VOL.1/ ISSUE 8/ August 2018
ISSN 2515-9534 (Print)
ISSN 2515-9542 (Online)

Scientific European

MONTHLY POPULAR SCIENCE MAGAZINE

Milky Way's 'Sibling' Galaxy Discovered

ISSN 2515-9542

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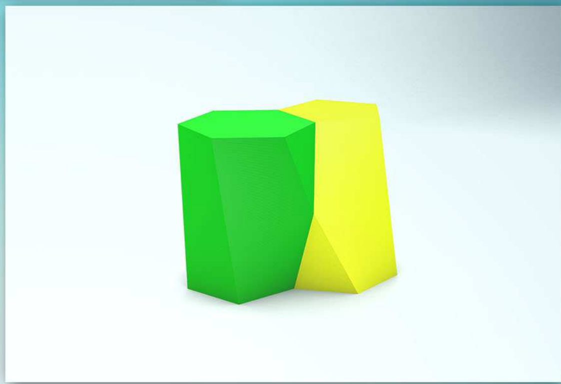
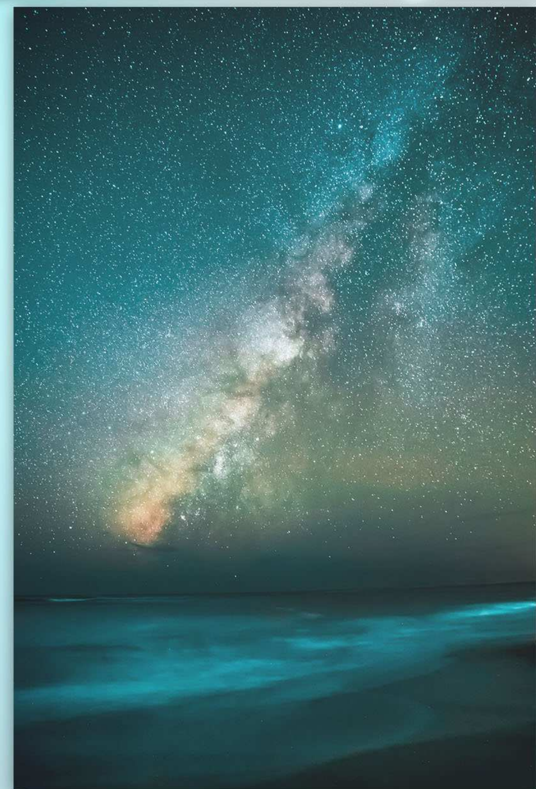
Published by UK Education Consultancy Services Ltd, (Company Number 10459935 Registered in England);
Country of publication: United Kingdom


MESSENGER RNA

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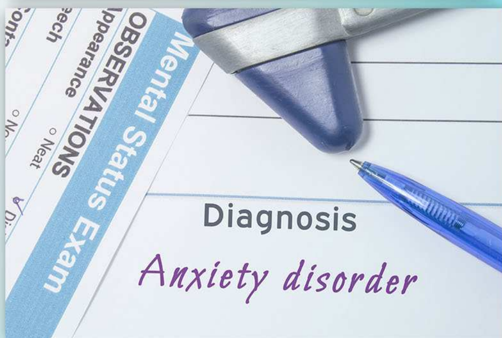
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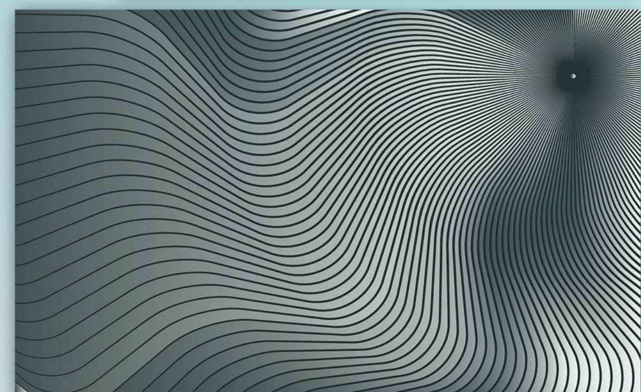

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NOTE FROM THE FOUNDER & EDITOR-IN-CHIEF

We are delighted to bring nine articles on latest relevant scientific studies which have the potential to impact mankind - new treatment for oesopheagel cancer, better understanding of mental disorders, mysteries of astronomy like gravity waves and galaxies, a variation of daily aspirin therapy and many more.

Hope you find these interesting!

Umesh Prasad

Publisher's statement: Scientific European® is both online and print science magazine published by UK Education Consultancy Services Ltd, (Company Number 10459935 Registered in England); city: Tadworth, Surrey; Country of publication: United Kingdom, ISSN 2515-9534 (Print), ISSN 2515-9542 (Online)

‘Transferring Memory’ From One Organism to Another a Possibility?

New study shows that it might be possible to transfer memory between orgaisms by transferring RNA from a trained organism into an untrained one

RNA or ribonucleic acid is the cellular ‘messenger’ which codes for proteins and carries DNA’s instructions to other parts of the cell. They have been shown to be involved in long-term memory in snails, mouse etc. They also effect chemical tags in the DNA and thus control gene switch on and off. These RNAs carry out many functions including regulation of various processes inside the cell which are crucial for development and in diseases.

RNAs hold the key

It is well established in neuroscience that long-term memory is stored inside connections between the brain cells (connections are called synapses) and each neuron in our brain has numerous synapses. In a study published in eNeuro, researchers suggest that storage of memory could involve change in gene expression induced by non-coding ribonucleic acids (RNAs) and memory could be stored in the nucleus of neurons with these RNAs holding the key. Researchers claim to have ‘transferred memory’ between two sea snails, one of which was a trained organism and the other untrained by using power of such RNAs. This breakthrough led by David Glanzman at University of California Los Angeles can give us more information about where the memory is stored and what is the underlying basis for it. The marine snail (Aplysia californica) was specifically chosen for the study as it is considered a brilliant model to analyse memory and brain. Also, a lot of information is available about the most simplistic form of “learning” done by this organism i.e. making long-term memories. These five inches long snails have large neurons which are relatively easy to work with. And most processes in cells and molecules are similar between marine snails and humans. It is interesting to note that snails have only about 20000 neurons compared to more than 100 billion in humans!

“Memory transfer” in snails?

Researchers started out their experiments by first “training” the snails. These snails were given five mild electric shocks at their tails after an interval of 20 minutes and then after a day they were given five such shocks again. These shocks caused the snails to exhibit an expected withdrawal symptom in order to defend themselves – an action to protect theselves from any impending harm mainly because these shocks increased the excitability of sensory neurons in the brain. So even if the snails, who had received the shocks, were tapped, they displayed this involuntary defence reflex which lasted for an average 50 seconds. This is referred to as “sensitization” or a kind of learning. In comparison, the snails who had not received the shocks contracted for a short duration of about one second when they were tapped. Researchers extracted RNAs from the nervous system (brain cells) of the group of ‘trained snails’ (who had received the shocks and thus were sensitized) and injected them into a control group of ‘untrained snails’ -who had not received the shocks. The training basically refers to ‘acquiring experience’. Researchers took the brain cells of trained snails and grew them in the laboratory

which they then used to bathe the untrained nerons of untrained snails. The RNA from a trained marine snail was used to create an "engram" - an artificial memory – inside an untrained organism of the same species. Doing so created a sensitized response lasting on an average 40 seconds in untrained snails as well as if they had themselves received the shocks and were trained. These results suggested possible 'transfer of memory' from untrained to trained organisms and indicates that RNAs could be used to modify memory in an organism. This study elucidates our understanding of how involved are RNAs in memory formation and storage and they may not just be the'messengers' as we know them.

Implications on neuroscience

To continue upon this work, researchers would like to identify the exact RNAs which can be used for 'memory transfer'. This work also opens up a possibility of replicating similar experiments in other organisms including humans. The work is being viewed with scepticism by many specialists and not being labelled as an actual 'transfer of personal memory'. Researchers do emphasise that their results may have been relevant for a specific type of memory and not the 'personalised' memory in general. The human mind is still an enigmatic mystery to neuroscientists as very little is known and its very challenging to try to understand more about how it works. However, if this study supports our understanding and also works in humans then this could lead us to perhaps 'lessen pain of sad memories' or even restore or awaken memories, which sounds completely farfetched to most neuroscientists. It could be most beneficial in Alzheimer's disease or post-traumatic stress disorder.

