Gmail John Trotti <jtmorgal@gmail.com>

Ode to E Pluribus Unum for Sunday March 5 2023

1 message

John Trotti <jtrotti@gmail.com> Sun, Mar 5, 2023 at 2:41 AM
To: John Trotti <jtmorgal@gmail.com>

Ode to E Pluribus Unum for Sunday March 5 2023

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Our Increasingly Active Sun

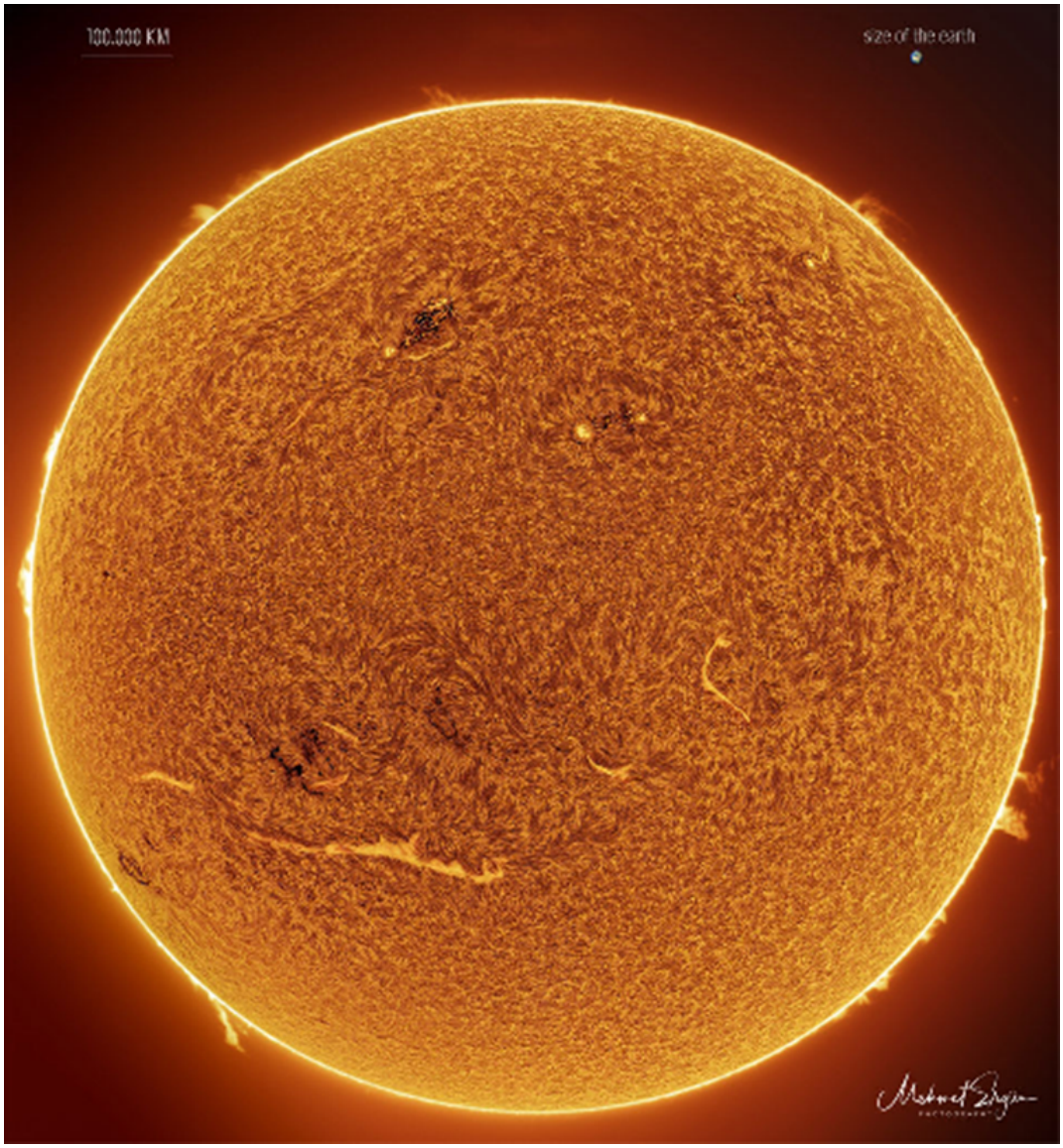

Image Credit & Copyright: Mehmet Ergün

Our Sun is becoming a busy place. Only two years ago, the Sun was emerging from a solar minimum so quiet that months would go by without even a single sunspot. In contrast, already this year and well ahead of schedule, our Sun is unusually active, already nearing solar activity levels seen a decade ago during the last solar maximum.

Our increasingly active Sun was captured two weeks ago sporting numerous interesting features. The image was recorded in a single color of light called Hydrogen Alpha, color-inverted, and false colored. Spicules carpet much of the Sun's face. The brightening towards the Sun's edges is caused by increased absorption of relatively cool solar gas and called limb darkening. Just outside the Sun's disk, several scintillating prominences protrude, while prominences on the Sun's face are known as filaments and show as light streaks. Magnetically tangled active regions are both dark and light and contain cool sunspots. As our Sun's magnetic field winds toward solar maximum over the next few years, whether the Sun's high activity will continue to increase is unknown.

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Battle for Iwo Jima Was at the Halfway Point 58 Years Ago

https://youtu.be/7uc2F7Vq7hY

A Marine-eye view.

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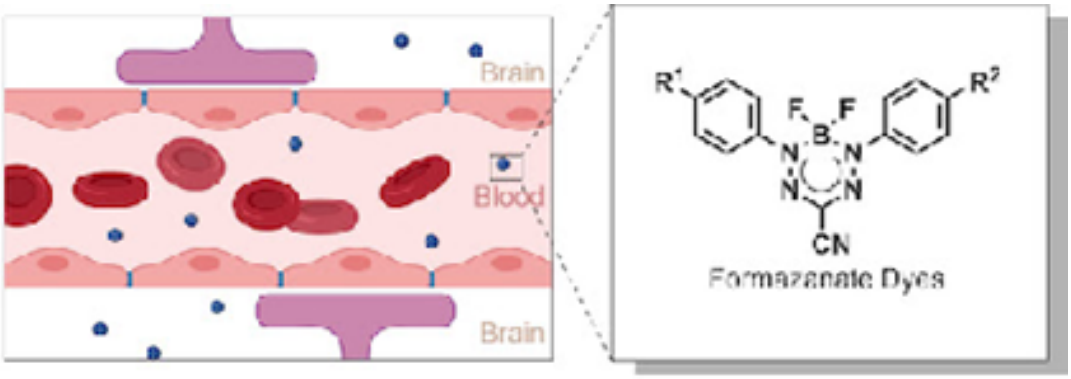
New Fluorescent Dye Can Light Up the Brain

Rice U. lab develops imaging tool that holds promise for cancer treatment



The formanzanate NIR-II small-molecule dye developed by Rice University chemist Han Xiao and collaborators is currently the only one of its kind that can cross the blood-brain barrier.
(Image courtesy of Xiao lab/Rice University)

Talk about a bright idea: Thanks to chemists at Rice University and Stanford University, lighting up the brain is no longer just a figure of speech.

Rice's Han Xiao, Stanford's Zhen Cheng and collaborators have developed a new tool for noninvasive brain imaging that can help illuminate hard-to-access structures and processes. Their small-molecule dye, or fluorophore, is the first of its kind that can cross the blood-brain barrier. What's more, it allowed the researchers to differentiate between healthy brain tissue and a glioblastoma tumor in mice.

"This could be very useful for imaging-guided surgery, for example," Xiao said. "Using this dye, a doctor could determine where the boundary is between normal brain tissue versus tumor tissue."

The study is featured on the cover of the Dec. 28 issue of the Journal of the American Chemical Society.

