000 years ago, this makes scenarios of earlier modern human occupation in the region more plausible," she said.

Science, *2017. DOI: 10.1126/science.aap8369 (About DOIs).*

http://bit.ly/2GrDs5S

Do our mitochondria run at 50 degrees C?

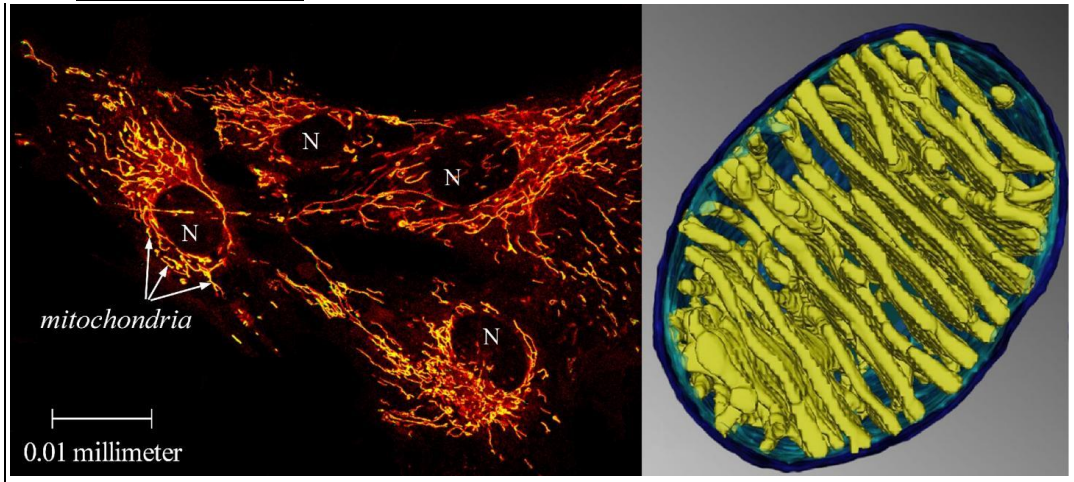
Surprising evidence that mitochondria optimized to run more than 10°C hotter than the body's bulk temperature

Our body temperature is held at a fairly steady 37.5°C, and the assumption has always been that most of our physiological processes take place at this temperature. The heat needed to maintain this temperature in the face of a colder environment is generated by tiny subcellular structures called mitochondria.

But a new study publishing January 25 in the open access journal *PLOS Biology* by INSERM and CNRS researchers at Hôpital Robert Debré in Paris led by Dr Pierre Rustin (and their international collaborators from Finland, South Korea, Lebanon and Germany) presents surprising evidence that mitochondria can run more than 10°C hotter than the body's bulk temperature, and indeed are optimized to do so. Because of the extraordinary nature of these claims, *PLOS Biology* has commissioned a cautionary accompanying article by Professor Nick Lane from University College, London, an expert on evolutionary bioenergetics.

To ensure a stable internal temperature, the human body makes use of the heat produced by the last stage of food consumption: combustion of nutrients in structures known as mitochondria, of which there are tens or hundreds in each cell. Mitochondria form a complex network within the cell, and their contents are isolated from the rest of the cell by two membranes. A considerable number of biologically catalyzed chemical reactions take place in their interior; 40% of the energy that they release is captured in the form of a chemical compound, ATP, which is used to drive functions of the body such as heart beats, brain activity or muscle contraction. The remaining 60%, however, is dissipated as heat.

The authors' results appear to show that, in maintaining our body at a constant temperature of 37.5°C, mitochondria operate much like thermostatic radiators in a poorly insulated room, running at a much higher temperature than their surroundings.



***Left: Mitochondria of human cells illuminated by the thermo-sensitive probe. Four human cells, each with its nucleus (N) and its numerous hot filamentous mitochondria (yellow-red). Right: Mitochondria as radiators. A high-magnification rendering of one such filament reveals parallel arrays of closely juxtaposed membranes that could heat the mitochondrial interior.* Left: Malgorzata Rak; Right: Terrence G. Frey**

This work was made possible by the use of a chemical probe whose fluorescence is particularly sensitive to temperature. When this "molecular thermometer" (Mito Thermo Yellow) was introduced into the heart of the mitochondria, they were able to demonstrate a stabilized temperature of about 50°C. Specifically, the probe's fluorescence suggested that the temperature of the mitochondria in living and intact cells, themselves placed in a culture medium maintained at 38°C, is more than 10°C higher, as long as the mitochondria are functional. This elevated temperature is abolished when the mitochondria are inactivated by various means. The researchers also showed that several human mitochondrial enzymes have evolved an optimum temperature close to 50°C, which helps to support their interpretation of the molecular thermometer data.

Nick Lane, who was not involved in the study, but helped the journal to assess the manuscript, finds the results potentially exciting, but warns that further work needs to be done. In his accompanying Primer, he says

"This is a radical claim, and if it is true, how come we didn't know something so important long ago?"

Lane asks a battery of questions about the Mito Thermo Yellow probe, about the plausibility of the extreme temperature gradients which the authors' interpretation imply, and about the meaning of the very concept of "temperature" at such microscopic scales. "We need to know a lot more about both the specific behaviour of Mito Thermo Yellow and its exact location within the mitochondrion before we can come to any firm conclusions about 'temperature'. In the meantime, I doubt that the 10°C temperature difference should be taken literally. But it should be taken seriously."

The authors acknowledge that these high temperatures at the core of the micro-space inside mitochondria are unexpected but emphasize that this revelation should lead to a reassessment of our vision of how mitochondria function and their role in cells. "Much of our knowledge about mitochondria, the activity of their enzymes, the permeability of their membranes, the consequences of genetic defects that impair their activity, the effect of toxins or drugs, have all been established at 37.5°C; the temperature of the human body, certainly, but apparently not that of the mitochondria," they say.

