Ode to E Pluribus Unum for Sunday January 15 2023

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NGC 4565: Galaxy on Edge

Image Credit & Copyright: Michael Sherick

Magnificent spiral galaxy NGC 4565 is viewed edge-on from planet Earth. Also known as the Needle Galaxy for its narrow profile, bright NGC 4565 is a stop on many telescopic tours of the northern sky, in the faint but well-groomed constellation Coma Berenices.

This sharp, colorful image reveals the galaxy's boxy, bulging central core cut by obscuring dust lanes that lace NGC 4565's thin galactic plane.

NGC 4565 itself lies about 40 million light-years distant and spans some 100,000 light-years. Easily spotted with small telescopes, sky enthusiasts consider NGC 4565 to be a prominent celestial masterpiece Messier missed.

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Astronaut Walter Cunningham Dead At 90

Image: NASA

Retired NASA astronaut Walter Cunningham passed away last Tuesday at the age of 90. Selected for NASA's third astronaut class in 1963, Cunningham went to space on the Apollo 7 mission, which was noted for being the first crewed flight test of the Apollo spacecraft. Before joining NASA, he served as a fighter pilot in the U.S. Marine Corps and worked as a scientist for the RAND Corporation.

"Walt Cunningham was a fighter pilot, physicist, and an entrepreneur—but, above all, he was an explorer," said NASA Administrator Bill Nelson. "On Apollo 7, the first launch of a crewed Apollo mission, Walt and his crewmates made history, paving the way for the Artemis Generation we see today. NASA will always remember his contributions to our nation's space program and sends our condolences to the Cunningham family."

Cunningham retired from NASA in 1971, going on to hold positions with companies including Century Development Corp., Hydrotech Development Company and 3D International. Over the course of his life, he logged more than 4,500 flight hours in 40 different aircraft. He was inducted into the Astronaut Hall of Fame, International Space Hall of Fame, Iowa Aviation Hall of Fame, San Diego Air and Space Museum Hall of Fame and Houston Hall of Fame and received awards including NASA's Exceptional Service Medal and Distinguished Service Medal, AIAA Haley Astronautics Award and UCLA Professional Achievement Award.

By Kate O'Connor for AVweb

Apollo 7 (AS-205), the first manned Apollo flight, lifted off from Launch Complex 34 at Cape Kennedy Oct. 11, carrying Walter M. Schirra, Jr., Donn F. Eisele, and R. Walter

Cunningham. Liftoff came at 11:03 a.m. EDT. Shortly after insertion into orbit, the S-IVB stage separated from the CSM, and Schirra and his crew performed a simulated docking with the S-IVB stage, maneuvering to within 1.2 meters of the rocket. Two burns using the reaction control system separated the spacecraft and launch stage and set the stage for an orbital rendezvous maneuver, which the crew made on the second day of the flight, using the service propulsion engine.

All primary Apollo 7 mission objectives were met, as well as every detailed test objective (and three test objectives not originally planned). Engineering firsts from Apollo 7, aside from live television from space, included drinking water for the crew produced as a by-product of the fuel cells. Piloting and navigation accomplishments included an optical rendezvous, daylight platform realignment, and orbital determination via sextant tracking of another vehicle. All spacecraft systems performed satisfactorily. Minor anomalies were countered by backup systems or changes in procedures. With successful completion of the Apollo 7 mission, NASA and the nation had taken the first step on the pathway to the moon.

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Lakme, the Flower Duet by Leo Delibes

Léo Delibes (born February 21, 1836, Saint-Germain-du-Val, France—died January 16, 1891, Paris). The French opera and ballet composer was the first to write music of high quality for the ballet.

https://www.youtube.com/watch?v=hrm59zqCKEU

Lakmé is an opera in three acts by Léo Delibes, first performed on 14 April 1883 in Paris. Set in British India in the mid-19th century, Lakmé is based on Théodore Pavie's story "Les babouches du Brahmane" and the novel Le Mariage de Loti by Pierre Loti. Gondinet proposed it as a vehicle for the American soprano Marie van Zandt.

The opera includes the popular Flower Duet ("Sous le dôme épais") for a soprano and mezzo-soprano, performed in act 1 by Lakmé, the daughter of a Brahmin priest, and her servant Mallika.[2] The name Lakmé is the French rendition of Sanskrit Lakshmi, the name of the Hindu Goddess of Wealth.