If you've been to an aquarium or a nightclub, you've probably noticed the colorful glow that some objects or surfaces emit under a black light. Known as fluorescence, this glowing effect can be useful for rendering visible things that otherwise go unnoticed.

"Fluorescence imaging has been applied for imaging cancer in different parts of our body," Xiao said. "The advantages of a fluorescence probe include high resolution and the ability to adapt the probe to read for different substances or activities."

The NIR-II small-molecule dye developed by the lab of Rice University chemist Han Xiao is featured on the cover of the Dec. 28 issue of the Journal of the American Chemical Society. (Image courtesy of Xiao lab/Rice University)

The deeper a tissue or organ is, the longer the wavelengths needed to discern the presence of fluorescent small molecules. For this reason, the second near-infrared (NIR-II) channel with wavelengths of 1,000 to 1,700 nanometers is especially important for deep-tissue imaging. For reference, visible light wavelengths range from 380 to 700 nanometers.

"Our tool is really valuable for deep imaging because it functions in the NIR-II region," Xiao said. "In contrast to NIR-II wavelengths, fluorescent effects within the visible spectrum or with near-infrared wavelengths between 600 and 900 nanometers (NIR-I) will only get you skin-deep."

Brain imaging poses a particular challenge not only because of tissue depth and accessibility, but also because of the blood-brain barrier, a layer of cells that acts as a very selective filter to restrict the passage of substances from the circulatory system to the central nervous system.

"People always want to know what exactly is happening in the brain, but it's very hard to design a molecule that can penetrate the blood-brain barrier. Up to 98% of small-molecule drugs approved by the Food and Drug Administration (FDA) cannot," Xiao said.

"Generally speaking, the reason a NIR-II dye molecule tends to be big is because it is a conjugated structure with many double bonds," he continued. "This is a true problem and the reason why we have been unable to use fluorescence in brain imaging until now. We tried to address this issue by developing this new dye scaffold that is very small but has a long emission wavelength."

Unlike the other two known NIR-II dye scaffolds, which are not capable of crossing the blood-brain barrier, the one developed by Xiao is more compact, which makes it a great candidate for probes or drugs targeting the brain. "In the future, we could modify this scaffold and use it to look for a lot of different metabolites in the brain," Xiao said.

Beyond the brain, the dye developed by Xiao has much greater lasting power than indocyanine green, the only NIR small-molecule dye approved by the FDA for use as a contrast agent. A longer lifespan means researchers have more time to record the fluorescent trace before it disappears.

"When exposed to light, the indocyanine green dye trace deteriorates in seconds, whereas our dye leaves a stable trace for more than 10 minutes," Xiao said.

The research was supported by the Cancer Prevention Research Institute of Texas (RR170014), the National Institutes for Health (GM133706, CA255894), the Department of Defense (W81XWH-21-1-0789), the Robert A. Welch Foundation (C-1970, C-0807), the National Science Foundation (1803066, 2203309), a Hamill Innovation Award, the John S. Dunn Foundation Collaborative Award and the Stanford University Department of Radiology.

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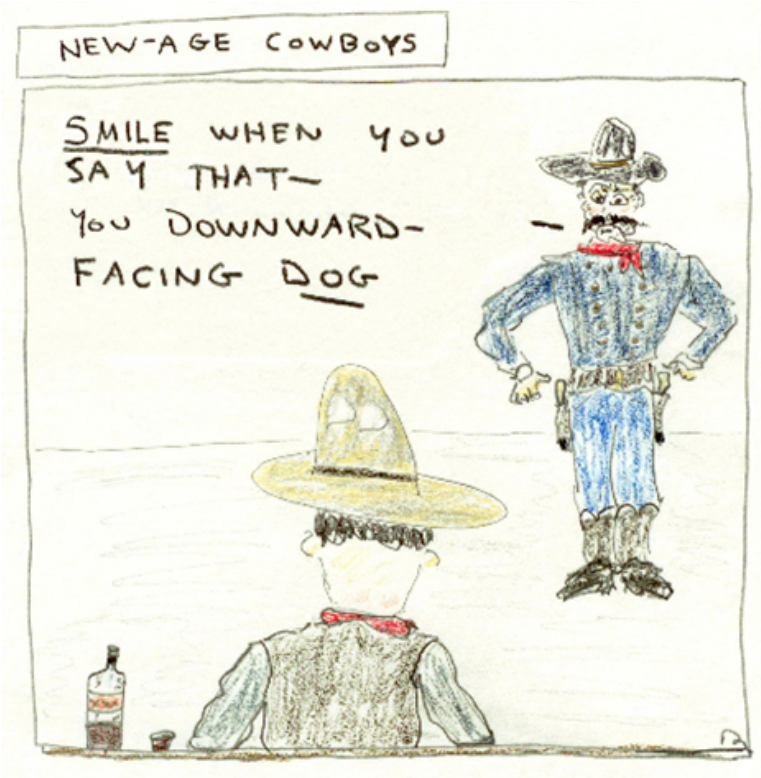

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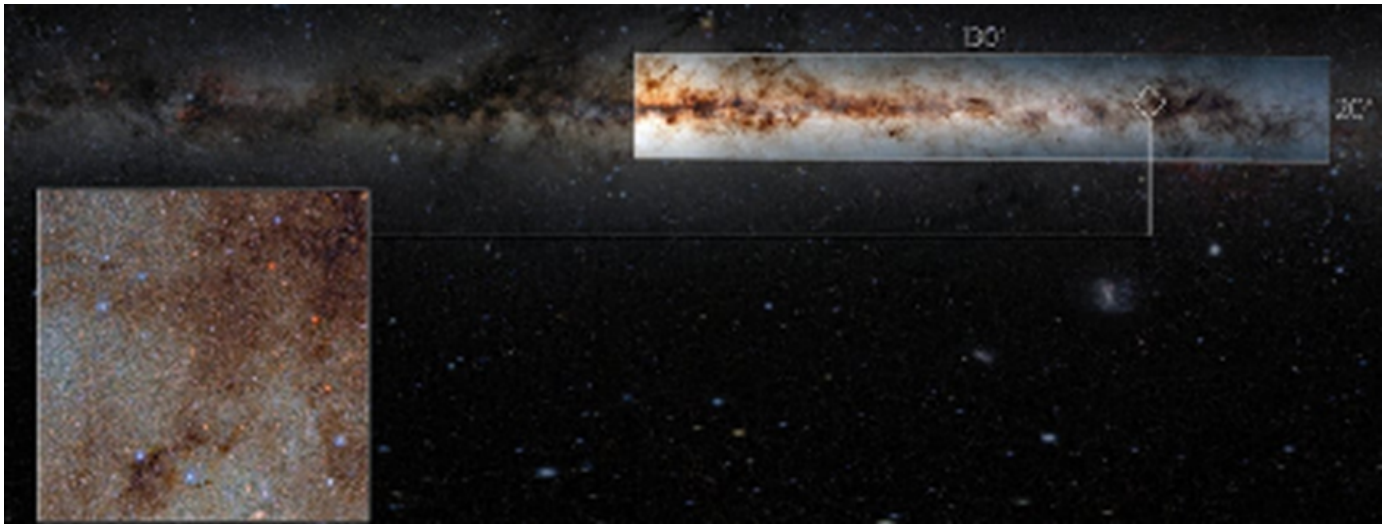
Enormous Panorama of the Milky Way Reveals Billions of Celestial Objects



https://bit.ly/3HkjZ8w

Five years hence it'll be trillions

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Polish Chicken 'The Po'

Feathers and head gear identify what we know
Is the Polish Hen, monick'erd 'The Po'
Translated from the Dutch word "head"
In the 16th century, the Po's popularity spread.
With colorful feathers, and tiny white eggs
In French society, they were strutting 'celebs'.
Enhancing a comb and heavy-overhanging crest
Po's limited eyesight was put to a test.
Easily wandering and without sight of direction
The Po favors and seeks its own flock's protection.
Like the Po we enjoy parading our feathers
Sharing and broadcasting our personal endeavors
When push comes to shove
And our security is threatened
Safety in numbers is our social weapon.