Source

Alexis Bédécarrats, Shanping Chen, Kaycey Pearce, Diancai Cai, David L. Glanzman. RNA from Trained Aplysia Can Induce an Epigenetic Engram for Long-Term Sensitization in Untrained Aplysia. eneuro, 2018; ENEURO.0038-18.2018 DOI: 10.1523/ENEURO.0038-18.2018 ■

Gravity Waves Above the Skies of Antarctica

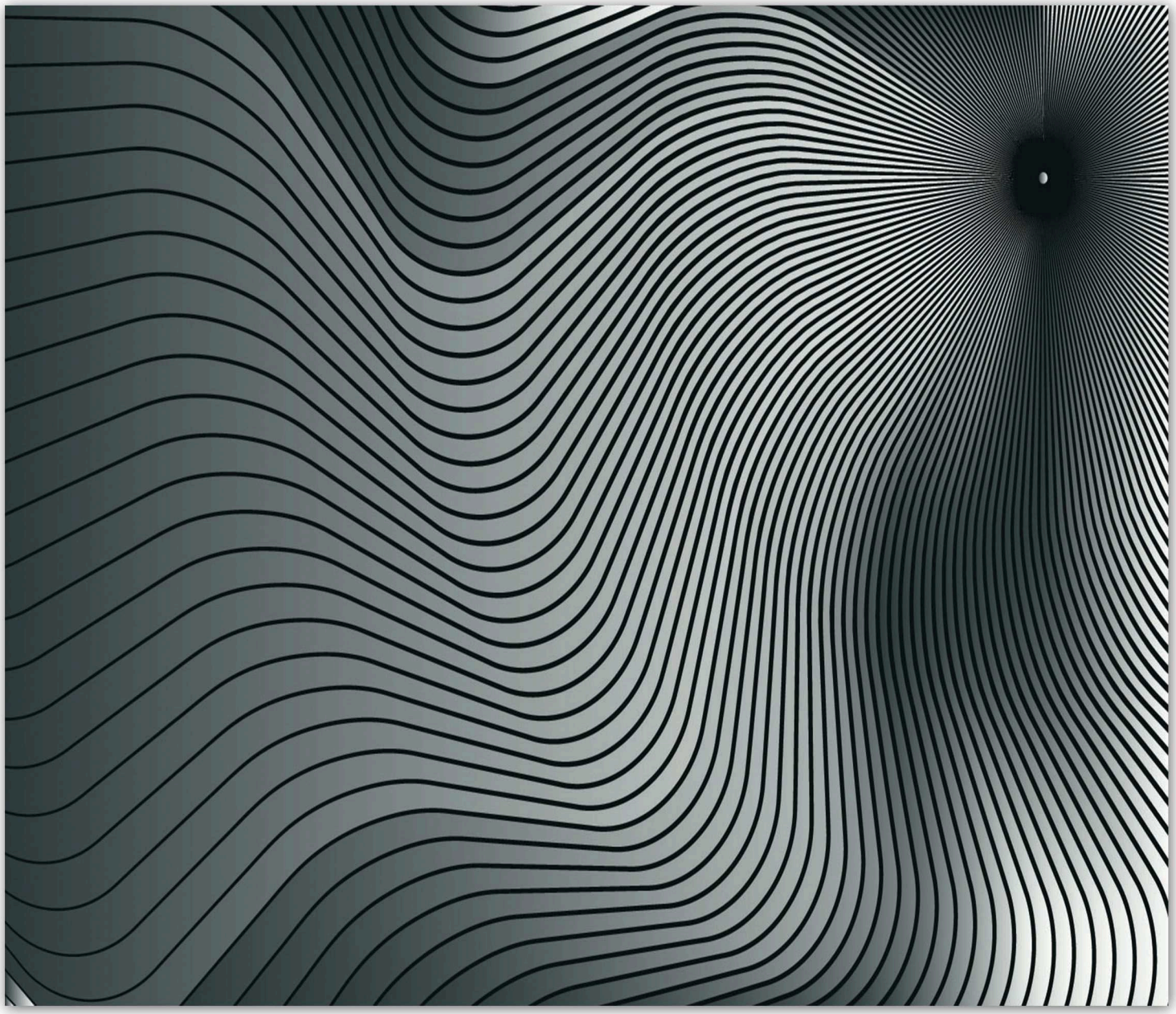
The origins of the mysterious ripples called gravity waves above Antarctica skies has been discovered for the first time

Scientists detected gravity waves above Antarctica's skies in the year 2016. Gravity waves, previously unknown, are characteristic of big ripples continuously sweeping through upper Antarctic atmosphere in 3-10 hours durations. These waves are known to occur frequently propagating across Earth's atmosphere and also that they tend to disappear after durations. However, above Antarctica these waves are very persistent as seen in periodical observations by scientists. These were called 'gravity waves' because they were mainly formed by the force of earth's gravity and its rotation and they spanned 3000 kilometres in the mesosphere layer. The main layers of Earth's atmosphere are troposphere, stratosphere, mesosphere and thermosphere being the layer which is furthest up. At that point in 2016, researchers were still unable to understand the origin of these waves. It is however crucial to pin point the origins of gravity waves so as to understand the connections between different layers in Earth's atmosphere which could then provide us with valuable information about how the air circulates around our planet.

Tracing origins of gravity waves

In a study published in Journal of Geophysical Research, the same group of researchers have combined their real-time observations with theoretical information and models to generate clues about the gravity waves[1].They proposed two possible explanations for the probable origins (how and where were they formed) of these 'persistent' gravity waves.

The first proposition is that these waves either originate from smaller lower-level waves in the atmospheric level below the mesosphere i.e. the stratosphere (30 miles above Earth's surface). The winds which flow down the mountains provide a push to these lower-level gravity waves making them grow bigger and the waves eventually move up higher into the atmosphere. Once gravity waves reach the end of stratosphere, they break and get excited like ripples in an ocean thus generating bigger waves with horizontal length of up to 2000 kilometres (while the smaller lower waves stand at 400 miles) and extend vastly into the mesosphere. This particular means of formation can be termed as 'secondary wave generation'. Authors observed that secondary waves are formed more persistently in winter than other times and thus is supposed to occur at mid to high latitudes in both hemispheres. An alternative second possibility suggested by researchers is that gravity waves originate from the swirling polar vortex. This vortex is a low-pressure area which rotates and takes over Antarctica's skies during the winter. This form of wind and weather circulates in the winter around the South Pole. Such high-speed rotating winds can alter low-level gravity waves as they move upwards in the atmosphere or can even generate secondary waves. Authors state that either one of their suggestions about the origins of gravity waves could be accurate and a concrete conclusion could still require additional research.



Researching in cold Antarctica

To understand the origins using the first proposition, Vadas' theory of secondary gravity waves was considered along with a high-resolution model developed by researchers and a theory was then formulated. Researchers ran computer models, simulations and calculations. They also used the lidar system installations - a laser-based measurement method - for which they survived in powerful cold winds and sub-zero temperatures in Antarctica. U.S. Antarctic Program and the Antarctica New Zealand program funded them for a period of eight years in Antarctica. The lidar system is very powerful and robust and has the capability to determine temperature and density across various regions of the atmosphere. It can successfully record perturbations caused by gravity waves. The technique is very helpful in recording the regions of the atmosphere which are the most difficult to otherwise observe. Study of atmospheric waves at the South Pole is important

Key points

- For the first time the origins of the gravity waves seen above Antartica's skies has been identified
- By pin pointing the origins of gravity waves we can understand the connections between different layers in Earth's atmosphere

for improvising climatic and weather-related models which can be utilized for both real-time recording and research purposes. Even the energy and momentum of the gravity waves can be measured by powerful lidar systems.

This study suggests that gravity waves affect global air circulation in the atmosphere which then affects temperatures and movement of chemicals and influences climate change.