"Heat has fallen out of fashion in biology. Whether or not all these ideas are correct, the distribution and heat generation of mitochondria within cells should be taken much more seriously. These researchers bring this important subject back to centre stage, which is exactly where it should be," concludes Lane.

Article: *http://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.2003992*
Primer: *http://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.2005113*

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http://bit.ly/2Bym3ET

What might explain the unhappiness epidemic?

Although measures of teen and adult happiness dropped during the high unemployment rates of the Great Recession, it didn't rebound when the economy started to improve.

Jean Twenge Professor of Psychology, San Diego State University

We'd all like to be a little happier.

The problem is that much of what determines happiness is outside of our control. Some of us are genetically predisposed to see the world through rose-colored glasses, while others have a generally negative outlook. Bad things happen, to us and in the world. People can be unkind, and jobs can be tedious.

But we do have some control over how we spend our leisure time. That's one reason why it's worth asking which leisure time activities are linked to happiness, and which aren't.

In a new analysis of 1 million U.S. teens, my co-authors and I looked at how teens were spending their free time and which activities correlated with happiness, and which didn't.

We wanted to see if changes in the way teens spend their free time might partially explain a startling drop in teens' happiness after 2012 – and perhaps the decline in adults' happiness since 2000 as well.

A possible culprit emerges

In our study, we analyzed data from a nationally representative survey of eighth-, 10th- and 12th-graders that's been conducted annually since 1991.

Every year, teens are asked about their general happiness, in addition to how they spend their time. We found that teens who spent more time seeing their friends in person, exercising, playing sports, attending religious services, reading or even doing homework were happier. However, teens who spent more time on the internet, playing computer games, on social media, texting, using video chat or watching TV were less happy.

In other words, every activity that didn't involve a screen was linked to more happiness, and every activity that involved a screen was linked to less happiness. The differences were considerable: Teens who spent more than five hours a day online were twice as likely to be unhappy as those who spent less than an hour a day.

Of course, it might be that unhappy people seek out screen activities. However, a growing number of studies show that most of the causation goes from screen use to unhappiness, not the other way around.

In one experiment, people who were randomly assigned to give up Facebook for a week ended that time happier, less lonely and less depressed than those who continued to use Facebook. In another study, young adults required to give up Facebook for their jobs were happier than those who kept their accounts. In addition, several longitudinal studies show that screen time leads to unhappiness but unhappiness doesn't lead to more screen time.

If you wanted to give advice based on this research, it would be very simple: Put down your phone or tablet and go do something – just about anything – else.

It's not just teens

These links between happiness and time use are worrying news, as the current generation of teens (whom I call "iGen" in my book of the same name) spends more time with screens than any previous generation. Time spent online doubled between 2006 and 2016, and 82 percent of 12th-graders now use social media every day (up from 51 percent in 2008).

Sure enough, teens' happiness suddenly plummeted after 2012 (the year when the majority of Americans owned smartphones). So did teens' self-esteem and their satisfaction with their lives, especially their satisfaction with their friends, the amount of fun they were having, and their lives as a whole. These declines in well-being mirror other studies finding sharp increases in mental health issues among iGen, including in depressive symptoms, major depression, self-harm and suicide. Especially compared to the optimistic and almost relentlessly positive millennials, iGen is markedly less self-assured, and more are depressed.

A similar trend might be occurring for adults: My co-authors and I previously found that adults over age 30 were less happy than they were 15 years ago, and that adults were having sex less frequently. There may be many reasons for these trends, but adults are also spending more time with screens than they used to. That might mean less face-to-face time with other people, including with their sexual partners. The result: less sex and less happiness.

Although both teen and adult happiness dropped during the years of high unemployment amid the Great Recession (2008-2010), happiness didn't rebound in the years after 2012 when the economy was doing progressively better. Instead, happiness continued to decline as the economy improved, making it unlikely that economic cycles were to blame for lower happiness after 2012.

Growing income inequality could play a role, especially for adults. But if so, one would expect that happiness would have been dropping continuously since the 1980s, when income inequality began to grow. Instead, happiness began to decline around 2000 for adults and around 2012 for teens. Nevertheless, it's possible that concerns about the job market and income inequality reached a tipping point in the early 2000s. Somewhat surprisingly, we found that teens who didn't use digital media at all were actually a little less happy than those who used digital media a little bit (less than an hour a day). Happiness was then steadily lower with more hours of use. Thus, the happiest teens were those who used digital media, but for a limited amount of time.

The answer, then, is not to give up technology entirely. Instead, the solution is a familiar adage: everything in moderation. Use your phone for all the cool things it's good for. And then set it down and go do something else.

You might be happier for it.

Disclosure statement

Jean Twenge has received funding from the Russell Sage Foundation and the National Institutes of Health. She consults for Jana Partners, LLC.

http://bit.ly/2rNK2A2

A usually ignored finding in the kidneys may signal stroke risk

Renal cysts may indicate there is also blood vessel damage in the brain and a heightened risk of stroke

LOS ANGELES -- Sacs of fluid in the kidneys may indicate there is also blood vessel damage in the brain and a heightened risk of stroke, according to preliminary research presented at the American Stroke Association's International Stroke Conference 2018, a world premier meeting dedicated to the science and treatment of cerebrovascular disease for researchers and clinicians.

Renal cysts (sacs of fluid in the kidneys) are common in older people and usually cause no symptoms. The cysts are often discovered when an ultrasound or CT scan is done for another purpose. Traditionally, renal cysts are regarded as benign kidney structural changes. Recent research suggests that renal cysts might represent an early stage of kidney damage. Since the kidney and brain have similar vascular anatomy and physiology, researchers wondered whether they might also signal blood vessel damage in the brain circulation and a heightened risk of stroke.