Francie Troy

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Four Key Genes May Explain How The Largest Whales Got So Big

Their size and lifespan are a recipe for cancer, a disease whales don't get.

The largest whales got to be so big and cancer-free thanks to four key genes.
Image credit: Chase Dekker / Shutterstock.com

The blue whale is not only the biggest animal on Earth, but it's also the largest ever to have existed on the planet. They can reach lengths of 33 meters (108 feet), and are three times the weight of the second largest fin whales, but how did they get so be so big?

New research has pinned down the pivotal role four genes played in not only promoting the enormous body sizes of whales, but also protecting them from the increased risk of cancer that typically affects larger animals. The cetaceans owe a lot to GHSR, IGFBP7, NCAPG, and PLAG1.

Identifying these four pivotal genes started with looking at a group of nine. Five of these related to the growth hormone/insulin-like growth factor axis, and the other four were associated with big body sizes in the hoofed animals, Artiodactyls, which despite being land-dwelling animals are actually related to whales.

The researchers on the study wanted to investigate the role of these genes across 19 species of whales, including seven giants that were classed as whale species over 10 meters long and included sperm whales, bowhead whales, gray whales, humpback whales, North Pacific right whales, fin whales, and – of course – blue whales.

If you need some context to visualize the enormity of these animals, here's how the smallest and biggest whales in the ocean compare against humans, an early cetacean mammal (*Pakicetus*), plus a pig who counts as one of those distantly related hoofed animals we were talking about. Oh, and Godzilla.

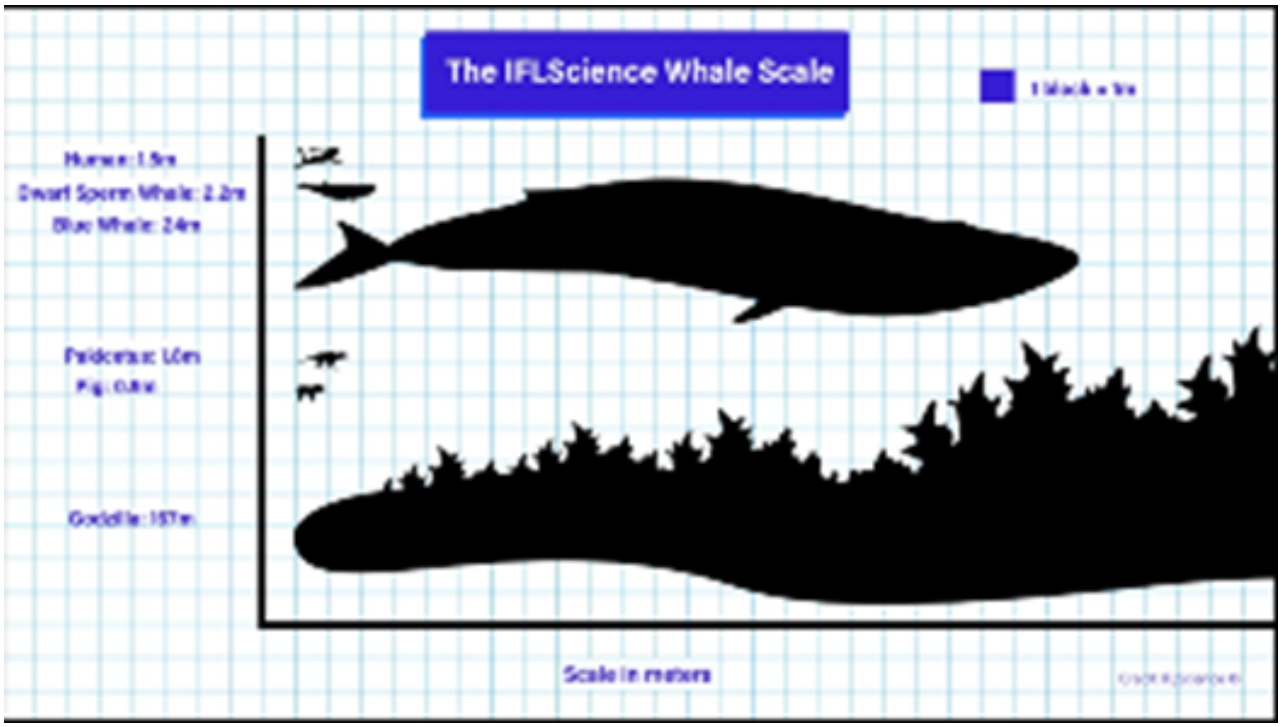

Image credit: (C) IFLScience

For the two groups of genes, researchers were able to identify four that were positively associated with the big boys of whales, with GHSR and IGFBP7 falling into the growth hormone/insulin-like growth factor axis group, and NCAPG and PLAG1 from the big, hoofed animal group. It's therefore the researchers' conclusions that these are four key ingredients to growing massive whales, but two of the genes in particular may have further influence in these animals' risk of disease.

"There's a joke that whales should be born with cancer and not even able to exist," Vincent Lynch, from the University at Buffalo, New York – who is not an author on the new study – told New Scientist. "They're just too big."

Whales seem almost perfectly designed to get cancer. As well as growing to enormous sizes they also live for ages: the bowhead whale in particular is thought to be one of the longest-living animals on the planet, with a maximum lifespan thought to stretch over two centuries. Age and size are both risk factors for cancer, but two of the genes identified in this new study may explain why whales still don't get it.

Both GHSR and IGFBP7 from the growth hormone/insulin-like growth factor axis group may suppress whales' cancer risk. This is because the GHSR gene influences the cell cycle (cancer is a disease caused when cells divide uncontrollably and spread into surrounding tissues), while IGFBP7 is already known to suppress several cancers.

So, the oceans' whales are free to get as big as they like seemingly free of the threat of cancer, and we humans were lucky enough to get to share the planet at a time when they reached their most ridiculous. Now, if we could just keep them from going extinct, that would be great.

The study was published in Scientific Reports.

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Acting Out Dreams Predicts Parkinson's and Other Brain Diseases

Enacted dreams could be an early sign of Parkinson's disease.

Credit: *Deena So'Oteh*

http://bit.ly/3D474Fg

This article was originally published with the title "When Dreams Foreshadow Brain Disease" in Scientific American 328, 2, 56-63 (February 2023) doi:10.1038/scientificamerican0223-56

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NASA and DARPA Will Build a Nuclear Rocket by 2027

By Brett Tingley

NASA wants to design and demonstrate a working nuclear thermal rocket by 2027.

NASA Administrator Bill Nelson introduced the project on Tuesday (Jan. 24) during a presentation at the 2023 American Institute of Aeronautics and Astronautics (AIAA) SciTech Forum and Exposition held in National Harbor, Maryland. Nelson said that the agency will partner with the Pentagon's Defense Advanced Research Projects Agency (DARPA) in order to "develop and demonstrate advanced nuclear thermal propulsion, a revolutionary technology that will allow the United States to expand the possibilities for future human spaceflight missions."

Under the agreement, NASA will join DARPA's Demonstration Rocket for Agile Cislunar Operations, or DRACO, a program that began in 2021. The program seeks to develop a nuclear thermal engine that will be used by an experimental spacecraft designed by DARPA. DARPA will develop the nuclear reactor and engine for this nuclear rocket, which the agency and NASA hope to fly in an in-space demonstration as early as 2027. Nelson called the partnership an "exciting investment in the future of human space exploration" and "a major investment in getting to Mars."