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Synapses Stick Around in Mice’s Brains

‘Silent’ connections may explain how adults make new memories

A nerve cell (illustrated) branches out to create connections called synapses. Inactive, or silent, synapses in adult mice may be important for forming new memories, scientists say.
Koto_Feja/E+/Getty Images Plus

Learning lots of new information as a baby requires a pool of ready-to-go, immature connections between nerve cells to form memories quickly. Called “silent” synapses, these connections are inactive until summoned to help create memories, and were thought to be present mainly in the developing brain and die off with time. But a new study reveals that there are many silent synapses in the adult mouse brain, researchers report in the Dec. 8 Nature.

Neuroscientists have long puzzled over how the adult human brain can have stable, long-term memories, while at the same time maintaining a certain flexibility to be able to form new memories, a concept known as plasticity. Silent synapses may be part of the answer, says Jesper Sjöström, a neuroscientist at McGill University in Montreal who was not involved in the work.

“The silent synapses are ready to hook up,” he says, possibly making it easier to store new memories as an adult by using these connections instead of having to override or destabilize mature synapses already connected to memories. “That means that there’s much more room for plasticity in the mature brain than we previously thought.”

In a previous study, neuroscientist Mark Harnett of MIT and colleagues had spotted many long, rod-shaped structures called filopodia in adult mouse brains. That surprised Harnett because the protrusions are mostly found on nerve cells in the developing brain.

"Here they were in adult animals, and we could see them crystal clearly," Harnett says. So the team decided to examine the filopodia to see what role they play, and if they were possibly silent synapses.

The researchers used a technique to expand the brains of adult mice combined with high-resolution microscopy. Since nerve cell connections and the molecules called receptors that allow for communication between connected cells are so small, these methods revealed synapses that past research missed.

The team looked for the typical signs of a silent synapse: the presence of a type of receptor called NMDA and the absence of another known as AMPA. Both of these receptors respond to the chemical messenger glutamate, but both typically need to be present for a synapse to be active.

Of the more than 2,000 synapses that the team looked at, about 30 percent were filopodia and, of those, nearly all had characteristics suggesting that they could be silent synapses.

To test whether the connections were truly silent, the researchers turned to glutamate. Artificially adding the chemical messenger was not enough to activate the synapses, the team found, suggesting the connections were actually silent ones.

Adding an electrical current in addition to glutamate turned these connections from immature into mature synapses. That's also what happens in the developing brain when a new memory is formed from a silent synapse.

It's unclear whether silent synapses are also prevalent in the adult human brain, though Harnett and other scientists like Sjöström think it's likely. Harnett's team is now using the same techniques on human brains to find out.

By Claudia López Lloreda for Neuroscience

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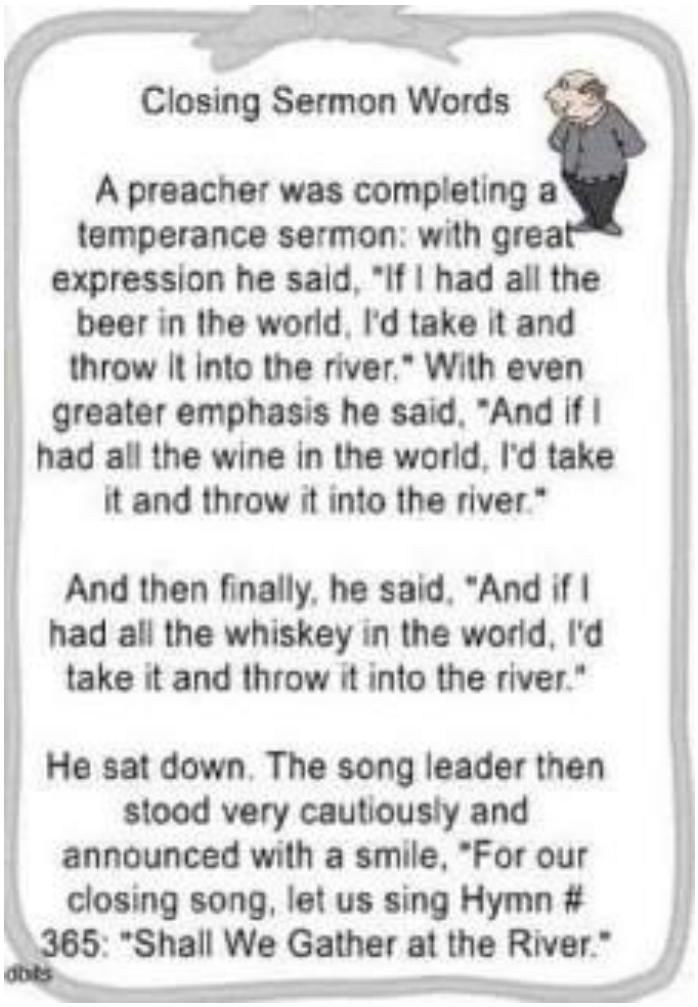