In a study of 2,984 people (average age 72 years, 57 percent female) from the general population in Rotterdam, the Netherlands, who underwent a kidney ultrasound, researchers examined medical records and found:

- ***stroke prevalence was 1.63 times higher in people with a single renal cyst (found in 17 percent of participants) compared to no cysts;***
- ***stroke prevalence was even higher (2.14 times higher risk) in those with multiple renal cysts (found in 6.6 percent of participants) compared to those without cysts; and***
- ***the associations were independent of other stroke risk factors such as high blood pressure, diabetes and age.***

The Rotterdam Study is funded by Erasmus Medical Center and Erasmus University, Rotterdam, Netherlands Organization for the Health Research and Development (ZonMw), the Research Institute for Diseases in the Elderly (RIDE), the Ministry of Education, Culture and Science, the Ministry for Health, Welfare and Sports, the European Commission (DG XII), and the Municipality of Rotterdam.

Sanaz Sedaghat, Ph.D., Erasmus University Medical Center, Rotterdam, The Netherlands.

- *Available downloadable B-roll, animation and images related to this news tip are on the right column of the tip link https://newsroom.heart.org/news/a-usually-ignored-finding-in-the-kidneys-may-signal-stroke-risk?preview=04bcd4d862f725931372bf4d14db85f3*

http://wb.md/2DPnBzB

Oral HPV Infection Rate Is Alarmingly High in US Men

HPV16 prevalence six times more common in men than in women

Maurie Markman, MD

Hello. I am Dr Maurie Markman from Cancer Treatment Centers of America in Philadelphia, Pennsylvania. I want to briefly discuss a very important—and, quite frankly, a very distressing—paper that appeared in the November 21, 2017, issue of the *Annals of Internal Medicine*. The title of the paper is "Oral Human Papillomavirus Infection: Differences in Prevalence Between Sexes and Concordance With Genital Human Papillomavirus Infection."[1]

This paper reports a population-based analysis of adults aged 18-69 years who participated in the National Health and Nutrition Examination Survey (NHANES) from 2011 to 2014. Specimens had been obtained from these individuals from a variety of locations in the body, looking specifically at the prevalence of oral human papillomavirus (HPV).

The study demonstrated that 11.5% of men and 3.2% women in this analysis had HPV Infection. This translates to 11 million men and 3.2 million women nationally with HPV infection, an extremely serious concern. Looking at oral HPV 16, the prevalence was six times more common in men than in women, or 1.7 million men and 270,000 women in the United States with oral HPV 16 infection.

The potential seriousness specifically related to the increase in head and neck cancers in the United States associated with HPV infection, particularly in men, cannot be overstated. The enormous potential value for the individual and for society, related to HPV vaccination to prevent persistent infection, cannot be overstated.

This study should alarm all of us. I hope it will be an important wake-up call for physicians, for health policy experts, for all members of our society, and for the government to understand the importance of HPV vaccination for men and women—and in this case, for the prevention of a cancer that occurs more in men than in women and which is absolutely related to HPV infection.

Although the data are still not in in terms of prevention of head and neck cancers related to vaccination, the data on cervical cancer are reassuring. If this vaccination is in widespread use in our young men and women, it will prevent serious cancer from developing.

I encourage you to read this very important paper. Thank you for your attention.

References

1. Sonawane K, Suk R, Chiao EY, et al. Oral human papillomavirus infection: differences in prevalence between sexes and concordance with genital human papillomavirus infection, NHANES 2011 to 2014. Ann Intern Med. 2017;167:714-724.

http://bit.ly/2nkdyIx

Your Brain Knows What Songs Are For, No Matter Where They Came From

Researchers find that people easily recognize lullabies and dance songs from around the world

Marcus Woo

A Nyangatom woman from East Africa sings in an up and down lilt, her unadorned voice rising and falling like a hilly landscape. If you heard this song, with no geographical or cultural context, would you know it was a lullaby meant to soothe babies to sleep? It turns out you probably would, according to a new study published in *Current Biology*.

In the largest experiment of its kind, cognitive scientists asked hundreds of English speakers from around the world to listen to lullabies, dance songs, love songs, and healing songs from a wide swath of non-Western cultures. Although listeners had trouble identifying love songs, many could distinguish a healing song. But what struck the researchers most was the high confidence with which people identified lullabies and dance songs.

“What that suggests is that lullabies, dance songs, and, to a lesser extent, healing songs, share enough features across cultures to be universal features of human behavior,” says Samuel Mehr, a cognitive scientist at Harvard University and the Victoria University of Wellington in New Zealand, and an author on the new study. “You don’t need to know anything about a particular culture to be able to make some really interesting and accurate inferences about their music.”

What that means is that music could indeed be universal—and not just in a broad, metaphorical sense. Every culture has its own music, but some researchers have hypothesized that certain features and patterns hidden among the notes and rhythms are common to all cultures. So far, however, evidence for these hypothesized universal features has been lacking.

Researchers have only recently begun hunting for universal features. Traditionally, anthropologists and ethnomusicologists, who study the

diversity of the world's music, have eschewed comparative studies, says Greg Bryant, a cognitive scientist at the University of California at Los Angeles, who wasn't part of the new study. "A lot of cultural anthropologists weren't as interested in comparing cultures because they thought it was comparing apples and oranges," says Bryant. Instead, they focus on the nuances and complexities of individual cultures.

Perhaps as a result, a survey that the researchers conducted of 940 academics found that only about half of music scholars, and less than 30 percent of ethnomusicologists, thought people would be able to identify a song's function just by listening to it. Meanwhile, more than 70 percent of cognitive scientists, who seek commonalities stemming from biology, thought otherwise.

But even if we something seems obvious, it's not always true. "It's really easy to think something is true across cultures because of our biased perspectives," Bryant says. (Westerners may think of beans as part of a savory dish like chili, but in Asia, they're often found in dessert.) You have to look at the data—which is why the new experiments stand out. "They're really looking at a lot of different songs from different places, and using a pretty big sample of listeners," he says.