"DRACO will be a critical part of evaluating the technologies that will take us deeper into the solar system," NASA Deputy Administrator Pam Melroy said during the presentation. "Our intent is to lead and develop a blueprint for human exploration and sustained presence throughout the solar system. That is a very important goal. And we think that these advanced technologies will be a critical part of it."

NASA and DARPA released an interagency agreement(opens in new tab) outlining the roles and responsibilities of each agency; the agreement grants NASA final authority over the nuclear thermal rocket engine's development and fabrication. However, the agreement grants DARPA authority over the "experimental NTR vehicle (X-NTRV)," the spacecraft that will be powered by the planned nuclear rocket engine, and DARPA will be responsible for operating and disposing of the X-NTRV in orbit.

"NASA has a long history of collaborating with DARPA on projects that enable our respective missions, such as in-space servicing," Melroy said. "Expanding our partnership to nuclear propulsion will help drive forward NASA's goal to send humans to Mars."

This vision for a nuclear rocket dates back decades(opens in new tab). NASA's Nuclear Engine for Rocket Vehicle Application, or NERVA program, sought to launch a crewed Mars mission in 1979 powered by a nuclear rocket. The program was canceled in 1972 due to budget cuts and worries of escalating the Cold War.

Sending humans to Mars has become one of the primary spaceflight goals of government space agencies and private spaceflight firms alike. NASA's Artemis program is part of the agency's "Moon to Mars" vision that will leverage what NASA will learn from its planned lunar exploration to work toward establishing a human presence on the Red Planet.

SpaceX, meanwhile, says it will soon launch orbital flight of its Starship vehicle that the company plans on eventually landing on Mars; other private space companies are working to beat that goal.

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Antidepressants Could Fuel the Rise of Superbugs

A lab study suggests that antidepressants may push bacteria to become superbugs.

Antidepressants can spur the development of antibiotic resistance in bacteria in lab dishes.
(Image credit: Rodolfo Parulan Jr. via Getty Images)

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Selling the seas

Location: A remote island in the South Pacific with limited connectivity to the outside world. Population: Around 2,500 locals, a dozen or so tourists and countless whales. With 4G set to arrive this year, conservationists ask themselves how it will affect locals, wildlife conservation and whale-focused tourism.

http://bit.ly/3lk4jtj

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Encouraging Information - The Brain of an Older Person.

The surprise has arrived!

Healthy human brain compared with 90 year old brain

documentingreality.com

The director of the George Washington University School of Medicine maintains that the brain of an elderly person is much more practical than is commonly believed. At this age, the interaction of the left and right hemispheres of the brain becomes harmonious, which expands our creative possibilities. That is why among people over the age of 60 you can find many personalities who have just started their creative activities.

Of course, the brain is no longer as fast as it was in youth. However, it gains in flexibility. Therefore, with age, we are more likely to make the right decisions and less exposed to negative emotions. The peak of human intellectual activity occurs around the age of 70, when the brain begins to work in full force.

Over time, the amount of myelin in the brain increases, a substance that facilitates the rapid passage of signals between neurons. Due to this, intellectual abilities increase by 300% compared to the average.

Also interesting is the fact that after 60 years a person can use 2 hemispheres at the same time. This allows you to solve much more complex problems.

Professor Monchi Uri, from the University of Montreal, believes that the elderly brain chooses the path that consumes less energy, eliminates the unnecessary and leaves only the right options to solve the problem. A study was conducted in which different age groups participated. The young people were very confused while passing the tests, while those over 60 years old made the right decisions.

Now, let's look at the characteristics of the brain between the ages of 60 and 80. They are really pink.

Characteristics of the brain of an older person.

1. The neurons of the brain do not die, as everyone around you says. The connections between them simply disappear if one does not engage in mental work.

2. Distraction and forgetfulness arise due to an overabundance of information. Therefore, you do not need to focus your whole life on unnecessary trifles.

3. From the age of 60, a person when making decisions does not use only one hemisphere of the brain, like young people, but both.

4. Conclusion: if a person leads a healthy lifestyle, is mobile, has viable physical activity and is fully mentally active, intellectual abilities DO NOT decline with age, they simply GROW, reaching a peak

at the age of 80-90 years.

Healthy tips:

1) Don't be afraid of old age.

2) Strive to develop intellectually.

3) Learn new crafts, make music, learn to play musical instruments, paint pictures! Dance!

4) Take an interest in life, meet and communicate with friends, make plans for the future, travel as best you can.

5) Don't forget to go to shops, cafes, shows.

6) Don't shut up alone, it's destructive for anyone.

7) Be positive, always live with the thought: following: "all good things are still ahead of me!"

Source: New England Journal of Medicine.

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More to E. Coli than Meets the Eye:

BME Lab Discovers Evidence of Multicellularity in Single Cell Organism

Researchers in the Wallace H. Coulter Department of Biomedical Engineering at Georgia Tech and Emory University have uncovered something new in one of the most studied organisms on Earth, and their discoveries could impact the treatment and prevention of devastating bacterial diseases.

Escherichia coli, or E. coli, gets a bad rap, and for good reason. This diverse group of bacteria that live in our intestines are mostly harmless and play an important role in sustaining a healthy digestive system. But some E. coli are among the most virulent disease-causing micro-organisms.

Pathogenic E. coli takes a deadly, costly toll on humanity, costing billions of dollars to treat and killing millions of people worldwide each year. It’s responsible for diarrheal diseases, peritonitis, colitis, respiratory illness and pneumonia, and other illnesses, and is the main cause in 80% of urinary tract infections, which are the most common bacterial infection.

Consequently, researchers have been keen to learn everything they can about E. coli for the past century or so. They have probed it from every angle, synthesized it, scrutinized it to the extent that, many people believe, there isn’t much else to learn.

“It’s probably the best studied and best understood organism on the planet,” said Kyle Allison, assistant professor in the Coulter Department. “And so, there’s a tendency among microbiologists, particularly in the last 20 years or so, to focus more on other microbes.”

But Allison and his colleagues have taken a closer look at E. coli and their research is yielding novel insights, and raising new questions, about of this prevalent unicellular organism. For one thing, it appears that E. coli may not always be unicellular. The research team explained it all in their study, “Evidence of a possible multicellular life cycle in Escherichia coli,” published this month in the journal iScience.

“We’ve identified some things that have never been seen before in bacteria,” said Allison, whose Emory-based lab closely studies individual bacteria to better understand antibiotic resistance and multicellular biofilms. Collaborating with Allison were two members of his lab, graduate researcher Devina Puri, who was the lead author, and postdoctoral researcher Xin Fang.

Microbe Communities

In nature, bacteria live in communities called biofilms, which are clusters of microbes encased in a self-made, self-sustaining slime matrix, and attached to many kinds of wet surfaces. They’re everywhere around us and inside of us. Common, everyday examples of biofilms include dental plaque and pond scum.

They can grow on plant and animal tissue, like the inside of our digestive tract, and cause serious infections. On top of that, the bacteria living inside a biofilm's protective matrix are less likely to be affected by antibiotics.

"We know that biofilms are clinically important, particularly in relation to infection," said Allison, who noted that approximately 80% of all bacterial infections have a biofilm component. "And almost any bacteria that's ever been studied can make them."

For this study, Allison's team developed devices that combined microfluidics and agarose pads (which are used for live cell imaging) and used automated microscopy to track and record morphogenesis in E. coli.

They discovered something new – a multicellular self-assembly process in E. coli. Researchers observed unattached, single-celled organisms combining into four-cell rosettes, a natural multicellular formation thought to be uncommon in bacteria.

"Rosettes are rather significant in higher organisms, like mammals, because they initiate developmental processes like embryogenesis," Allison said.

Multicellular Chains

They observed E. coli rosettes grow into constant-width chains, which continue growing for 10 generations before attaching to a surface and creating a biofilm. They saw and recorded the bacterial processes that had never been seen or recorded before.