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Carolina Chickadee Thang

Carolina Chickadee

Where there's one, there are two or maybe three
Bold Carolina Chickadee.
Five inches long, black bib and cap
Size is no issue for this spunky chap.
Pair-bonding is common, lasting for years
Socializing in flocks of like-minded peers.
An abundance of energy supports daily needs
For nourishment and nesting securities.
Fear tops the list as our ultimate jailor,
When doubting ourselves in the confusion of failure.
We can learn from this bird by his example set,
Life's resources are there if we git'up and go get.

When we are fearless and willing to seize the day,

The good life we want will come our way.

Francie Troy

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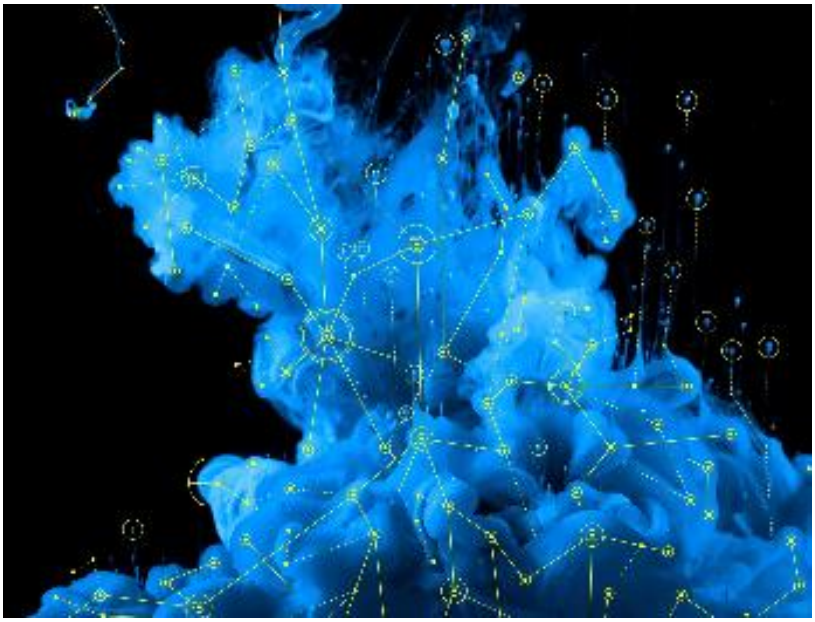
The Physics Principle That Inspired Modern AI Art

Diffusion models generate incredible images by learning to reverse the process that, among other things, causes ink to spread through water



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The greatest challenge in life
is discovering who you are.
The second greatest challenge
is being happy with what you find.

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Jumping Beans' Random Strategy Always Leads to Shade — Eventually

Random jumps aren't fast, but they're guaranteed to get jumping beans out of the sun

A jumping bean moth rests on a seed pod that was once its home where, as a larva, it relied on random hops to beat the heat.

By James R. Riordon

Jumping beans, which are really seed pods with twitchy moth larvae inside, hop around in a way that — if they live long enough — is guaranteed to eventually land them in the shade, researchers report in a study to appear in January in Physical Review E.

When a jumping bean finds itself in a sunny spot where it might overheat and die, the moth larva will twitch to make the bean jump a short distance. "If I'm a bean and I exist outside of the shade," says physicist Pasha Tabatabai of Seattle University, "all I want to know is what's the eventual probability of finding shade?"

To determine how the creatures approach the problem, Tabatabai and Devon McKee — now a computer scientist at the University of California, Santa Cruz — tracked the jumps of beans placed on a warm surface. They discovered that each jump was in a

random direction, with no correlation to the previous jumps. Mathematicians call this way of moving around a random walk (SN: 3/15/06).