The current climate models available do not completely account for the energy of these waves. No doubt that it is important to learn more about the stratosphere to understand the effects on the ozone layer which is found mainly in lower region of stratosphere. A clear understanding of gravity waves waves, especially how the secondary waves get generated can help us improve current computational simulation models. Authors do acknowledge other parallel theories available from 2016 which suggest that vibrations[2] of Ross Ice Shelf in Antarctica which is caused by ocean waves maybe responsible for creating these atmospheric ripples and undulations. This current study has helped to form a clear picture of global atmospheric behaviour though many mysteries still need to be addressed. However, immense hope has been generated that a combination of observations and computer modelling can help unravel many more secrets of this universe.

Source

1. Xinzhao Chu et al. 2018, 'Lidar observations of stratospheric gravity waves from 2011 to 2015 at McMurdo (77.84 °S, 166.69°E), Antarctica: Part II. Potential energy densities, lognormal distributions, and seasonal variations', Journal of Geophysics Research, DOI:https://doi.org/10.1029/2017-JD027386
2. Oleg A. Godin, Nikolay A. Zabotin. 2016, 'Resonance vibrations of the Ross Ice Shelf and observations of persistent atmospheric waves', Journal of Geophysical Research: Space Physics, DOI: 10.1002/2016JA023226 ■

A New Approach to Prevent Oesophageal cancer

A novel treatment which "prevents" oesophageal cancer in at-risk patients is reported in a large clinical trial.

Oesophageal cancer is the eight most common cancer worldwide and one of the most dangerous. This type of cancer starts in the oesophagus - a soft muscular tube which connects the mouth to the stomach and everything which is consumed by a person reaches the stomach through the oesophagus. When cancer develops in the oesophagus commonly called food pipe,there is uncontrollable growth of cells lining the tube making them cancerous and causing havoc to the basic mechanism of ingesting food. Unfortunately, majority of symptoms associated with this type of cancer start occurring when the cancer is at an advanced stage i.e. when cancerous cells have blocked the oesophagus completely and cancer has spread to other parts of the body. This scenario makes treating this cancer very challenging. The early stages of this cancer are completely undetectable unless screened.

Causes of Oesophageal cancer

Overuse of alcohol and tobacco is the leading cause of oesophageal cancer. Other important risk factors are gastroesophageal reflux disease (GERD), Barrett's oesophagus and obesity. In GERD, the acid from the stomach moves up into the oesophagus causing a persistent heartburn. In another condition called 'Barrett's oesophagus' occurring in 10 to 15 percent patients of GERD, the normal cell lining of the oesophagus gets damaged after it gets replaced by 'abnormal cells' (called Barrett's cells) mainly due to chronic acid reflux. These abnormal cells look exactly like the cells which line the stomach and small intestine but they are more resistant to stomach acid. The symptom for Barrett's oesophagus is mostly heartburn though sometimes

no symptoms exists. As some time progresses, Barrett's cells first become precancerous by a process called dysplasia and then later may become cancerous since high-grade dysplasia is linked to the maximum risk of cancer. Thus, an early screening for precancerous changes can go a long way in controlling oesophageal cancer. Though not all patients with this condition get the cancer but they are in the highest risk category. Maintaining a healthy diet and stable body weight can also reduce the risk for this cancer.

New study on preventing Oesophageal cancer

In a recent study published in The Lancet, the results of the largest cancer prevention clinical trial spearheaded by Royal College of Surgeons in Ireland (RCSI) conducted over a period of 20 years has been reported. Researchers have discovered a new treatment which "significantly prevents" oesophageal cancer in at-risk patients. This study has been described as a major breakthrough in the field of cancer therapeutics in recent times. During the clinical trial, around 2550 patients who were suffering from the abnormality 'Barrett's oesophagus' were followed up over a duration of nine years and their health conditions were recorded. These patients owing to their condition had acid refluxes and thus they were more susceptible to cancer as well as to non-cancer conditions like pneumonia. The main goal of the study was to find how this abnormality could be prevented from turning into cancer. The patients were randomly given one of the four different combination of medicines. These medicines were acid-suppressions (which suppress the stomach acids in general) and aspirin. So, either a low acid-suppression, a high acid-suppression, a low acid-suppression with 300 mg of aspirin or a high acid-suppression with 300 mg of aspirin was given to the four sets of randomly selected patients. It was discovered that a precise combination of acid-suppression medicines along with aspirin can effectively prevent oesophageal cancer in patients suffering from Barrett's oesophagus. The effective combination of high dose acid-suppression medicine alone prevented cancer, premature death and to some extent the progress rate of precancerous cells. Aspirin also showed some effect, and interestingly high dose acid suppression and aspirin together worked more in favour when compared to each of these taken alone.

This is a hallmark clinical trial which has displayed high standards of efficacy and safety. The results of this trial are significant and also less than 1 percent of patients suffered any serious adverse effects from these medications which is extraordinary. This study has reported a new approach towards preventing cancer of the food pipe and this could be a gamechanger for the field of oesophageal cancer.

Source

Janusz A Z Jankowski, John de Caestecker, Sharon B Love, Rebecca Harrison, Hugh Barr, Paul Moayyedi, et al 2018, 'Esomeprazole and aspirin in Barrett's oesophagus (AspECT): a randomised factorial trial', The Lancet, Vol. 392, no. 10145, pp.400-408, DOI: https://doi.org/10.1016/S0140-6736(18)31388-6

■

Meghalayan Age

Geologists have marked a new phase in the history of earth after discovering evidences in Meghalaya, India

The current age which we are living in has been recently officially designated at the 'Meghalayan Age' by the International Geologic Time scale. This scale divides the history of our planet into different eons, eras, periods, epochs and ages. The timing of events on the basis of which these time periods are divided is collated by geologists and archaeologists worldwide and is based upon substantial events like continents breaking up, dramatic change in climatic conditions, extinction or emergence of certain animals and plants. The units of this scale are based upon proof and evidence of sedimentary layers which have collected over time and these layers contain different sediments, fossils and chemical isotopes. Such strata bear recordings through a passage of time which also convey associated physical and biological events. This is called geologic age dating where each of such material are assigned an age and then the likely events around it are predicted. This is how we know today that earth is 4.6 billion years old. The International Commission on Stratigraphy (IUGS) is chiefly responsible for regulating the Geologic Time Scale.

The current era that we live in, - the Holocene epoch - has been updated and subdivided into three new geological ages which are Early Holocene called Greenlandian, Middle Halocene called Northgrippian and Late Halocene called the Meghlayan age. Greenlandian age is marked when the ice age came to an end and warming started on earth around 12000 years ago.

Key Points

- A new distinct Meghalayan age which has now been identified started 4,200 years ago and is till present day.
- This discovery furthers our understanding of Earth's complete geological history.

Northgrippian age started around 8000 years ago. Both these ages are marked by ice cores found in Greenland. A new distinct Meghalayan age which has now been identified started 4,200 years ago and is till today. The agency International Union of Geological Sciences is responsible for these international standards in geology. Researches have taken up to eight years to mark the dates for the Meghalayan age.

All ages have been assigned unique names based upon their origin or start. The Greenlandian and Northgrippian ages are named for the North

GRIP site in Greenland. This site depicts the swift warming of the planet signifying the culmination of ice age followed by a swift universal cooling at the start of Northgrippian age which was caused by entry of melted ice water into the North Atlantic. Further, around 4,200 years ago, a significantly drier phase or aridification has been identified by researchers which they have designated as the start of Meghlayan Age. The Meghalayan age is termed after a stalagmite (a type of rock formation) in Mawmlul cave located in the north eastern state Meghalaya in India to mark the exact origin of this age. The word "Meghalaya' means "the abode of clouds" in Sanskrit. The timestamp of this age is understood by explaining that this stalagmite was deposited on the floor of the cave from minerals deposits over several thousands of years because of the rain water seeping inside the cave through ceiling drippings. This occurred most probably because of ocean shifts and atmospheric circulation. The mineral layers depict the change in precipitation over time as their chemical signatures show that a single stalagmite's change in oxygen atom isotopes led to the area experiencing 20-30 percent decrease in monsoon rainfall. This is being considered as significant evidence for this discovery. In fact, such evidence has been discovered on all seven continents on Earth. This 'mega draught' launched the new geological age. Such extreme climatic conditions also would have left to collapse of civilizations and uprooting of human settlements especially those engaged in agriculture near the Mediterranean Sea, the Middle East and Asia as indicated in studies. The effects of this 'mega draught' appear to have lasted for over 200 years. Many experts believe this event to be vastly connected with social and economic reasons.