"What we're seeing here is bacteria maybe are not what we've considered them to be in the past," Allison said. "My suspicion is that what we found is far more common that we knew."

What they learned about the diversity of E. coli and biofilms has implications for synthetic biology, the treatment and prevention of bacterial diseases, and our understanding of multicellular development. For example, Allison can see his lab's study being useful as a blueprint for other areas of research – biofilm engineering, for example, which harnesses the beneficial uses of microbial communities, resulting in programmable biofilms.

"Based on what we've learned, probably the most effective approach to biofilm engineering is to let the organisms do what they want to do," Allison said. "Then, for the last stage, the idea would be to program it to do what you need it to do – create a molecule for drug development, express an enzyme to help degrade a bioplastic, or something harmful in the environment. Our work gives some clear evidence on how to proceed."

CITATION: *Devina Puri, Xin Fang, Kyle R. Allison. "Evidence of a possible multicellular life cycle in Escherichia coli." iScience (Jan. 2023).* ***https://doi.org/10.1016/j.isci.2022.105795***

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Strutted Airliner Might Replace 737

By Russ Niles

Boeing says its collaboration with NASA on a highly efficient single-aisle airliner could lead to a replacement for the 737. In an earnings call on Wednesday, Boeing CEO Dave Calhoun confirmed that the Sustainable Flight Demonstrator meets the "standard needed to launch a commercial airplane" with its major increases in fuel efficiency. "The program that we've embarked on here is how do you commercialize it?" Calhoun told the call. "So, there's real intent there to be able to do it."

NASA is kicking in $425 million of the $1.2 billion cost of building a prototype of the new airliner with its long "transonic truss-braced" wings. The glider-like wings will cut drag and improve efficiency by up to 30 percent over the 737 MAX and Airbus A320neo. NASA said it wants to see the design become commercially viable, and Calhoun said that's where the project is headed. "It will definitely have a role to play someday in the narrowbody world," Calhoun said.

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Got Gophers? Maybe Propane's the Answer

https://www.youtube.com/watch?v=LzApW0WsVfs

Or maybe not.

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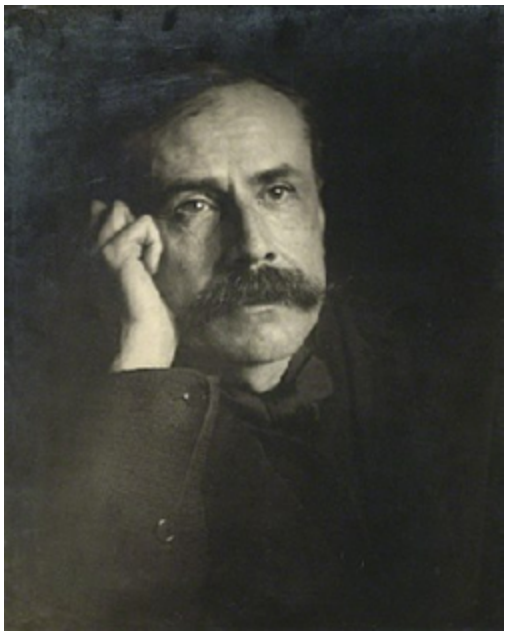
Nimrod: The Mighty Hunter: Enigma Variations

'Nimrod' is the name given to the ninth and best-known variation in Edward Elgar's Enigma Variations, an orchestral work of 14 variations on an original theme composed between 1898 and 1899.



The sombre nature of this variation means it is also a widely popular choice for funerals. Similar to Barber's Adagio for Strings, 'Nimrod' achieves tearjerker status through long phrases of swelling dynamics and undulating melody, building slowly to an emotional climax. The peaks of the work are signaled by timpani rolls, heightening the anticipation of its spine-tingling moments of impact. Moments of dissonance are resolved quickly, but remain just long enough to make their presence felt, therefore intensifying the sense of emotional relief in its dissipation.

Elgar described how on the evening of 21 October 1898, after a tiring day's teaching, he sat down at the piano. A melody he played caught the attention of his wife and he began to improvise variations on it in styles which reflected the character of some of his friends. These improvisations, expanded and orchestrated, became the Enigma Variations.

US Marine Corps Band https://youtu.be/jAUlEopJxa4
Chicago Symphony https://youtu.be/sUgoBb8m1eE
Stephen Buzard Pipe Organ version https://youtu.be/F20w5Mb7PcA

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National Geographic 'Pictures of the Year' Photo Contest

See all 10 of the top photographs and find out how perseverance—and a ton of patience—got Karthik Subramaniam the grand-prize-winning shot.

http://bit.ly/3Zhvjly

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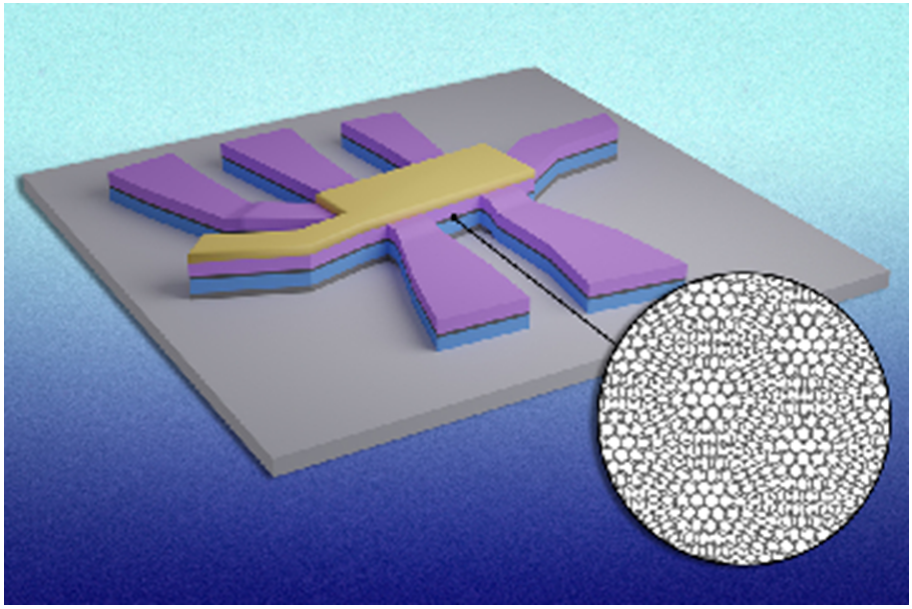
Superconductivity Switches on and off in "Magic-Angle" Graphene

A quick electric pulse completely flips the material's electronic properties, opening a route to ultrafast, brain-inspired, superconducting electronics.



MIT physicists have found a new way to switch superconductivity on and off in magic-angle graphene. This figure shows a device with two graphene layers in the middle (in dark gray and in inset). The graphene layers are sandwiched in between boron nitride layers (in blue and purple). The angle and alignment of each layer enables the researchers to turn superconductivity on and off in graphene with a short electric

pulse.

Credit: Courtesy of the researchers. Edited by MIT News.

With some careful twisting and stacking, MIT physicists have revealed a new and exotic property in "magic-angle" graphene: superconductivity that can be turned on and off with an electric pulse, much like a light switch.

The discovery could lead to ultrafast, energy-efficient superconducting transistors for neuromorphic devices — electronics designed to operate in a way similar to the rapid on/off firing of neurons in the human brain.

Magic-angle graphene refers to a very particular stacking of graphene — an atom-thin material made from carbon atoms that are linked in a hexagonal pattern resembling chicken wire. When one sheet of graphene is stacked atop a second sheet at a precise "magic" angle, the twisted structure creates a slightly offset "moiré" pattern, or superlattice, that is able to support a host of surprising electronic behaviors.

In 2018, Pablo Jarillo-Herrero and his group at MIT were the first to demonstrate magic-angle twisted bilayer graphene. They showed that the new bilayer structure could behave as an insulator, much like wood, when they applied a certain continuous electric field. When they upped the field, the insulator suddenly morphed into a superconductor, allowing electrons to flow, friction-free.