While a random walk isn't a quick way to travel, Tabatabai says, a creature using it to move on a surface, like the ground near a tree, will theoretically visit every place on the surface eventually. That means a random walking bean will always end up in the shade if it keeps it up long enough.

Picking a direction and repeatedly going that way would cover distance faster. "You're certainly going to find shade fastest," Tabatabai says — assuming you're headed the right way. "But it's also very likely that you'll pick the wrong direction and never find shade."

Random walks are slow, and many jumping beans don't survive to find shade in real life. But, Tabatabai says, the strategy minimizes the odds that they will never escape the sun.

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Frontrunners in the Trillion-Dollar Race for Limitless Fusion Power

Nuclear, believe it or not, is booming again. And with a serious pile of private and public funding behind them, these companies say they're even getting closer to fusion.

Technicians work on construction of the magnetic system that will help confine and model plasma in the tokamak of the government-funded International Thermonuclear Experimental Reactor (ITER) in southeastern France, on July 28, 2020. Last year, private investment in fusion surpassed government funding for the first time.
[Photo: CLEMENT MAHOUDEAU/AFP via Getty Images]

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Saint-Paul-les-Durance,

Shortcut to a Monastic Life

Celibacy can be a choice in life, or a condition imposed by circumstances.

At a Marriage Weekend, my wife and I listened to the instructor declare, 'It is essential that husbands and wives know the things that are important to each other.'

He then addressed the men, 'Can you name and describe your wife's favorite flower?'

I leaned over, touched my wife's hand gently, and whispered,

'Gold Medal-All-Purpose, isn't it?'

And thus began my life of celibacy.

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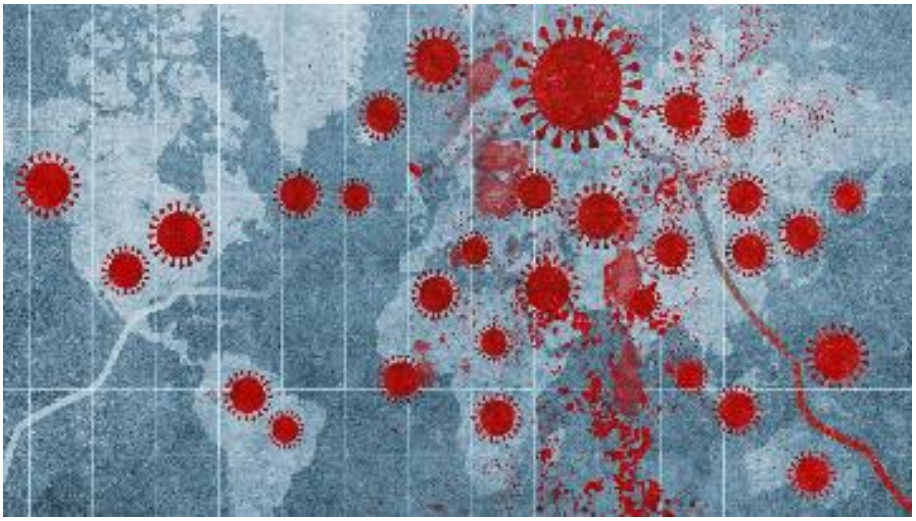
What Does it Mean For a Disease to be 'Endemic'?

In the context of a disease, the transition from "epidemic" to "endemic" means a pathogen is no longer causing outbreaks but isn't disappearing.



As viruses such as COVID-19 spread, they can become endemic in new regions.
(Image credit: Peter Zelei Images via Getty Images)

You may have heard the term "endemic" used to describe diseases, often in comparison with the terms "epidemic" and "pandemic." Many health officials say that COVID-19 is likely transitioning from pandemic to endemic status in many countries. But what does that mean?

More broadly, the term "endemic" refers to an organism that's found in a specific region. In ecology, that means a species that lives only in one geographical area, like a plant or animal limited to an island, according to the U.S. Geological Survey(opens in new tab). However, in the context of public health, "endemic" refers to a disease with a constant presence or "usual" number of infections in a specific area, according to the Centers for Disease Control and Prevention(opens in new tab).

"The technical definition is a disease that's at a steady state. It's there all the time," Dr. Christopher J. Gill(opens in new tab), a professor of global health at Boston University, told Live Science. "It's not really causing outbreaks, and it's not dying away."