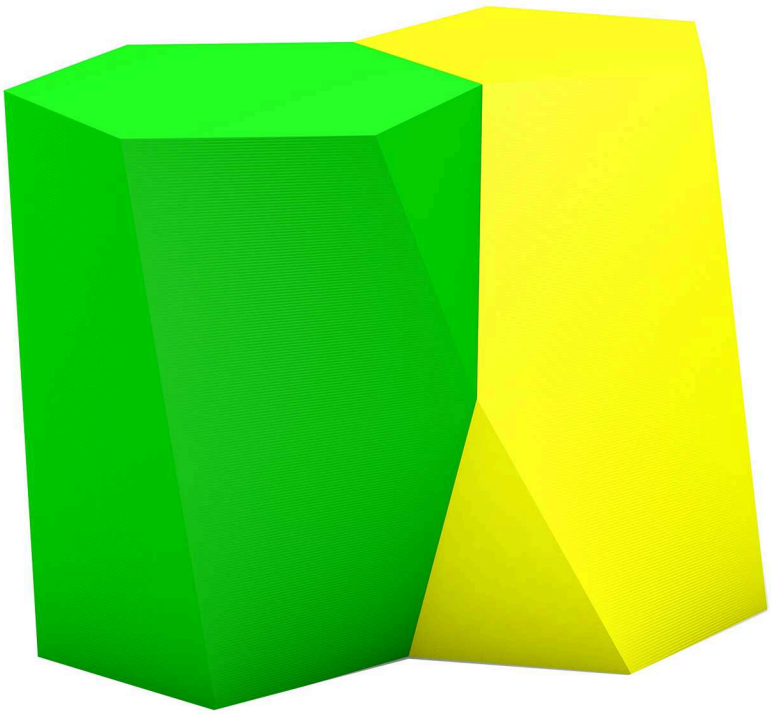
The smallest global climatic event in the history of our planet has been discovered for the first time and it furthers our understanding of Earth's complete geological history. This is a remarkable discovery and an addition into the history of Holocene and also archaeology. Geologists are planning to add a new epoch after the Holocene which is being called the Anthropocene which would mark the impact of humans on the geology of the planet after industrialization.

Source
International Commission on Stratigraphy, www.stratigraphy.org, accessed Aug 5, 2018 ■

A New Shape Discovered: Scutoid

A new geometrical shape has been discovered which enables three-dimensional packing of epithelial cells when making curved tissues and organs.

Every living organism begins as a single cell, which then divide into more cells, which further divide and subdivide until billions of cells are formed to create the whole organism. Its one of the most enigmatic aspects of biology how starting from cells, first tissues and then organs are formed. Essentially, a simple structure of the embryo formed by only few cells becomes a living organism having complex organs. For example, millions of epithelial cells pack together to form the human skin, our largest organ and strongest barrier. If our skin was a completely flat surface, known geometrical shapes could be stacked together to build skin. But since our body is not flat, these epithelial cells have to curve and bend themselves. These epithelial cells not just form the outer layer of our skin, but they also line the blood vessels as well as the organs in all animals. When an embryo is developing, tissues (which are made of cells) bend and form complex three-dimensional shapes which then become organs like heart or liver etc. The starting blocks epithelial cells 'move' and 'join' together to organize themselves and pack tightly to give an organ its final three-dimensional shape since most organs are curved structures. Because of this requirement of curvature, it is undestood that epithelial cells that line the organs have to adopt colum nar or bottle shapes to be able to surround organs while the embryo is growing. Epithelial cells also provide other functions like forming a barrier against infections and absorption of nutrients.



A new shape discovered!

Researchers at Seville University, Spain and Lehigh University, USA conclude in their study published in Nature Communications that epithelial cells adopt a shape something similar to 'twisted prisms'. This new solid geometric shape has been dubbed as 'scutoid'. This shape enables epithelial cells to achieve their purpose of providing a three-dimensional cover to organs. Scutoid is a prism like

structure, with six sides on one side and five on the other along with a triangle face on one of the prism's long edges. This unique structure of scutoid makes it possible to stack them together with alternating five-sided and six-sided ends allowing creation of curved surfaces. This name does not exist in geometry and was chosen by researchers after careful consideration and owing to similarity of scutoid with the shape of a scutellum of a beetle which is the posterior end of an insect's thorax.

Scutoid shape is abundant

Researchers used computational modelling technique utilizing Voronoi diagramming. This is the most commonly used tool to understand geometrical shapes across different fields of study. Modelling experiments showed that as the curvature in the tissue increases, cells constituting these tissues used more complex shapes than just columns and bottle-shapes as earlier believed. The epithelial cells adopt a shape which is prevously undescribed and this particular shape helps the cells to make them more energy efficient while maximizing a steady packing. Researchers looked closely at the three-dimensional packing of various tissues in different animals to analyse their views. Experimental data established that epithelial cells do adopt very similar 3D motifs as predicted by computational modelling. So, this new shape scutoid helps in bending and curving and allows for the most optimal way for the cells to remain stably packed. Once establishing that a new shape exists, researchers explored in other organisms for the presence of scutoid-like shape and they found that this shape was abundantly present. These scutoid-like shapes have also been found in epithelial cells of zebra fish and salivary glands of fruit flies and especially in those regions where tissue required to curve the most rather than have a flat appearance.

This is a very interesting and unique discovery which can further our understanding and help us control three-dimensional organization of organs (morphogenesis). It can throw more light on what happens when an organ does not form correctly leading to diseases. It could also be of immense help in the field of growing artificial organs and tissue engineering as building scaffolds with correct packing structure would lead to better outcomes. The discovery of this new shape has potential applications across various scientific fields.

Source

Pedro Gómez-Gálvez, et al. 2018, 'Scutoids are a geometrical solution to three-dimensional packing of epithelia', Nature Communications, vol. 9, no. 1, DOI: 10.1038/s41467-018-05376-1 ■