That discovery was a watershed in the field of "twistronics," which explores how certain electronic properties emerge from the twisting and layering of two-dimensional materials. Researchers including Jarillo-Herrero have continued to reveal surprising properties in magic-angle graphene, including various ways to switch the material between different electronic states. So far, such "switches" have acted more like dimmers, in that researchers must continuously apply an electric or magnetic field to turn on superconductivity, and keep it on.

Now Jarillo-Herrero and his team have shown that superconductivity in magic-angle graphene can be switched on, and kept on, with just a short pulse rather than a continuous electric field. The key, they found, was a combination of twisting and stacking.

In a paper appearing today in *Nature Nanotechnology*, the team reports that, by stacking magic-angle graphene between two offset layers of boron nitride — a two-dimensional insulating material — the unique alignment of the sandwich structure enabled the researchers to turn graphene's superconductivity on and off with a short electric pulse.

"For the vast majority of materials, if you remove the electric field, zzzzip, the electric state is gone," says Jarillo-Herrero, who is the Cecil and Ida Green Professor of Physics at MIT. "This is the first time that a superconducting material has been made that can be electrically switched on and off, abruptly. This could pave the way for a new generation of twisted, graphene-based superconducting electronics."

His MIT co-authors are lead author Dahlia Klein PhD '21, graduate student Li-Qiao Xia, and former postdoc David MacNeill, along with Kenji Watanabe and Takashi Taniguchi of the National Institute for Materials Science in Japan.

Flipping the switch

In 2019, a team at Stanford University discovered that magic-angle graphene could be coerced into a ferromagnetic state. Ferromagnets are materials that retain their magnetic properties, even in the absence of an externally applied magnetic field.

The researchers found that magic-angle graphene could exhibit ferromagnetic properties in a way that could be tuned on and off. This happened when the graphene sheets were layered between two sheets of boron nitride such that the crystal structure of the graphene was aligned to one of the boron nitride layers. The arrangement resembled a cheese sandwich in which the top slice of bread and the cheese orientations are aligned, but the bottom slice of bread is rotated at a random angle with respect to the top slice. The result intrigued the MIT group.

"We were trying to get a stronger magnet by aligning both slices," Jarillo-Herrero says. "Instead, we found something completely different."

In their current study, the team fabricated a sandwich of carefully angled and stacked materials. The "cheese" of the sandwich consisted of magic-angle graphene — two graphene sheets, the top rotated slightly at the "magic" angle of 1.1 degrees with respect to the bottom sheet. Above this structure, they placed a layer of boron nitride, exactly aligned with the top graphene sheet. Finally, they placed a second layer of boron nitride below the entire structure and offset it by 30 degrees with respect to the top layer of boron nitride.

The team then measured the electrical resistance of the graphene layers as they applied a gate voltage. They found, as others have, that the twisted bilayer graphene switched electronic states, changing between insulating, conducting, and superconducting states at certain known voltages.

What the group did not expect was that each electronic state persisted rather than immediately disappearing once the voltage was removed — a property known as bistability. They found that, at a particular voltage, the graphene layers turned into a superconductor, and remained superconducting, even as the researchers removed this voltage.

This bistable effect suggests that superconductivity can be turned on and off with short electric pulses rather than a continuous electric field, similar to flicking a light switch. It isn't clear what enables this switchable superconductivity, though the researchers suspect it has something to do with the special alignment of the twisted graphene to both boron nitride layers, which enables a ferroelectric-like response of the system. (Ferroelectric materials display bistability in their electric properties.)

"By paying attention to the stacking, you could add another tuning knob to the growing complexity of magic-angle, superconducting devices," Klein says.

For now, the team sees the new superconducting switch as another tool researchers can consider as they develop materials for faster, smaller, more energy-efficient electronics.

"People are trying to build electronic devices that do calculations in a way that's inspired by the brain," Jarillo-Herrero says. "In the brain, we have neurons that, beyond a certain threshold, they fire. Similarly, we now have found a way for magic-angle graphene to switch superconductivity abruptly, beyond a certain threshold. This is a key property in realizing neuromorphic computing."

This research was supported in part by the U.S. Air Force Office of Scientific Research, the U.S. Army Research Office, and the Gordon and Betty Moore Foundation.

By Jennifer Chu | MIT News Office

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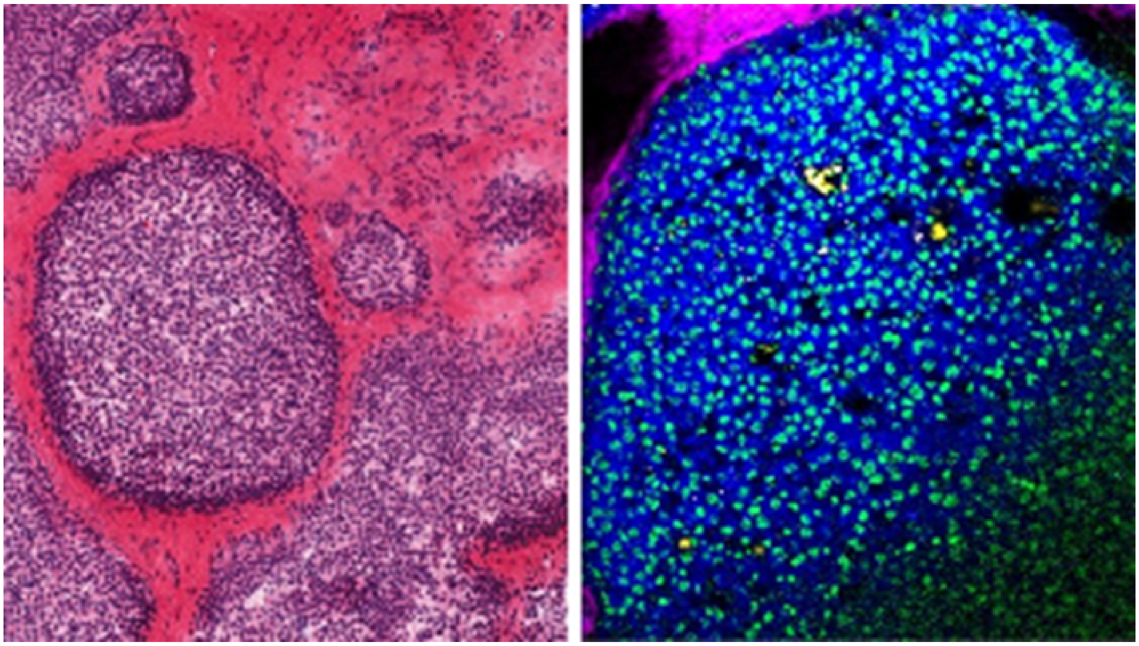
Microcalcification 'Fingerprints' Can Yield Info About Cancer



Left, a pathology stain of a ductal carcinoma, showing cells and connective tissue. Right, a Raman mapping of the calcification, which was captured by a technique that detects the distinct vibrational signatures of a biological molecule's organic and inorganic chemistries.

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Heavyweights Rise to Meet Weighty Challenges

If you ever feel a little bit stupid, just up and read this again; you'll begin to think you're a genius.

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(On September 17, 1994, Alabama's Heather Whitestone was selected as Miss America 1995.)

Question: If you could live forever, would you and why?

Answer: "I would not live forever, because we should not live forever, because if we were supposed to live forever, then we would live forever, but we cannot live forever, which is why I would not live forever,"

--Miss Alabama in the 1994 Miss USA contest.

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"Whenever I watch TV and see those poor starving kids all over the world, I can't help but cry. I mean I'd love to be skinny like that, but not with all those flies and death and stuff."