That concept, in turn, depends on the idea of an "epidemic" disease — one with greater-than-normal levels of infection in a population, Gypsyamber D'Souza(opens in new tab), an epidemiology professor at the Johns Hopkins Bloomberg School of Public Health, told Live Science. (An epidemic disease becomes "pandemic" if it spreads over several countries or the globe.)

Endemic status also depends on the impacts a disease has on society in a particular region, D'Souza said. "It means that there is enough immunity in the population that we have learned to live with that infection," she said. "We don't have surges of disease … that disrupt daily life."

Not every epidemic disease becomes endemic, however; many just disappear. "If you have an epidemic and you successfully contain and treat it and you are able to drive it to zero infections, you can prevent it from becoming endemic," D'Souza said. Examples include the 2005 H5N1 bird flu and the 2002-2004 severe acute respiratory syndrome (SARS) outbreaks.

A host of diseases have become endemic in the U.S., including respiratory illnesses such as flu and respiratory syncytial virus (RSV), as well as many childhood diseases. "Measles, mumps, rubella, chickenpox, group A strep [Streptococci], pink eye — all of these things are just constantly circulating," Gill said. At the beginning of the COVID-19 pandemic, experts wondered whether the disease would rise quickly in prevalence and disappear or eventually become endemic, though most predicted an endemic route, Gill said. At nearly three years into the pandemic, many experts said COVID-19 was endemic in the U.S. or soon to become so, as most people had some immunity from vaccination or exposure, D'Souza said.

The timing of that transition could vary according to the expert, however, as they evaluated how far infection and death levels had fallen. "It's not an exact science," she said. "We're not going to say this exact day is when we have transitioned." Meanwhile, epidemic infection levels may continue in other parts of the world even as a disease becomes endemic in another region.

Experts caution that becoming endemic doesn't necessarily mean less-severe disease, although "generally, we expect pathogens to become less pathogenic over time," Gill said. Similarly, endemicity doesn't mean a disease has ceased to be a public health problem, virologist and immunologist Matt Koci said in a North Carolina State University(opens in new tab) post. "Smallpox was an endemic disease that consistently killed 1 out of every 3 people it infected," he said.

Rarely, endemic diseases — particularly influenza — can return to epidemic status, Gill said. "Occasionally, the influenza virus can mutate radically into something almost completely unseen by the population," he said. "And then you can have a totally disastrous influenza pandemic," as happened in the 1918 influenza outbreak, in which a new flu strain killed roughly 50 million people.

By Michael Dhar for Live Science

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What's the Deadliest Month of the Year?

By Elizabeth Rayne

In the U.S., the deadliest month of the year is in the winter.
(Image credit: Andrew Bret Wallis via Getty Images)

People die daily from causes ranging from common ailments, such as heart disease, to rare occurrences, such as getting hit by lightning. But during which month do the most deaths happen in the United States?

The deadliest month in the U.S. is the one that heralds the New Year: January. An average of 251,699 people in the U.S. died in January every year between 2010 and 2020, according to a Live Science analysis of the Centers for Disease Control and Prevention (CDC) Wonder database, which tracks how and when people die. In comparison, the averages for the other months for this time period range from 218,102 (August) to 242,475 (December), Live Science found.

Other analyses also find that January is the deadliest month in the U.S. According to an analysis of the CDC Wonder database by The Washington Post(opens in new tab), there were 40,000 to 60,000 more fatalities during January than August or September from 1999 to 2014.

Why is January so dangerous? According to the World Health Organization(opens in new tab) (WHO), the culprit could be the world's most prolific killer: heart disease, a 1999 study in the journal Circulation(opens in new tab) found, noting that heart conditions were more fatal during the winter months, especially January and February. More body heat is lost during the cold months, so the heart has to work harder, which creates extra stress for people with existing heart conditions, the British Heart Foundation(opens in new tab) reported.

However, that does not completely explain why warmer locales, such as California and Florida, also experienced more deaths in January than during the rest of the year.

Dr. Robert Glatter, an emergency medicine physician at Lenox Hill Hospital in New York City, acknowledged that there has been an ongoing debate about whether the summer or winter is more fatal. Heat-related illnesses are on the rise because of climate change. Young children, older adults and the immunocompromised are the most vulnerable to scorching, humid temperatures. However, despite the increased risk of heatstroke and organ failure during the summer, the winter months are more deadly. Here's why: The flu and other respiratory viruses tend to thrive during the winter.