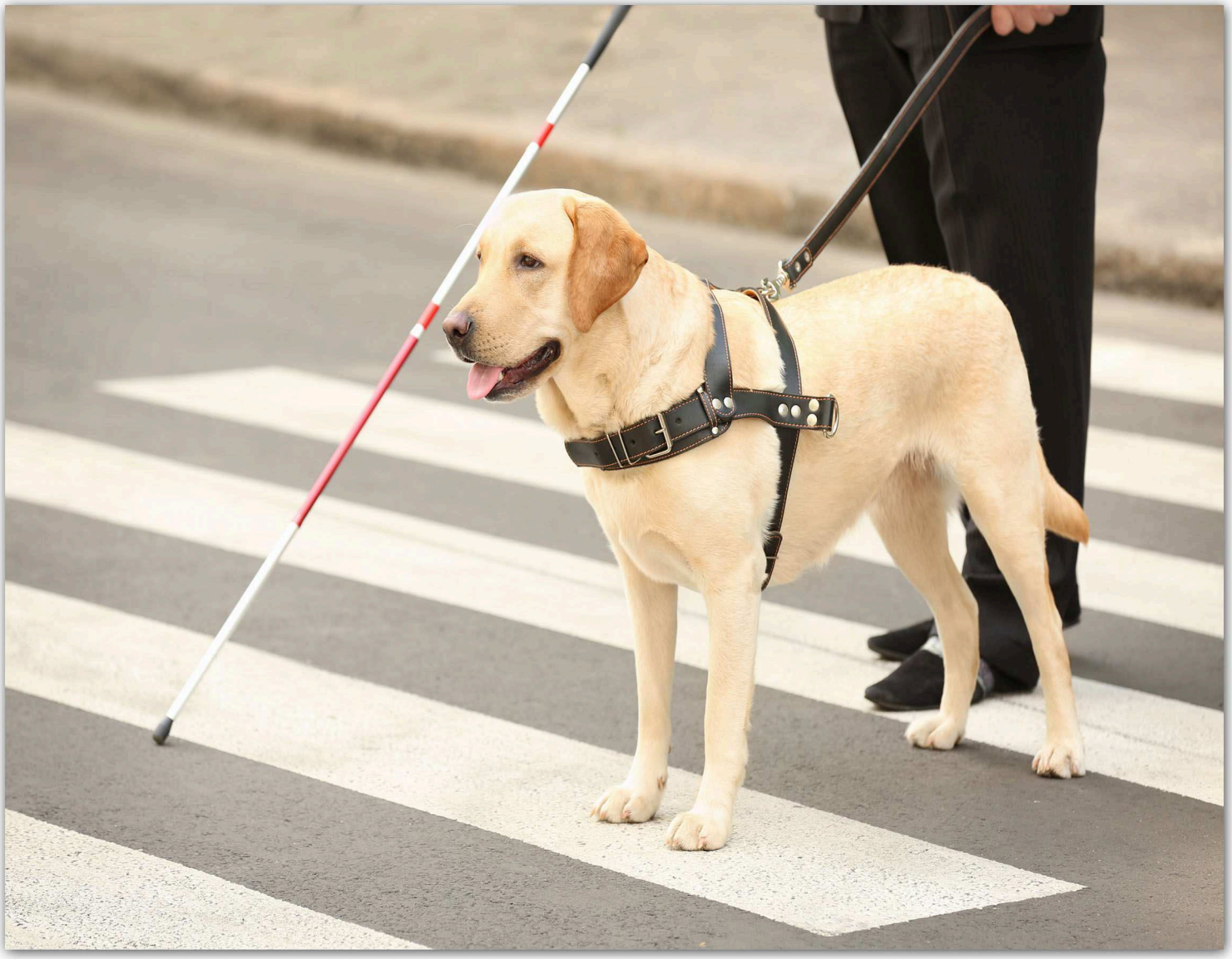
Dog: Man's *Best Companion*

Scientific research has proven that dogs are compassionate beings who overcome obstacles to help their human owners.

Humans have domesticated dogs for thousands of years and the bonding between humans and their pet dogs is a fine example of a strong and emotive relationship. Proud dog owners around the world have always felt and often discussed with their friends and family at some point on how they sense and feel that their canine companions are filled with empathy and compassion especially during the times when the owners are themselves upset and distraught. Dogs are perceived to not only love their owners but dogs also consider these humans as their affectionate family who provides them shelter and protection. Dogs have been labelled as 'Man's best friend' for as long as literature has existed. Such anecdotes about dog's particular loyalty,- three months of pregnancy when the organs are still forming. affection and bonding with humans have been popularised in every medium be its books, poetry or feature films. Despite this overwhelming understanding about how good the relationship between a human and his pet dog is, scientific studies with mixed outcomes have been produced on this area so far.

Dogs are compassionate creatures

Researchers from John Hopkins University have analysed in their recent study published in Springer's Learning and Behaviour that dogs are indeed man's best friend and they are highly compassionate creatures with underrated social awareness and they rush to comfort their owners when they realise that their human owners are in distress. Researchers conducted several experiments to understand the levels of empathy which dogs show towards their owners. In one out of many experiments, a set of 34 dog owners and their dogs of different sizes and breeds were gathered and the owners were asked to either cry or hum a song. It was done one at a time for each pair of dog and dog owner while both sitting across in different rooms with a transparent closed glass door in between supported only by three magnets to enable ease of opening. Researchers carefully judged the dog's behavioural reaction and also their heart rate (physiological) by taking measurements on a heart rate monitor. It was seen



Key Points

- Research shows that dogs are highly compassionate creatures with underrated social awareness and they rush to comfort their owners when they realise that their human owners are in distress
- Trying to understand how dogs think and react can provide us with a starting point to comprehend how empathy and compassion evolve

that when their owners 'cried' or yelled "help" and dogs heard these distress calls, they opened the door three times faster to come in and offer comfort and aid and essentially "rescue" their human owners. This is in stark comparison to when the owners were only humming a song and appeared to be happy. Looking at the detailed observations recorded, dogs responded within an average of 24.43 seconds when their owners pretended to be distressed compared to an average response of 95.89 seconds when owners appeared happy while humming children rhymes. This method is adapted from the 'trapped other' paradigm which has been used in many studies involving rats.

Its interesting to discuss why would dogs still open the door when the owners were only humming and there was no sign of trouble. This shows that dog's behaviour was not just empathy based but also suggested their need for social contact and also bit of curiosity of what lies across the door. Also, those dogs who showed a much faster response in opening the door had lower stress levels themselves. The levels of stress were noted by determining a line of progress through making baseline measurements. This is an understandable and well-established psychological observation that dogs will have to overcome their own distress in order to take an action (here, opening the door). This means that dogs suppress their own feelings and act on empathy instead by focusing on their human owners. Such is the case also seen with children and sometimes adults when they have to overcome their own overwhelming personal stress to be able to offer help to someone. On the other hand, the dogs who did not open the door at all displayed clear signs of distress in them like panting or pacing which showed their anxiety towards the situation involving someone they truly love. Researchers emphasise that this is normal behaviour and not at all worrisome since dogs, just like humans, can display varied degrees of compassion at one point or another. In another experiment, researchers analysed the gazes of dogs to their owners to learn more about the relationship.

In the experiments conducted, 16 out of the 34 dogs were trained therapy dogs and registered "service dogs". However, unexpectedly, all dogs performed in a similar way irrespective of whether they were service dogs or not, or even the age or their breed did not matter. This means that all dogs exhibit similar human-animal bonding traits, just that therapy dogs have acquired more skills when they register as service dogs and these skills account for obedience rather than the emotional state. This result has strong implications on the criterion used to choose and train service therapy dogs. Specialists can judge which traits are most important to make therapeutic improvements in designing selection protocols.

This study shows high sensitivity of canines to the sentiments and feelings of humans as they are seen to strongly perceive change in emotional state of humans. Such learnings advance our understanding of canine empathy and range of cross-species behaviour in the general context. It would be interesting to expand the scope of this work to do further studies on other pets like cats, rabbits or parrots. Trying to understand how dogs think and react can provide us with a starting point to comprehend how empathy and compassion evolve even in humans which make them act empathetically in difficult situations. It can help us to investigate the extent of compassionate response and also improve our understanding of the shared evolutionary history of mammals – human and dogs.

Source

Emily M. Sanford, Emma R. Burt, Julia E. Meyers-Manor 2018, 'Timmy's in the well: Empathy and prosocial helping in dogs', Learning & Behavior, DOI: 10.3758/s13420-018-0332-3 ■

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Weight-Based Dosing of Aspirin for Prevention of Cardiovascular Events

Study shows that a person's body weight influences the effects of low-dose aspirin in preventing cardiovascular events

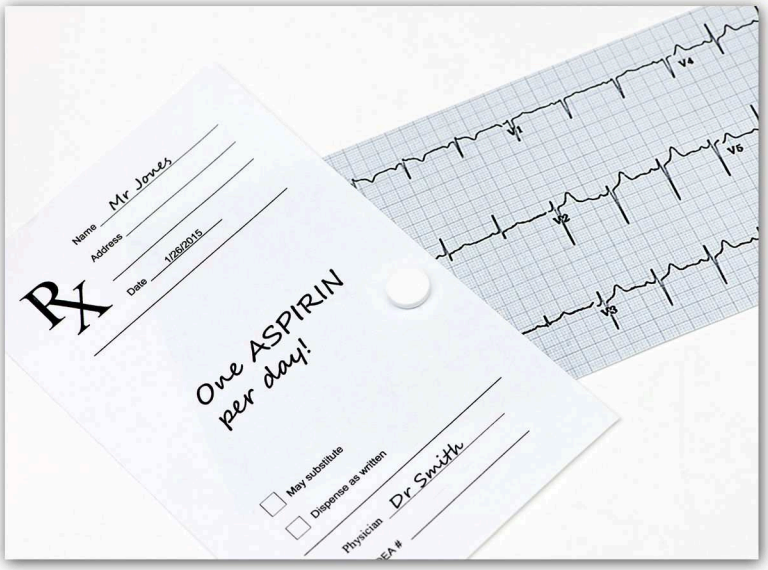
Cardiovascular diseases are the leading cause of global mortality. Major risk factors for a cardiovascular event include genetics, family history of heart diseases, hypertension, diabetes, high cholesterol and smoking. The 'daily aspirin therapy' is recommended to lessen the risk of heart attack. Aspirin is known to restrict clotting of the blood. Blood clotting happens around the area of bleeding when clotting cells in the blood (called platelets) stop the bleeding at a wound site by forming a "plug" which seals the opening of our blood vessels. This clotting of blood is essential to stop unnecessary bleeding. However, such blood clotting can sometimes happen undesirably in internal blood vessels which supply blood to the heart. If these vessels are already narrow due to atherosclerosis (fatty deposits in arteries), fat deposit in the blood vessel lining can erupt causing undesired blood clotting action to start which can completely block the artery. This situation prevents blood flow to the heart and can cause a heart attack. Aspirin is thus given to avoid this undesired clotting in possibly preventing a heart attack. Daily aspirin therapy is known to be beneficial for someone who has had a heart attack or a stroke in the past and also for middle-aged men and women who are at greater risk of cardiovascular events. The only exceptions for daily aspiring therapy are people bleeding. Many cardiologists recommend taking a low dose aspirin regularly (after weighing the risks and benefits) especially for the ages 50 till 69 years as a preventive measure for heart atacks, strokes and some types of cancer like digestive cancer. And common clinical practise is to consume low doses of aspirin everyday irrespective of body weight.