The researchers are the first to use such a large, diverse database of music, part of a project based at Harvard called the Natural History of Song. The collection contains 118 field recordings and 5,000 descriptions of song and dance. To find possible universal features in song, researchers are culling descriptions and recordings of vocal music from around the world, including data such as a song's tempo and the demographics of singers and the audience.

Previous studies have been few and limited. They generally compared only two types of music, or they used databases that didn't accurately represent music from around the world, Mehr says. In 2015, researchers led by Patrick Savage, a musicologist at Oxford University, identified several features—specific characteristics of rhythm and pitch, for example—that were statistically common in a collection of 304 recordings. According to Savage and his coauthors, their study provided the first quantitative evidence for universal features in music. But, according to the new paper, the database didn't represent an even sampling of the world's music.

In contrast, the new study involved 118 recordings from 86 small, isolated societies scattered evenly across the globe. In the first experiment, 750 English speakers from 60 countries listened to a random sample songs online. Then they ranked how confident they were that a particular clip was used for dancing, to soothe a baby, to heal an illness, to express love, to mourn the dead, or to tell a story. (The latter two options, which didn't apply to any of the samples, were thrown in to keep the listeners from answering simply by elimination.)

A second experiment explored the general song characteristics that influenced the listeners' decisions. A different set of 1,000 online listeners from the U.S. and India rated contextual features—such as the singer's gender, and musical features, such as whether the song had a steady beat. A statistical analysis revealed that the features that explain how people identify lullabies were the complete opposite of those for dance songs. Lullabies sounded sadder, simpler and slower while dance songs were happier, faster and more complex.

Overall, the analysis shows that people recognized the purpose of a song based on both context and, to a greater degree, musical features. But neither feature could explain the full extent of the rankings in the first experiment, the researchers say. Something else inherent to the music was tipping off the listeners.

As of now, the experiments can only hint at the existence of specific, universal features; it can't yet tell us what they are. "In itself, it's not saying much about universals," says Sandra Trehub, a psychologist at the University of Toronto whose 1993 experiments suggested adults could identify lullabies from other cultures, and who wasn't involved in the new research. "But I think it's leading in that direction."

To see if their results are really universal, the researchers are now repeating their experiments with non-English speakers and with small-scale societies. In the future, they hope to analyze the music itself—maybe even with artificial intelligence techniques—and zero in on the specific features that may make music universal. “I’m really excited to find out what happens next,” Mehr says.

Equally tantalizingly, this kind of study could even help pinpoint the evolutionary origin of music. Some researchers hypothesize that songs are the most primitive form of music, Bryant says. Lullabies, for example, may have evolved from parent-offspring interactions, according to a recent theory proposed by Mehr. In the new study, the data on both lullabies and dance songs are so pronounced that they might point at something deep and fundamental, says Manvir Singh, an author of the paper.

“Both of these may be important for why music evolved,” he says.

http://bit.ly/2DUOoKM

Too few with stroke of the eye are treated to reduce future stroke

Few patients with retinal infarction are seen by a neurologist putting them at increased risk for another stroke

LOS ANGELES - Too few patients with retinal infarction, or loss of blood flow in the eye, are evaluated for stroke risk or seen by a neurologist, putting them at increased risk for another stroke, according to preliminary research presented at the American Stroke Association's International Stroke Conference 2018, a world premier meeting dedicated to the science and treatment of cerebrovascular disease for researchers and clinicians.

The study showed that 1 in 100 patients in the study experienced an ischemic stroke within 90 days of a retinal infarction. In addition, among 5,688 individuals with retinal infarction, only one-third underwent basic testing, and fewer than one in 10 were seen by a neurologist. Within 90 days of symptoms, only 34 percent received cervical carotid imaging tests; 28.6 percent received heart-rhythm testing; 23.3 percent received echocardiography; and 8.4 percent were evaluated by a neurologist.

The findings illustrate the importance of expediting stroke evaluation testing for those who have experienced a retinal infarction, and for increased awareness and understanding about retinal infarctions and how they may signal future strokes. Retinal infarction may provide an opportunity in preventing stroke, explained lead study author Alexander Merkler, M.D., a neurologist at Weill Cornell Medical Center in New York.

"Our research tells us that we need to do a better job at evaluating patients with retinal infarction and making sure they receive the same standard of care tests that someone with a stroke in the brain would have," said Merkler. "We need to work more closely with ophthalmologists to ensure patients with stroke of the eye get the appropriate tests and treatments in a timely manner."

The findings are based on Medicare ophthalmology claims from between 2009 and 2015. Retinal infarction is a form of ischemic stroke in the eye. Symptoms can include blurred vision or vision loss, and tissue damage to the eye itself. Risk factors associated with stroke in the brain, including high blood pressure, high cholesterol, diabetes, and atrial fibrillation, are also associated with retinal infarction.

Stroke is the fifth-leading cause of death in the United States, accounting for one in every 20 deaths, but less is known about retinal infarction, which may go undetected and under-treated. Merkler plans to study the connections between retinal infarction and stroke using brain magnetic resonance imaging tests to see what's happening.

Co-authors are Gina Gialdini, M.D.; Ajay Gupta, M.D.; and Hooman Kamel, M.D. Author disclosures are on the abstract.

Additional Resources:

- *Available downloadable video interviews with ASA expert and the study researcher, B-roll, animation and images related to this news release are on the right column of the release link https://newsroom.heart.org/news/too-few-with-stroke-of-the-eye-are-treated-to-reduce-future-stroke?preview=ea093d5aa3fefbb6b8f0517b9c87e4d7*

http://bit.ly/2nk9S9q

Asian-American ethnicity associated with severe stroke, worse outcomes

Asian Americans were more likely to experience a severe ischemic stroke and have worse outcomes than whites

LOS ANGELES - Asian Americans were more likely to experience a severe ischemic stroke and have worse outcomes than whites, according to preliminary research presented at the American Stroke Association's International Stroke Conference 2018, a world premier meeting dedicated to the science and treatment of cerebrovascular disease for researchers and clinicians.