"In the wintertime, influenza, along with secondary bacterial pneumonia and other typically benign respiratory viruses such as RSV, enterovirus D68, and rhinoviruses" are concerning, Glatter told Live Science in an email.

The pathogens that cause respiratory infections lurk everywhere during the winter. Closed spaces are germ vectors, breeding bacteria and viruses from too many people being too close together for long stretches of time. Even worse, the flu virus grows a tougher lipid coating during the winter months, according to the University of Southern California's Verdugo Hills Hospital(opens in new tab), and that combined with a more

sluggish immune system (another downside of winter) raises the chances of getting sick. The flu still kills millions of people worldwide and 12,000 to 52,000 in the U.S. every year, according to the CDC(opens in new tab). Lower respiratory infections, like bronchitis or pneumonia, are the fourth-leading cause of death worldwide, according to the WHO(opens in new tab).

But there are myriad other factors that make winter so deadly. "Exposure to extreme cold and wind, lack of adequate heating, older persons living alone, and the use of space heaters, which can lead to fires and carbon monoxide poisoning, are all concerns that make January the deadliest month of the year," Glatter said.

The aftermath of the holiday season also may affect death rates. Overconsumption of food, salt and alcohol adds to physical cardiac stress, along with the psychological stresses that plague what is supposed to be the "most wonderful time of year." But Glatter said that despite the assumption that holiday and post-holiday suicides are the reason for the spike in January deaths, they are not the main causes of death during that month. Generally, the springtime months of April, May and June tend to have the most suicides in the U.S., according to John Hopkins Medicine(opens in new tab).

Deaths from COVID-19 in the past several years have also spiked in the winter. As the U.S. Census database(opens in new tab) reveals, COVID-19 pushed up death rates in the U.S. by 19% between 2019 and 2020. The U.S. hasn't seen such an upsurge in death rates since the 1918 influenza pandemic about a century ago. Ariel Karlinsky(opens in new tab) — who researches excess mortality and economics at The Hebrew University of Jerusalem and started the World Mortality Dataset(opens in new tab) with colleague Dmitry Kobak(opens in new tab), who studies COVID-19 excess mortality at Tübingen University in Germany — has been investigating just how much excess mortality there has been worldwide since the pandemic struck. He found that COVID deaths hit a high in January 2020 and 2021.

Glatter is concerned about what could happen as the flu, RSV and COVID-19 flare up in the winter in what he calls a "tripledemic." He urged people to wear a mask to protect against COVID-19, RSV and the flu, especially in spaces without much ventilation. And he had some additional advice as winter approaches.

"Get a flu shot now and a COVID-19 booster if you are not up to date," he said. "And don't forget to wash your hands after contacting people who are ill or coughing. All of these measures can be lifesavers in the long run."

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Fly to Space and Back with SpaceX Falcon 9 Rocket

By Mike Wall

Get a rocket's-eye view of SpaceX's 200th orbital launch.

SpaceX

https://www.youtube.com/watch?v=mfQjG4t4M08

On Tuesday morning (Jan. 3), a SpaceX Falcon 9 rocket launched on a "rideshare" mission called Transporter-6 from Cape Canaveral Space Force Station in Florida, carrying 114 satellites to orbit for a variety of customers.

Transporter-6 was the 200th orbital flight for SpaceX since the company's 2002 founding. And it was the 15th mission for this particular Falcon 9's first stage, tying a SpaceX reuse record.

A SpaceX Falcon 9 rocket captured this view of its Transporter-6 mission — the company's 200th orbital flight — on Jan. 3, 2022. (Image credit: SpaceX via Twitter)

The first stage chronicled its journey to space and back with an onboard camera, the footage from which SpaceX released via Twitter on Thursday morning (Jan. 5).

The video accelerates the action considerably, compressing liftoff and landing into just 90 seconds. (In reality, the booster touched down successfully at Cape Canaveral's Landing Zone 1 about 8.5 minutes after launch.)

But the sped-up footage still captures the essentials of a Falcon 9 flight nicely. It shows how the rocket's plume spreads out as the vehicle travels higher into ever-thinner air, for example, and highlights how intricately the booster controls its descent when coming back home to Earth.

That control comes courtesy of multiple features, including orientation-shifting nitrogen-gas thrusters and hypersonic grid fins, waffle-like structures near the booster's base that it deploys after reaching space.