Daily aspirin therapy according to body weight

Studies published in *The Lancet* has shown in a randomized trial that effects of common medicine aspirin in preventing cardiovascular events depends heavily on the patient's weight[1,2]. Thus, benefits of taking the same medication may not be similar for patients with high body weight. The study was conducted with people having body weight between 50 and 69 kilograms (kgs) (around 11,8000 patients). They consumed a low dose of aspirin (75 to 100 mg) and it was seen that around 23 percent has lower risk of heart attack, stroke or another cardiovascular event. However, patients having weight more than 70 kgs or even who were lighter than 50 kgs did not seem to have received similar benefits of low dose aspirin. Low dose of aspirin was actually harmful for patients who weighed more than 70 kgs and fatal for patients less than 50 kgs. And, giving these

patients a higher dose though beneficial would be problematic as the next high dose of aspirin was a full dose of 325 mg which is known to cause adverse bleeding in some patients. Though this risk of bleeding went away for patients weighing more than 90kg. However, it is still to be considered about how much higher dose can be given because many individuals fall in 70 kg+ category and thus benefits and risks have to be analysed together.

Therefore, the importance of body weight is vital when discussing efficacy of aspirin for prevention cardiovascular events and also cancer. The approach of 'one size fits all' needs to be dismissed and a more tailored and personalized dosing strategy needs to be adopted. Though the exact recommended dose with people with higher body weight (more than 70 kgs) is still to be researched upon. The authors do suggest that a full-dose aspirin should be consumed daily by people who weigh more than 69 kgs or are heavy smokers or suffer from an untreated diabetic condition. The higher dose would be protective towards at-risk patient who are more likely to suffer from undesired blood clot formation. Interestingly, no differences between stroke rates amongst genders were detectable when only the body weight was the sole criteria. A low-dose aspirin is not effective in 80 percent men and around 50 percent women who weigh at least 70 kgs thereby challenging the current common practise of prescribing low dose aspirin to all patients in the 50 to 69 age group.



The study suggests that best benefit of aspirin for long-term prevention of cardiovascular events should be focussed on under dosing in big individuals while overdosing in small. One of the direct implications of this study is to dissuade widespread use of high dose of aspirin (325 mg) in low weight people (less than 70 kgs) as it is seen that lower doses are effective enough minus any hazards of excess dosing. And excessive dosage could be even fatal. More research needs to be carried out to these validate findings. But clearly these results have the potential to affect public health systems by persuading discussion of weight-adjusted dosage of aspirin in routine clinical care. Also, comparisons of aspirin with other antiplatelet or antithrombotic dosages be also based upon body size and weight. It is clear that the most ideal dose of aspirin to prevent cardiovascular diseases/events is dependent on body weight – i.e. body mass and height rather than BMI (Body Mass Index). This study also puts forward the idea of precision medicine i.e. providing a personalised therapy to each patient.

Source

1 Peter M Rothwell et al. 2018, Effects of aspirin on risks of vascular events and cancer according to bodyweight and dose: analysis of individual patient data from randomised trials, The Lancet, Vol. 392, no.10145, pp.361-362.

2 Katherine N ThekenTilo Grosser, 2018, 'Weight-adjusted aspirin for cardiovascular prevention', The Lancet, DOI:https://-doi.org/10.1016/S0140-6736(18)31307-2 ■

Milky Way's *'Sibling' Galaxy* Discovered

A "*sibling*" of Earth's galaxy Milky Way is discovered which was torn apart by Andromeda galaxy billions of years ago

Key points

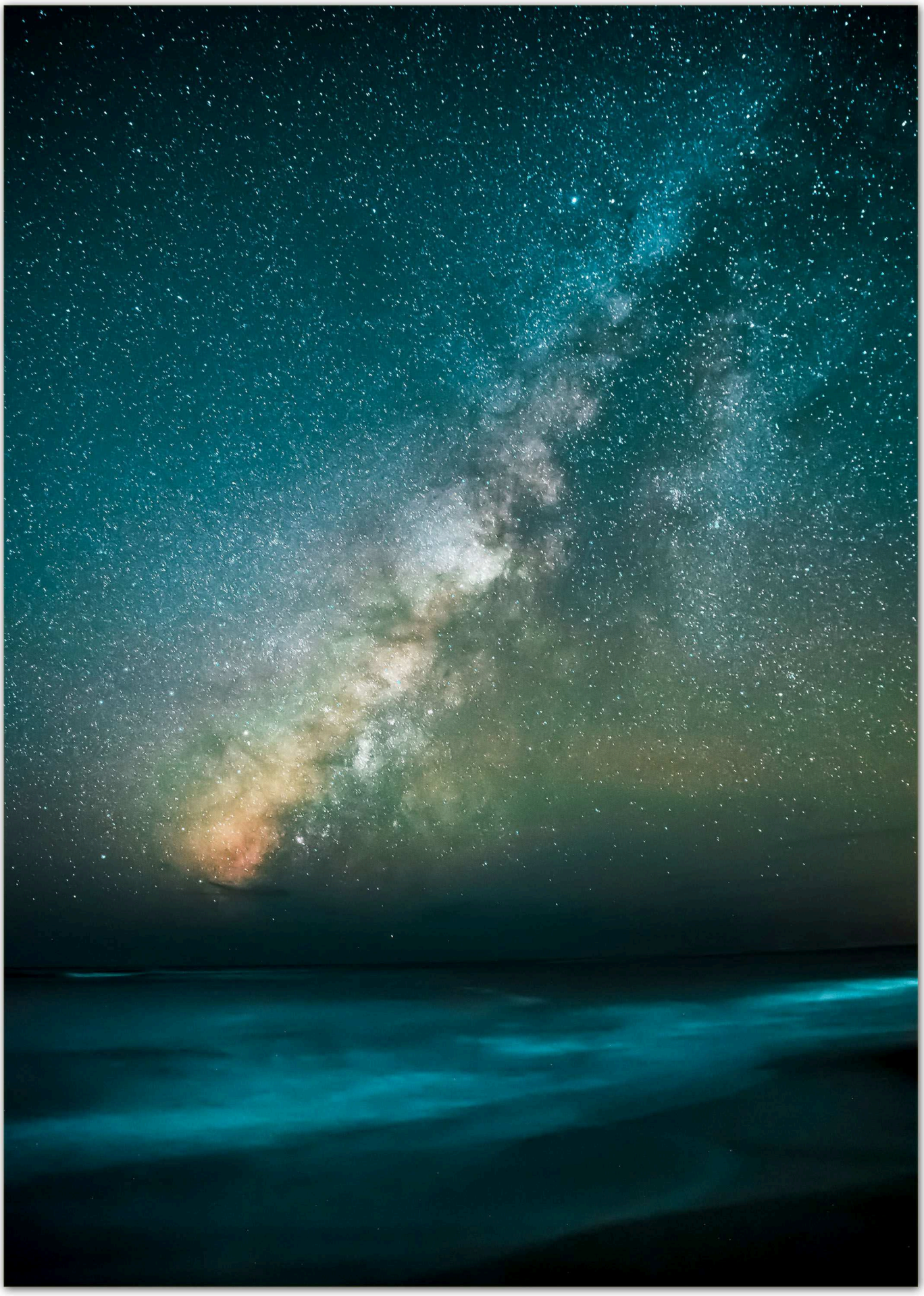
- A "big sibling" of Milky Way galaxy has been discovered which had 'combined' with Milky Way.
- The study helps to further our understanding of the universe and shed light on causes and effects which fuel growth of galaxies and also their mergers.