--Mariah Carey

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"Smoking kills. If you're killed, you've lost a very important part of your life,"

-- Brooke Shields, during an interview to become spokesperson for federal anti-smoking campaign

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"Outside of the killings, Washington has one of the lowest crime rates in the country,"

--Mayor Marion Barry, Washington , DC .

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"It isn't pollution that's harming the environment. It's the impurities in our air and water that are doing it.."

--Al Gore, Vice President

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"I love California . I practically grew up in Phoenix .."

-- Dan Quayle

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"We've got to pause and ask ourselves: How much clean air do we need?"

--Lee Iacocca

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"The word "genius" isn't applicable in football. A genius is a guy like Norman Einstein."

--Joe Theisman, NFL football quarterback & sports analyst.

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"We don't necessarily discriminate. We simply exclude certain types of people."

-- Colonel Gerald Wellman, ROTC Instructor.

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"Your food stamps will be stopped effective March 1992 because we received notice that you passed away. May God bless you. You may reapply if there is a change in your circumstances."

--Department of Social Services, Greenville , South Carolina

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"Traditionally, most of Australia 's imports come from overseas."

--Keppel Enderbery

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"If somebody has a bad heart, they can plug this jack in at night as they go to bed and it will monitor their heart throughout the night. And the next morning, when they wake up dead, there'll be a record."

--Mark S. Fowler, FCC Chairman

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I received several emails relating to stupidity on the same day. While I've never claimed to be in the same universe with Norman Einstein, I'm getting the feeling that maybe my brain is ready for an octogenarian overhaul and a dose of Andy Granatelli's STP.

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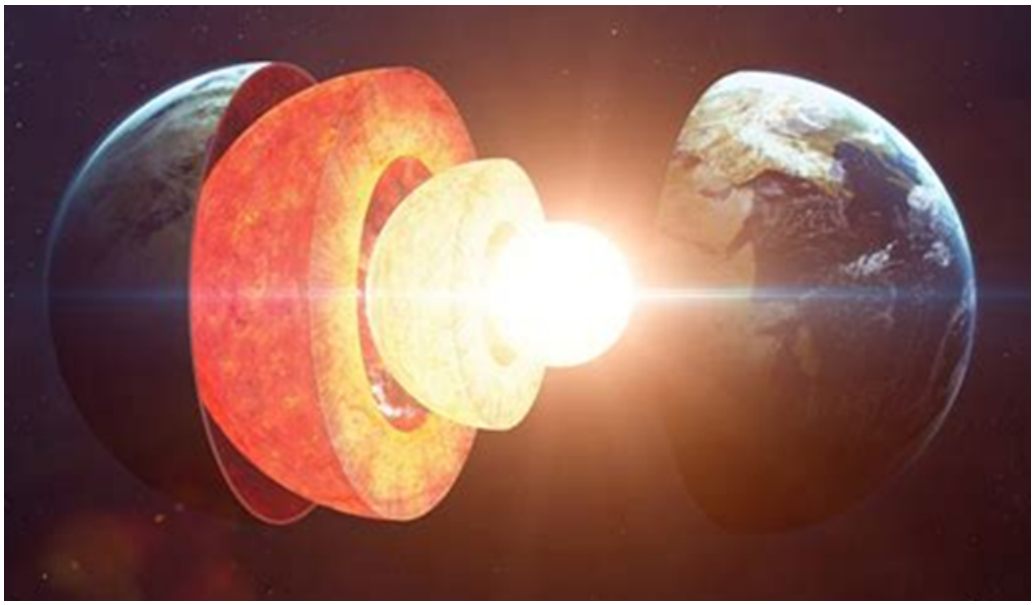
New Insights into What Makes Plate Tectonics Possible

Using seismic waves, scientists detect widespread partially molten rock hidden under the Earth's tectonic plates in a new way, a step in settling a long-held geological debate that has big implications in understanding plate motion.



Brown University

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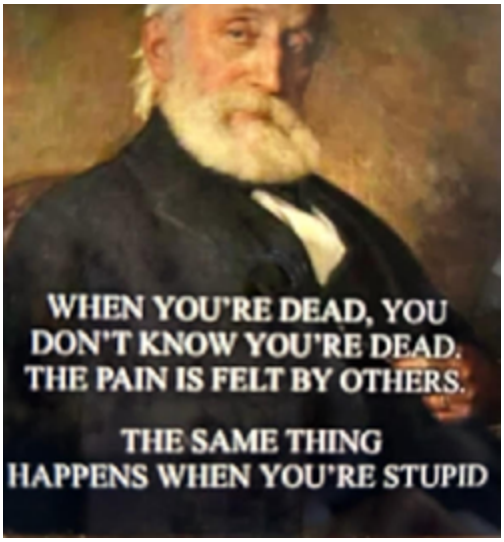

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Brain Wiring Explains Why Autism Hinders Grasp of Vocal Emotion

Children with autism have trouble identifying emotional tones because of differences in a brain region that processes social information, a Stanford Medicine study found.

Research at Stanford Medicine suggests that in autistic children, auditory processing of voices is normal, but the social parts of the brain interpret the information differently than in neurotypical people.
Pixel-Shot/Shutterstock.com

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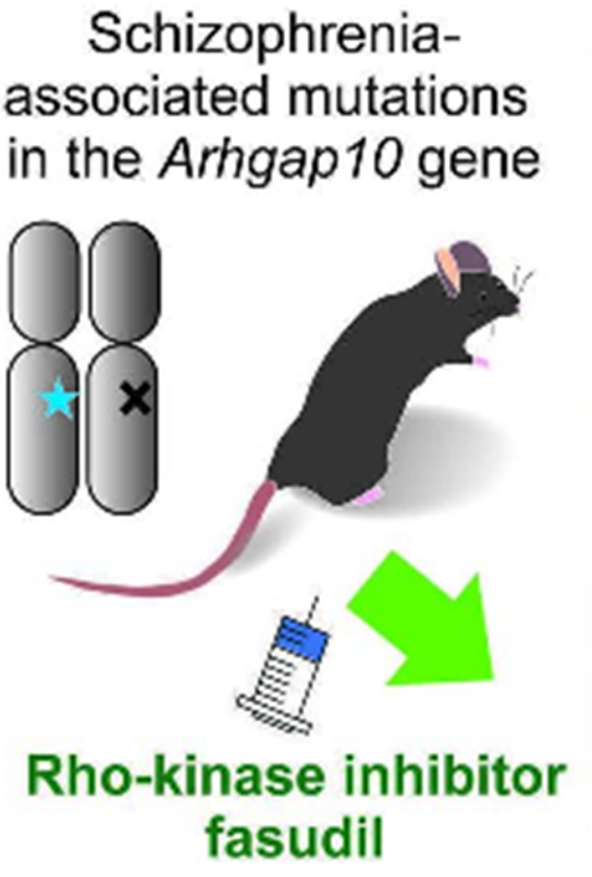
Fasudil Reverses Key Symptoms of Schizophrenia in Mice



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Do Mice Really Like Cheese?

http://bit.ly/3EPx3Bl

A house mouse will eat pretty much anything that's nearby, Megan Phifer-Rixey said. That could include grains, insects, trash — and yes, cheese, if it's available. But cheese is, by no means, a mouse's favorite food, she said.

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"Whatever you do don't look like a balloon."

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Scientists Just Discovered New Patterns of Brain Activity In Freely-Moving Octopuses

"We now have the ability to peer into their brain while they are doing specific tasks. That's really exciting and powerful."

Some of the brain activity captured as the octopuses slept, ate, and moved around looked similar to that seen in mammals, but some of it has never been described before.
Image credit: Wayne and Pam Osborne via iNaturalist, CC BY-NC 4.0

Scientists have been able to peer inside the brains of freely-moving octopuses for the first time thanks to a new approach that uses an implanted device. The resulting recordings revealed several distinct patterns of activity in the brain, with some mirroring states observed before in mammals while others looked totally alien.