Little is known about stroke care and trends over time in Asian Americans. This study is the largest analysis of clinical and functional outcomes for Asian-American acute ischemic stroke patients. Researchers reviewed the clinical and functional outcomes of more than 1.77 million ischemic stroke patients (3.6 percent Asian American and 96.4 percent white).

"Asian Americans may have a distinctive pathophysiologic profile of ischemic stroke than whites," said Sarah Song, M.D., Ph.D., M.P.H., study author and assistant professor of cerebrovascular disease in the Department of Neurology at Rush University Medical Center in Chicago, Illinois. "Regardless, this study highlights the need for more focused research, improved stroke prevention and possibly different treatment strategies for Asian Americans."

In the large analysis, researchers also found that compared to whites, being Asian-American was associated with:

poorer functional recovery;

receiving the clot-busting drug tissue plasminogen activator (tPA) less frequently, which can improve the chances of recovering from a stroke; and

more serious and bleeding complications with tPA, despite receiving it quickly.

One good point the findings revealed, she said, is that stroke care for both Asian Americans and whites seems to have improved over time. "Looking from 2004 to 2016, our study shows that overall, patients with acute ischemic stroke are recovering more, and they are receiving more IV tPA, with less complications and better post-stroke care. This likely has to do with an overall improvement in stroke quality and highly effective stroke systems of care. However, Asian Americans and whites had nuanced differences over time; for example, only whites had a decrease in trend in stroke severity, while Asian Americans had a greater increase in timely IV tPA administration."

Researchers used clinical characteristics, treatment patterns and outcomes from acute ischemic stroke admissions for Asian-American and white patients from 2004 through 2016 from 2,171 hospitals participating in Get With The Guidelines-Stroke - the American Heart Association/American Stroke Association in-hospital program that focuses on improving stroke care by promoting consistent adherence to the latest scientific treatment guidelines.

Limited attention has been given to stroke and stroke care in Asian-American minorities, due to barriers in care, education and research. In addition, Song said, "Even among Asian Americans, the various minority populations differ in so many ways. Vietnamese people are not the same as Korean, who are not the same as Japanese or South Asian groups. Aside from differences in language, differences in stroke risk factors, diet and lifestyle, and other cultural factors, make compiling all Asian-American groups into one single group problematic."

Putting all the groups together makes it difficult to pull out meaning for each group, which she considers a limitation of this study. "But I do think this is a very good first step," Song said. "This information gives us the urgency and the credibility to do more research in Asian Americans, who have historically been understudied in the stroke and cardiovascular literature."

Co-authors are Li Liang, Ph.D.; Gregg Fonarow, M.D.; Eric E. Smith, M.D., MPH; Deepak Bhatt, M.D., MPH; Roland Matsouaka, Ph,D.; Ying Xian, M.D., Ph.D.; Lee Schwamm, M.D. and Jeffrey Saver, M.D. Author disclosures are on the abstract.

http://bit.ly/2DIfkhE

Simple test speeds recognition of posterior stroke

Finger-to-nose test almost doubled the recognition of possible stroke involving the circulation at the back of the brain

LOS ANGELES - A simple finger-to-nose test by medical professionals almost doubled the recognition of possible stroke involving the circulation at the back of the brain, according to preliminary research presented at the American Stroke Association's International Stroke Conference 2018, a world premier meeting dedicated to the science and treatment of cerebrovascular disease for researchers and clinicians.

Posterior strokes represent up to a quarter of all stroke admissions to the hospital, but there are often delays in diagnosis because the patients may not have the typical stroke signs included in screening tools used by emergency medical technicians (EMTs).

In a new study, researchers compared the recognition of posterior strokes between EMTs who received standard training in stroke screening with EMTs who received standard training plus in-person training in the "finger-to-nose test." In this simple coordination test the patient alternates touching their own nose and the examiner's finger. Performance can be impaired in posterior stroke.

The researchers found:

After training including the finger-to-nose test, EMTs recognized 12 of 16 (75 percent) posterior strokes, compared with 9 of 26 (38 percent) in the 12 months prior to training.

After routine training (not including the finger-to-nose test), EMTs recognized 13 of 28 (46 percent) posterior strokes, compared with 10 of 36 (28 percent) in the 12 months prior to training, an improvement that was not statistically significant.

The Midwest Affiliate of the American Heart Association (American Heart Association Mentored Clinical & Population Research Award) funded the study.

John A. Oostema, M.D., Michigan State University, College of Human Medicine, Grand Rapids, Michigan.

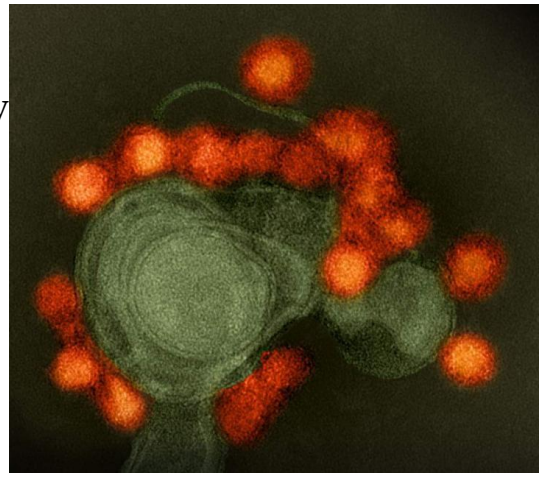
http://bit.ly/2njuMXb

Repurposed drug found to be effective against Zika virus

Researchers say findings support further investigation as potential treatment for Zika-infected adults

In both cell cultures and mouse models, a drug used to treat Hepatitis C effectively protected and rescued neural cells infected by the Zika virus -- and blocked transmission of the virus to mouse fetuses.