Our planet Earth is part of the solar system which comprises eight planets, numerous comets and asteroids which orbit the Sun and this solar system is located in Milky Way galaxy in the universe. Our sun is one amongst the billions of stars in this galaxy and there are more than 100 billion galaxies in the universe. Galaxies are systems made up of billions of stars, gas and dust held together by gravitational attraction. Milky way galaxy is typical spiral shaped with four arms attached to the disk. Earth is located at exactly two-thirds of the way out from the galactic centre of the galaxy with a distance of 26,000 light years between them.

Milky way galaxy is known to have started forming approximately 12 billion years ago.almost no mass, A group of 50 galaxies have been termed as the Local Group and Milky Way is part of this. Half of the galaxies in The Local Group are elliptical in shape and the others are spiral or irregular. Galaxies are generally clustered in correct orientation and pulled together by their shared gravitational attraction. Andromeda galaxy (M31), the largest galaxy is this group has two spiral arms and a ring of dust (perhaps from a smaller galaxy M32). The Andromeda galaxy is our closest biggest galactic neighbour and it can be spotted with naked eye from Earth. Because of this proximity, Andromeda galaxy is used to study the origins and process of evolution of many galaxies. It is expected that Milky Way and Andromeda galaxies will collide with each other in about 4.5 billion years resulting in creation of a giant elliptical galaxy.

Studying the universe

Astronomers have studied the Milky Way, Andromeda and their associated galaxies for decades. The invigorating, diverse and fun field of astronomy has always intrigued



many scientists worldwide as most of the information about our universe still remains a mystery. Though even if we didn't know much about galaxies, life would still continue the way it is on our planet. Earth and our solar system comprise only a tiny region of the Milky Way galaxy. However, scientifically, galaxies are important because they help us to estimate the size of the ever-expanding universe as galaxies have formed the universe in the first place. So, studying about galaxies is crucial to understand and learn more about other parts of space outside our own solar system. Learning more about the cosmos gives us insights into questions like what or who else is out there, are there other long surviving species like humans, is there another intelligent race? Such questions are eternal to understanding the successful existence of our species on planet earth. The exploration of the universe is fuelled further by existing knowledge and added imagination, curiosity and inquisitiveness.

A new galaxy discovered

Researchers at University of Michigan have for the first time discovered a "long lost big sibling" of Milky Way galaxy called the M32p galaxy which had combined with Milky Way during its life period. This galaxy was bigger than any galaxy with its size being estimated to be more than 20 times heavier than our galaxy. It is observed that M32p was shredded and torn apart by Andromeda galaxy more than two billion years ago. This makes M32p as the third largest galaxy after Andromeda and Milky Way. Even though disrupted, galaxy M32p has left behind a trace of evidences to consolidate its existence in the past. These evidences were put together using computer models. The evidences include almost invisible halo stars (even larger than the whole Andromeda galaxy), a stream of stars and independent enigmatic compact galaxy M32. The invisible halo of stars, specifically, consists of remnants of smaller shredded galaxies and this fact is well established. The smaller companions of these invisible halo of stars are thought to be consumed by Andromeda therefore making it difficult to analyse one of such companions. However, while doing computer simulations scientists have understood that most of the stars which are in the outer halo of Andromeda (spherical region surrounding the galaxy's disk) seem to come by shredding of a "single" large galaxy which is then most likely M32p. This information in outer halo of Andromeda can be used to understand the largest galaxy which has been shredded by it. Andromeda, also called M31 is a huge spiral galaxy which is thought to have shredded many smaller counterparts over a long duration of time. These mergers are highly complex and not much detailed information has been deduced about them.

The information retrieved from this work published in Nature Astronomy is amazing to say the least. Firstly, it is now very clear how Andromeda's mysterious M32 satellite galaxy evolved as this study provides a way to reconstruct some details of the now dead galaxy. M32 is a unique, compact and elliptical galaxy having many young stars. Studying this shredded galaxy will then help us comprehend how Milky Way has evolved, progressed and has survived mergers. Methods used in this study can be utilized for other galaxies to determine their big galaxy mergers if any. It can shed light on causes and effects which fuel growth of galaxies and also their mergers. All such information when put together can help to further our understanding of the universe, a huge, beautiful place where we exist and of which our planet Earth is just a meagre part.

Source:
Richard D'Souza & Eric F. Bell 2018, 'The Andromeda galaxy's most important merger about 2 billion years ago as M32's likely progenitor', *Nature Astronomy,* ■

Towards a better understanding of depression and anxiety

Researchers have studied detailed effects of 'pessimistic thinking' which occurs in anxiety and depression

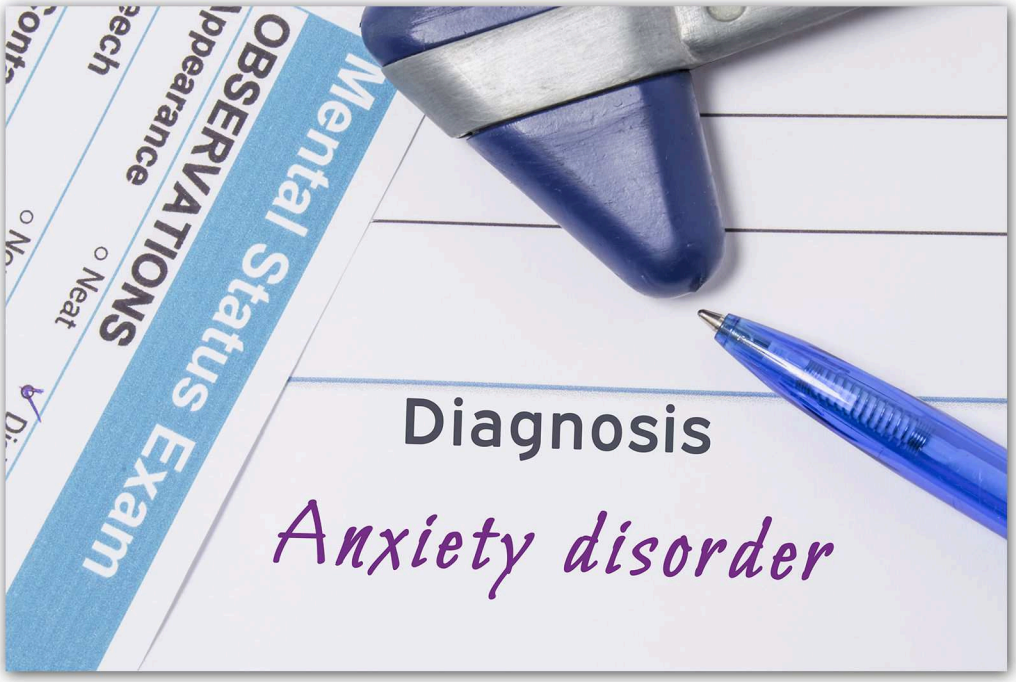
More More than 300 million and 260 million people worldwide suffer from depression and anxiety respectively. Many times, a person suffers from both these conditions. Psychiatric problems like depression and anxiety are devastating for patients and their families and they are extremely difficult to treat. Patients suffering from these neuropsychiatric disorders tend to experience a range of negative emotions and moods which makes them more pessimistic thereby making them focus more on the downside of any given situation. A specific personalised treatment can generally help patients alleviate some of the symptoms of these disorders. A type of psychotherapy – cognitive-behaviour therapy – is useful in curbing negative thoughts and emotions. Interpersonal therapy is also routinely used for better outcome for patients. Medications are also advised along with psychotherapy and sometimes interpersonal therapy.