Studying free-moving octopuses is exceptionally difficult owing to the fact that they have eight arms that can access 100 percent of their bodies. This means if you try simply attaching some kit, their arms will make quick work of ripping it all off again.

To overcome this, researchers created a waterproof device that could be implanted inside octopuses, with electrodes reaching the vertical lobe and median superior frontal lobe. These regions are of particular interest for brain research as it's thought to be responsible for visual learning and memory, which is what first author on a new paper, Dr Tamar Gutnick, and colleagues at the Physics and Biology Unit at the Okinawa Institute of Science and Technology (OIST), were hoping to investigate.

"If we want to understand how the brain works, octopuses are the perfect animal to study as a comparison to mammals," Gutnick explained in a. "They have a large brain, an amazingly unique body, and advanced cognitive abilities that have developed completely differently from those of vertebrates."

https://youtu.be/4jGPvBTPm4g

That octopuses have evolved such a high level of intelligence despite being so evolutionarily distant from other smart animals, and having grown up in an alien underwater world, has actually made them the subject of astrobiology research (something we explore in the March issue of CURIOUS.

For their deep dive into octopus brains, Gutnick and colleagues performed procedures on anesthetized octopuses to insert the implants which could then record 12 hours of data. The octopuses took about five minutes to recover and then proceeded to sleep, eat and move around, all the while having their brain waves recorded by the implanted device.

The results showed distinct patterns of brain activity, some of which appeared similar to those seen in recordings taken from mammals. However, there were other patterns that have never been described before made up of very long-lasting, slow oscillations.

"This is a really pivotal study, but it's just the first step," added Professor Michael Kuba, who led the project at the OIST Physics and Biology Unit and now continues at the University of Naples Federico II. "Octopus are so clever, but right now, we know so little about how their brains work.

This technique means we now have the ability to peer into their brain while they are doing specific tasks. That's really exciting and powerful."

The study was published in Current Biology.

By Rachael Funnell

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Can Our Brains Be Taken Over?

Several real-life pathogens can change a host's behavior against its will. Here's what we know about these zombie-like infections.

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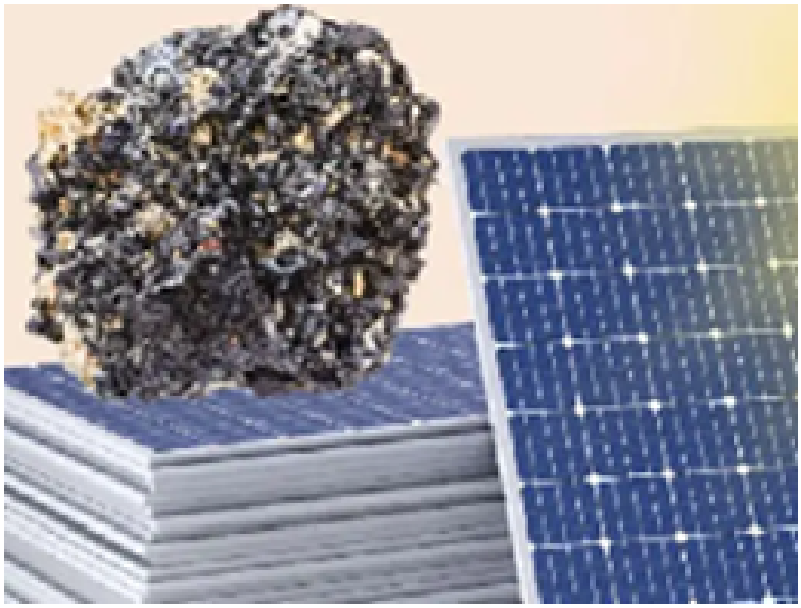
Are Perovskites a Better Solar Cell Material?



This alternative to silicon was already seen as promising, but researchers now see even more benefits.

Until now, silicon has been the standard solar cell semiconducting material, but perovskites have been increasingly drawing the spotlight. Now, researchers have discovered that there are even greater benefits to this alternative choice than previously known.

Silicon is abundant and naturally occurring, but it is also costly to mine and purify for its applications.

Silicon is a material used as a standard for solar cell, semiconductor chips, central processing units (CPUs) for computers, detectors and other applications. Its natural abundance makes it highly appealing for this purpose, but the cost of mining and purifying it is certainly a drawback. Perovskites have been drawing the eye of researchers around the world and the list of benefits of choosing them as an alternative is becoming increasingly long.

Perovskites are a type of materials that received their name due to their crystalline structure. They have been proving themselves as highly promising in recent years, particularly as they are considerably less expensive than silicon and are just as efficient as an alternative in the same applications.

A new study led by an optics professor from the University of Rochester, Chunlei Guo, now indicates that perovskites could become substantially more efficient than silicon. The study findings were published in the Nature Photonics journal.

The researchers took a physics-based approach to examining the potential for solar cell and other applications.

Usually, researchers synthesize perovskites in a wet lab. From there, they use what they have produced to apply it as a film onto a glass substrate. They can then explore the different applications for what they have created.

In Guo's research, he has proposed a new approach based on physics. Instead of using glass, a layer of metal or alternating layers of metal and dielectric material were used. The research team discovered that they were able to achieve an improvement in perovskite's light conversion efficiency by 250 percent. This would be a particularly meaningful development for the improvement of the solar cell.

"No one else has come to this observation in perovskites" said Guo. "All of a sudden, we can put a metal platform under a perovskite, utterly changing the interaction of the electrons within the perovskite. Thus, we use a physical method to engineer that interaction.

"*By Tami Hill*

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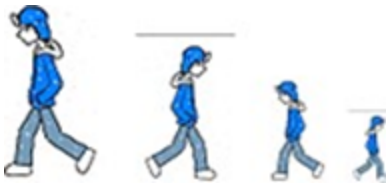
My Walking Thoughts



For Sunday March 5 2023

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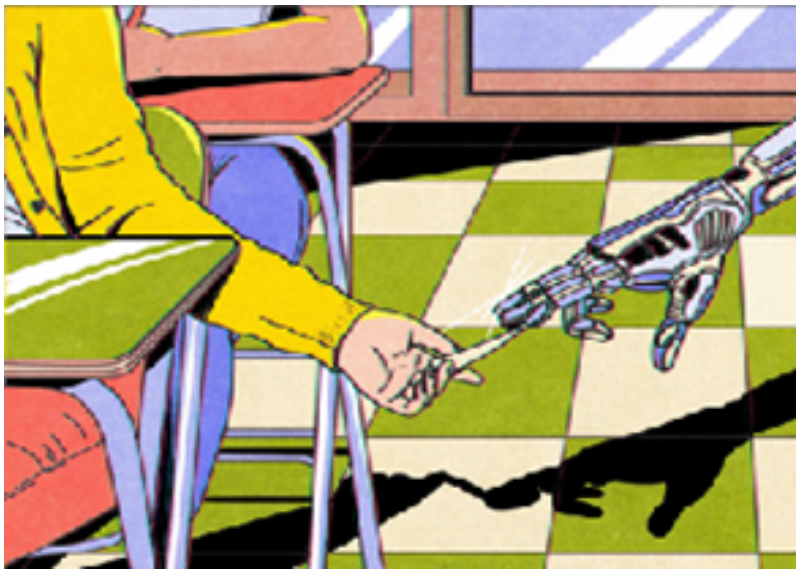
What Happens When Cheating Becomes the Norm?

With college kids doing college from their bedrooms and smartphones, and with the explosion of new technology, cheating has become not just easy but practically unavoidable.



http://bit.ly/3EPHmFo

Please read the accompanying article, after which I'd like you to focus on the parent aspect.

Consider how you would advise your children.

Do you tell them they should play it straight even that by doing so they might forfeit the opportunity to go to the college of their choice?

Do you have another choice?

John