Writing in the current online issue of the journal *Scientific Reports*, researchers at University of California San Diego School of Medicine, with colleagues in Brazil and elsewhere, say their findings support further investigation of using the repurposed drug as a potential treatment for Zika-infected adults, including pregnant women.



This is a transmission electron microscope image of negative-stained, Fortaleza-strain Zika virus (red), isolated from a microcephaly case in Brazil. **National Institute of Allergy and Infectious Diseases.**

"There has been a lot of work done in the past year or so to address the Zika health threat. Much of it has focused on developing a vaccine, with promising early results," said senior author Alysson Muotri, PhD, professor in the UC San Diego School of Medicine departments of Pediatrics and Cellular and Molecular Medicine, director of the UC San Diego Stem Cell Program and a member of the Sanford Consortium for Regenerative Medicine.

"But there is also a great need to develop clinical strategies to treat Zika-infected individuals, including pregnant women for whom prevention of infection is no longer an option. They represent the greatest health crisis because a Zika infection during the first trimester confers the greatest risk of congenital microcephaly."

Outbreaks of Zika virus in Brazil in 2015 and 2016 were marked by an increased incidence of newborns with congenital malformations, most notably undersized heads (microcephaly) and significant neurological abnormalities. A great deal of research has focused on the pathology of Zika infections, including earlier work by the Muotri lab and collaborators that described how the virus is transmitted from mother to fetus by infecting cells that, ironically, will later develop into the brain's first and primary form of defense against invasive pathogens.

In its latest work, however, the Muotri lab sought clinical solutions. The team investigated an antiviral drug called sofosbuvir, approved and marketed under the brand name Sovaldi to treat and cure hepatitis C infections. The drug works by inhibiting replication of the hepatitis C virus; researchers noted that both hepatitis C and Zika belong to the same viral family and bore strong structural similarities that could make sofosbuvir effective against the latter. In addition, it had been reported that sofosbuvir was protective against Zika in different cell types.

In tests using human neural progenitor cells (NPCs) -- self-renewing, multipotent cells that generate neurons and other brain cell types -- the scientists found that exposure to sofosbuvir not only rescued dying NPCs infected with the Zika virus, but restored gene expression linked to their antiviral response.

In subsequent tests using an immunodeficient mouse model infected by Zika, intravenous injections of sofosbuvir significantly reduced viral loads in blood serum compared to a placebo group. Moreover, fetuses of Zika-infected pregnant mice did not show detectable Zika virus amplification in the sofosbuvir-treated group.

"This suggests that one, the drug was well-tolerated by the Zika-infected pregnant mice and two, more importantly, that it was able to arrest Zika replication *in vivo* and stop transmission from mother to fetus," said Muotri.

The researchers emphasize that their findings are preliminary, with much more work to be done. "But they also illustrate the immediate translational potential of repurposing a drug that is already in wide clinical use for a similar viral infection," Muotri said. "Until there is approval of a Zika vaccine, we think this is an approach that needs to be pursued whole-heartedly."

Co-authors include: Pinar Mesci, Angela Macia, Spencer M. Moore, Leon Tejwani, Isabella R. Fernandes, Nicole A. Suarez, Sandro Montefusco, Jeremiah D. Momper, and Jair L. Siqueira-Neto, all at UC San Diego; Sergey A. Shiryaev, Antonella Pinto and Chun-Teng Huang, Sanford Burnham Prebys Medical Discovery Institute; Matthew J. Kolar and Alan Saghatelian, Salk Institute for Biological Studies; Scott C. Rosenberg, UC San Diego and Ludwig Institute for Cancer Research; Roberto H. Herai, Pontificia Universidade Catolica do Parana, Brazil; Fernanda R. Cugola, Fabriele B. Russo, and Patricia C.B. Beltrao-Braga, University of Sao Paulo, Brazil; Nicholas Sheets, and Sujan Shresta, La Jolla Institute for Allergy & Immunology; and Kevin D. Corbett, Ludwig Institute for Cancer Research.

Disclosure: Muotri is a co-founder and has equity interest in TISMOO, a company dedicated to genetic analysis focusing on therapeutic applications customized for autism spectrum disorder and other neurological disorders with genetic origins. The terms of this arrangement have been reviewed and approved by the University of California San Diego in accordance with its conflict of interest policies.

http://bbc.in/2DUz7cF

Winter flu outbreak is peaking, say health experts

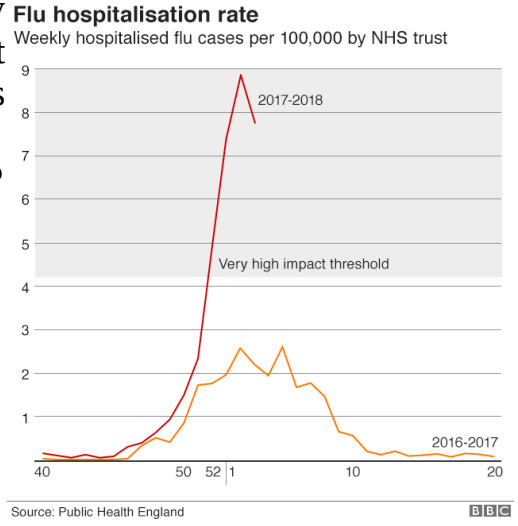
The winter flu outbreak appears to be peaking, health officials say.

Officials are hopeful the worst of the season may soon be over after a fall in the numbers being admitted to hospital.

While the numbers still remain "very high" - around 4,000 in England last week - the rate of hospitalisation was lower then the week before.

The numbers coming to see their GP have fallen in Scotland and Northern Ireland, although small rises have been seen in England and Wales.