Understanding the effects of depression and anxiety disorders

In a study published in Neuron scientists have studied how emotions are controlled by our brain. The main goal of researchers was to investigate if they could reproduce the effect on brain which happens to people suffering with depression, anxiety or other similar disorders. These patients have a highly negative thinking and they tend to place more weight on negative aspects and outcomes of any particular situation.

The group of researchers from MIT pinpointed a region in the brain which is linked to emotional decision making and is responsible for generating pessimistic moods. This region is called 'caudate nucleus' and when it is stimulated it leads to generation of negative moods and /or decisions. This study has been conducted in animals for now. The animal was seen to focus more on the negative drawbacks of situations and not on the benefits whenever this region was stimulated in their brain. This pessimistic decision-making continued for at least 24 hours after the first stimulation was performed. The same group of researchers had previously identified a neural circuit which is crucial for a type of decision making which is called as 'approach-avoidance conflict'. Making such choices requires a person to weigh the positive as well as negative aspects of a situation and this involves high levels of anxiety and sometimes stress. This stress obviously then affects the decision-making process. Therefore, animals got influenced and they then chose a high-risk option under stress anticipating better payoffs.

To make validations, researchers offered the animals a reward (juice) along with an unfriendly stimulus (a big puff of air to their face) and then stimulated their caudate nucleus with a minor electrical current. In every trial a different proportion for prize and pain was used to judge whether the animals will accept or reject. This is an



example of decision-making which requires analysis of cost and benefit. It was interesting to see that upon each stimulation, when the cost-benefit ratio became skewed i.e. more cost and less benefit, animals started rejecting combinations which they had previously accepted. This continued for up till 24 hours after the stimulation. This conveyed that animals started devaluing the reward which they were desiring earlier and their focus shifted more towards the cost part. Also, based upon their acceptance or rejection their brain activity in caudate nucleus changed whenever there was any change in the pattern of their decision-making. Therefore, this change in 'beta can serve as biomarker to see if the animals will respond to particular drugs.

Mood regulation

Researchers explained that some regions in the caudate nucleus are connected with the limbic system which is known to control a person's mood. This system directs input to motor areas of the brain as well as the dopamine-producing regions. The authors concluded that maybe caudate nucleus was disrupting this dopamine activity. Therefore, even a slight change in our system could mean rapid change our behaviour. The findings in this study could help us understand depression and anxiety in detail which can then assist us to develop new effective ways of therapy.

Source

Ken-ichi Amemori, Satoko Amemori, Daniel J. Gibson, Ann M. Graybiel. 2018 'Striatal Microstimulation Induces Persistent and Repetitive Negative Decision-Making Predicted by Striatal Beta-Band Oscillation', Neuron, DOI:10.1016/j.neuron.2018.07.022 ■

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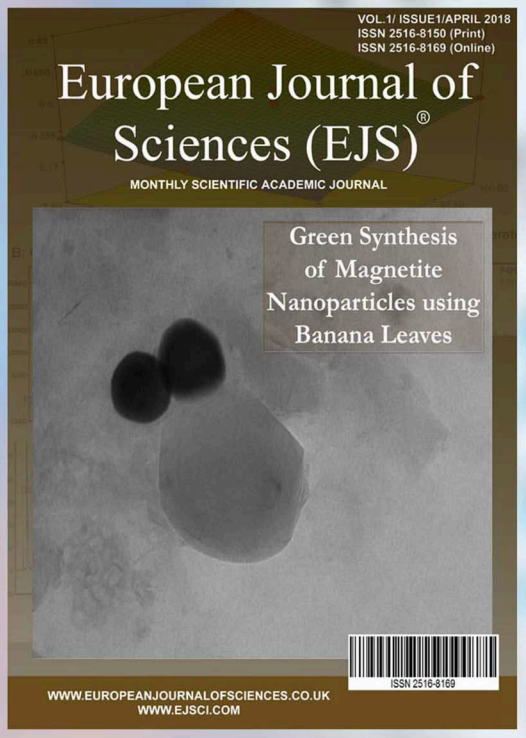

ISSN 2516-8150 (Print)
ISSN 2516-8169 (Online)

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Publisher's statement: European Journal of Sciences (EJS)® is both online and print scientific academic journal published by UK Education Consultancy Services Ltd, (Company Number 10459935 Registered in England); city: Tadworth, Surrey; Country of publication: United Kingdom, ISSN 2516-8150 (Print) ISSN 2516-8169 (Online)

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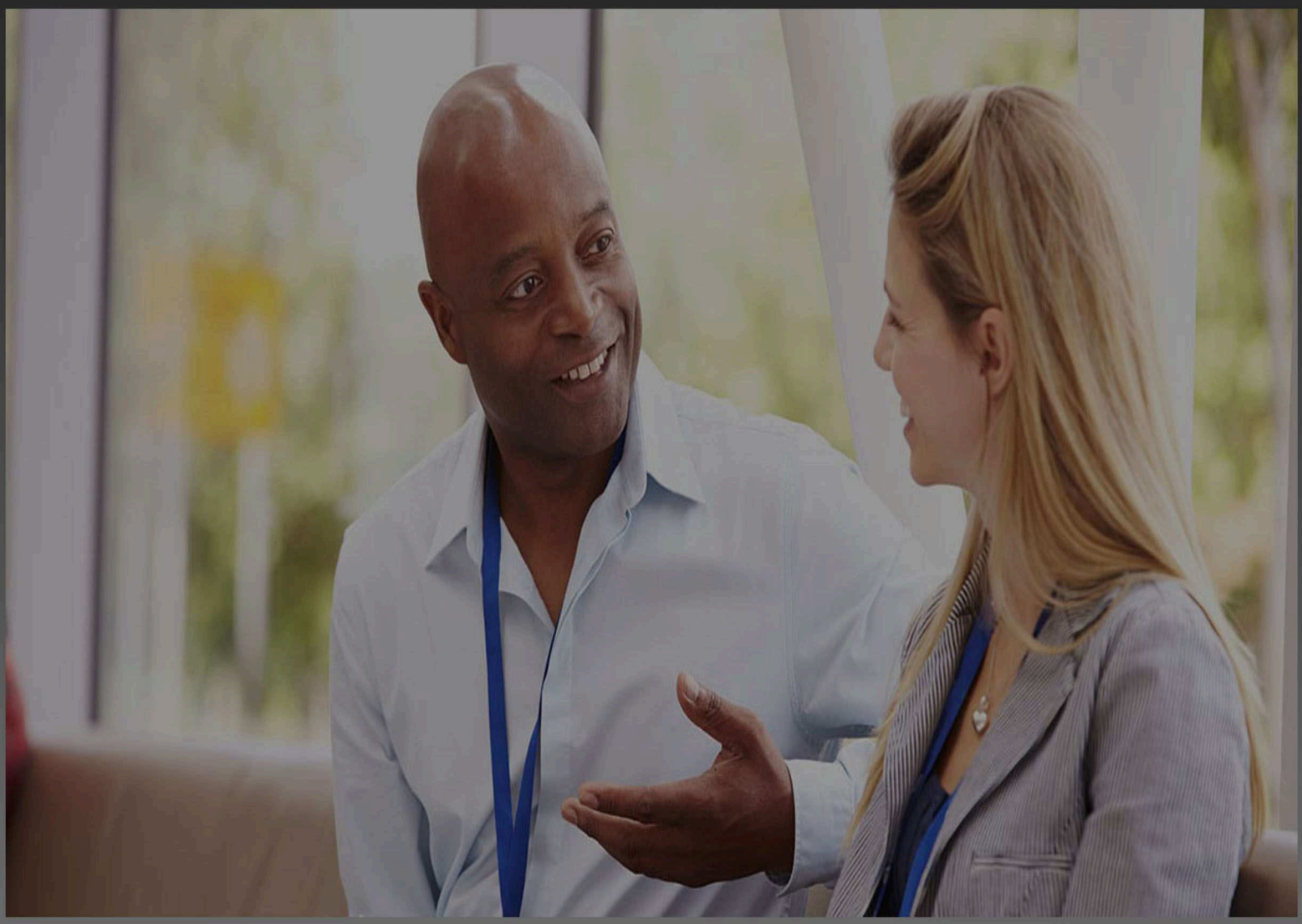

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