Public Health England's Richard Pebody said the fact flu rates had stabilised was a good sign and suggested "flu activity is starting to peak".



NHS officials also welcomed the news, but warned the health service was still in the middle of a very difficult winter.

Prof Helen Stokes-Lampard, of the Royal College of GPs, said: "There are still huge numbers of patients being seen in general practice with flu and other common winter conditions - and GPs and our teams are certainly feeling the pressure."

And Phillippa Hentsch of NHS Providers, which represents hospital bosses, said the system was working "beyond its limits" in some places, with hospitals overcrowded and "struggling to cope with demand".

The weekly reports released on Thursday also showed high rates of the vomiting bug norovirus.

http://bit.ly/2BAudfM

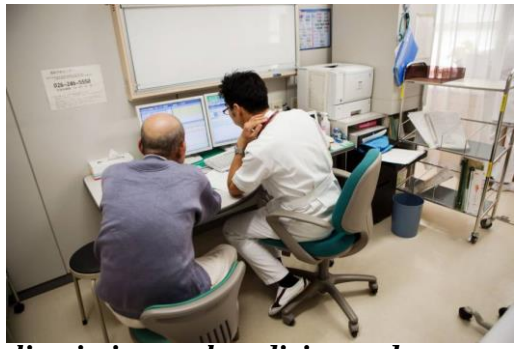
Japan's shocking decline of rural doctors

Medical doctors specializing in internal medicine and surgery are fast disappearing from many rural municipalities.

Commentary / Japan | SENTAKU MAGAZINE

Such a nightmare may be hard to believe, but it is becoming a reality due to a new system for certifying specialist medical doctors that will take effect this spring.

The new system, initiated jointly by the Japanese Medical Specialty Board (JMSB) and the Health, Labor and Welfare Ministry, is causing an increasing number of young and talented doctors to turn away from internal medicine and surgery, and to seek work in ophthalmology and otorhinolaryngology instead.



A new system to certify doctors as specialists in internal medicine and surgery, which is time-consuming and requires them to work in remote areas, is causing an increasing number of young physicians to shun these fields. **BLOOMBERG**

This is because doctors will not get certified as specialists until after they reach the age of 30 and they will be required to work in remote areas before receiving such certifications in internal medicine and surgery. Although the JMSB and the health ministry claim that the new system is aimed at producing skilled specialists, it will in fact ruin Japan's medical services and unless something is done, deprive residents in rural communities of chances to receive proper medical care.

An analysis of data compiled by the JMSB has revealed shocking facts. In the nine prefectures of Akita, Fukui, Kagawa, Tokushima, Tottori, Shimane, Yamaguchi, Kochi and Miyazaki, the number of new doctors specializing in internal medicine will dwindle to 15 or less each during fiscal 2018, which begins in April. Similarly, the 14 prefectures of Aomori, Gunma, Yamagata, Fukui, Yamanashi, Nara, Shimane, Yamaguchi, Tokushima, Ehime, Kagawa, Kochi, Saga and Miyazaki will each have five or less new surgeons. Of them, Gunma, Yamanashi and Kochi will have only one each.

Should this trend continue, medical services in rural areas will fall apart and a growing number of people will lose the opportunity to be treated properly, making the government's pet slogan of "resuscitation of rural areas" a pie in the sky.

The root cause of this crisis is the JMSB. Until now, specialist certifications have been issued independently by the Japanese Society of Internal Medicine and the Japan Surgical Society. Because of some disparities in the certification standards between the two societies, a call has come for unifying the standards by a neutral third party. Thus the JMSB has been created with the task of certifying specialists in 19 principal fields.

Those seeking specialist certification are usually young doctors who have just completed early clinical training. It is only natural for most of them to try to find employment in Tokyo and other metropolitan areas where many medical institutions are eager to hire them.

A downside of the new scheme is conspicuous in internal medicine and surgery, both of which cover wide fields. For example, those who want to get specialist certification in internal medicine are required to be trained in 12 specialized fields, including gastroenterology and

neurology, in addition to general internal medicine. These fields were added at the insistence of experts in each field. With these and other requirements, the age at which doctors are certified as specialists will be 32 at the earliest.

Another problem has surfaced. After being criticized that the new certification system will further aggravate an uneven geographical distribution of doctors, the JMSB has made it mandatory for specialist certification candidates to receive training in remote corners of the country. This has led medical institutions in remote rural areas to have excessive expectations over specialists of internal medicine and surgery, which are the core medical services in those areas. Many of the young doctors seeking to become specialists in internal medicine and surgery have resented this and shifted their area of specialization to other fields.

In November, the JMSB closed the filing of applications for training for specialist certification for fiscal 2018. The number of those who were accepted stood at 7,791, or about 90 percent of those who will have completed their early clinical training. That meant that with the exception of a few who seek to engage in basic medical studies and administrative work, most young doctors decided to apply for the certification.

For this spring, 2,527 have applied for training for certification as specialist internal medicine doctors, down by about 20 percent from an average of 3,224 for the past three years. The comparable figures for surgery are 767, down 6 percent from the fiscal 2010-2014 average of 820 who were chosen for training for specialist certification.

In stark contrast, the number of those aspiring to serve in such “minor” medical fields as ophthalmology is increasing. The number of applicants for specialist certification in ophthalmology is 60 more than the previous year’s 228, or an increase of more than 20 percent. This is despite the fact that there already are more eye doctors than needed.

This situation has caught the JMSB off guard because things were moving in a direction completely opposite the board’s express goal of evening up the distribution of medical doctors among different fields. According to an insider of a university hospital in central Japan, the JMSB suddenly asked it to reduce from 10 to seven the fixed number of young doctors applying for specialist certification in ophthalmology. Unable to resist the pressure, the university persuaded three young doctors to postpone their training for specialist certification till next year.

Benefiting from the new system are hospitals attached to prominent universities in Tokyo, where the number of internal medicine doctors is increasing. This spring, 520 will start receiving training to be certified as specialists in internal medicine in Tokyo. This represents an increase of 15 percent over 450 who sat for exams in Tokyo to get specialist certification in internal medicine in fiscal 2016.

Tokyo has 3.8 internal medicine doctors per 100,000 residents — 5.5 times higher than the lowest prefectural figure of 0.7 in Kochi. A characteristic feature in Tokyo is the high percentage of doctors who receive training for specialist certification at university hospitals. Of the 520 young doctors in Tokyo seeking to get specialist certification in internal medicine, 387 — or more than 70 percent — are to receive the training at such hospitals, surpassing the national average of 63 percent.

As more and more young doctors want to be trained in Tokyo, its two neighboring prefectures of Saitama and Chiba have felt an adverse impact. Saitama has 67 and Chiba 82 young doctors who will start receiving training for specialist certification in internal medicine this spring, down from the 79 and 102, respectively, doctors who took exams to receive the certification in fiscal 2016, and the third and ninth smallest figures, respectively, among the nation’s 47 prefectures.

The blueprint for this new system was drawn up by bureaucrats at the health ministry specializing in medicine. The JMSB, tasked with implementation of the system, is in fact a “mutual aid society” of professors of medicine at universities, according to a journalist well-versed in medical services. A scandal involving a pharmaceutical firm, Novartis Pharma, in 2012 caused a sharp fall in monetary contributions from the pharmaceutical industry to professors in medicine. With the

introduction of the new system by the JMSB, says the journalist, well over ¥1 billion will start pouring in annually under the guise of fees for renewing specialist certification and for certifying hospitals as fit for giving specialist training.

The same journalist says that the JMSB has hired 16 staffers and rented office space at the Tokyo International Forum complex near Tokyo Station. Its budget for fiscal 2016 included ¥15.55 million for rent, ¥37.08 million for business trips, ¥33.57 million for dispatch of lecturers and ¥7 million for conferences. The reason why the JMSB expends so much money without much business to do lies in the fact that the board has become a “lucky mallet of good fortune” for university professors, according to the journalist.

In April last year, the Japan Association of City Mayors issued a statement expressing serious concerns over the new specialist certification system for doctors. The plea was ignored, and the new system detrimental to the nation’s medical services will start functioning very soon. This will undoubtedly become an overture to the collapse of medical services in rural areas.

http://bit.ly/2DIL71T

Parasite mimics human proteins to provide 'ready meals' from the gut

Giardia parasites - responsible for one of the world's most common gastric diseases - are able to mimic human cell functions to break apart cells in the gut and feed off them, new research has shown.

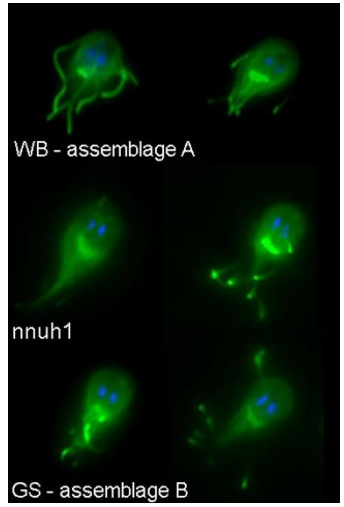
A team at the University of East Anglia (UEA) has been investigating the secret behind the success of giardia, which has eluded scientists for more than 300 years.

They found that the parasite produces two main types of protein that enable it to cut through layers of protective mucus in the gut, breaking the links that knit cells together in order to easily access the nutrients within them.

The parasite, which people typically pick up through drinking infected water or contaminated food, causes a disease called giardiasis, with symptoms including diarrhoea and stomach pains. Currently more than 200,000 people are ill with giardiasis and there are 500,000 new cases a year.

The research team, based in the National Institute for Health Research Health Protection Research Unit in Gastrointestinal Infections, at UEA's Norwich Medical School, wanted to find out more about how the parasite's activities can cause severe symptoms in some patients.

Working with colleagues at the Institute of Infection and Global Health at the University of Liverpool, the team looked at cell cultures infected with giardia in the laboratory to see what the parasite was producing that could be interacting with cells in the gut. Of the two 'families' of protein identified, the team discovered that one "mimics" a group of human proteins called Tenascins.



Giardia under the microscope. **Suha Al Naimi and Kevin Tyler**

Tenascin proteins are essential for us - they regulate cell adhesion during wound healing and tissue remodelling - providing help to cells to break apart when necessary and balancing the proteins that glue the cells together.

The giardia parasite has evolved by making proteins that are very similar to ours and able to trigger this process.

However, the giardia tenascins are used instead to upset the body's balance by preventing healing of the junctions between cells that hold them together. The research is published in the journal GigaScience.

Senior author Dr Kevin Tyler, from UEA's Norwich Medical School, said: "We've discovered an entirely new model for how this disease develops in the gut - which can also explain why in some people the symptoms can be more severe. Because the giardia have broken down the cell barriers and made all these nutrients available, other,

opportunistic bacteria can move in to take advantage of these 'ready meals' which can make giardiasis even more severe for some.

"Giardia was one of the very first disease-causing microbes to be visualised - scientists have known of its existence since 1681. But this is the first time we have been able properly to understand why this parasite is so successful."

The next step for the team is to look at whether neutralizing these proteins can provide therapy for the illness and to ask whether differences in these molecules, between parasites that cause more severe disease and those that do not, can be used to identify the more dangerous strains - which is not currently possible.

The research is part of the Aquavalens programme, a €9 million EU-funded research project to improve the safety of European drinking water, led by UEA.

'Giardia Secretome Highlights Secreted Tenascins as a Key Component of Pathogenesis' is published in the journal Gigascience on January 29, 2018.