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Photos Reveal New Eruption of Hawaii's Kīlauea Volcano

Hawaii's Kīlauea volcano, which erupted for 16 months beginning in September 2021, is erupting once again.
USGS

https://bit.ly/3ZkKVff

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Reports of Young Children Eating Marijuana Edibles Soar

Edibles are often packaged to look like candy, and children, unaware of the risk, may find them appealing.

endo.tv

More young children are getting sick from inadvertently eating marijuana edibles, according to a study published Tuesday in the journal Pediatrics.

Calls to poison control centers about kids 5 and under consuming edibles containing THC rose from 207 in 2017 to 3,054 in 2021 — a 1,375% increase, according to the study. THC, or tetrahydrocannabinol, is the psychoactive ingredient in marijuana.

Nearly all of the children — about 97% — found the edibles at home.

The findings were based on more than 7,000 pediatric cases reported to the National Poison Data System, a database that tracks reports of poisonings.

The combination of more states' legalizing recreational marijuana and the coronavirus pandemic, which meant more children were staying at home, most likely drove the increase, said a co-author of the study, Dr. Antonia Nemanich, an assistant professor of emergency medicine and toxicology at Rush University Medical Center in Chicago.

Edibles are often packaged to look like candy or cookies, and kids, unaware of the risk they pose, can sometimes eat several in a single sitting, Nemanich said.

"They don't know what it is," she said, "and they don't know when to stop."

https://bit.ly/3WWTqf1

'Copycat' edibles made to look like snacks pose risk to kids, study says

A little over half of the reports concerned 2- and 3-year-olds, followed by 4-year-olds (18%), 1-year-olds (15%) and 5-year-olds (13%), the study found. Infants accounted for 1.9% of the calls.

Eating too much can lead to serious health problems in young children, including confusion, hallucinations, fast heart rate and vomiting, experts said. In severe cases, children can experience trouble breathing or even comas. The severity usually depends on children's size and age and how much cannabis they've consumed.

"It can be really concerning for the physicians treating them," Nemanich said.

Nearly a quarter of the children were admitted to the hospital, 8.1% of whom who needed intensive care, the study found. No deaths were reported.

Dr. Sam Wang, an emergency medicine physician and pediatrician at Children's Hospital Colorado, said the study reflects what he is seeing in his hospital.

Wang said the majority of the cases at the Colorado hospital have been "pretty mild," with children often experiencing sleepiness or loss of balance, although he has seen, in rare instances, children who needed to be put on ventilators to help with breathing or children who had fallen into comas. Wang wasn't involved with the study.

Similar observations have been noted in Philadelphia.

"I think the pattern that we're seeing is well-represented by this study," said Dr. Kevin Osterhoudt, the medical director of the poison control center at Children's Hospital of Philadelphia. "Emergency physicians all across the country have been recognizing what they believe to be a sharp increase in both young children and teenagers showing up to emergency departments for THC intoxication."

Some manufacturers have started to increase the dosage of THC in their edible products, said Osterhoudt, who wasn't involved with the research. That could lead to an even greater rise in the number of children who get sick.

A typical edible can contain around 100 milligrams, he said, but even adults often start with about one-tenth of that. In some states, especially those where recreational marijuana isn't legal and isn't regulated, products can contain as much as 500 mg of THC, he added.

Wang called for regulation of how marijuana manufacturers can advertise their products, including regulations that ensure the advertising doesn't appeal to children.

Parents can protect their children by keeping the edibles out of sight, either behind locked doors or high up on shelves, Nemanich said.

"There's no reason that people can't enjoy these products," she said. "We just want kids to be safe."

Osterhoudt went a step further: "The safest thing for a parent of young children to do would be not to bring edible THC products into their homes."

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‘Breakthrough’ Obesity Drugs that Have Stunned Researchers

Illustration by Karol Banach

A class of drugs that quash hunger have shown striking results in trials and in practice. But can they help all people with obesity — and conquer weight stigma?

https://bit.ly/3Xehwl6

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Losing Weight May Not Resolve Inflammation Tied to Weight Gain

A mouse study suggests the struggle for better health doesn’t necessarily begin and end with weight loss.

https://bit.ly/3vPqREh

In a mouse study published Thursday in the journal Science, researchers found that inflammation lingered in mice that had been fed a high-fat diet after the rodents shed the ounces. The findings hint at a potential mechanism for the seeming link between obesity and inflammation, as well as evidence that these issues may remain regardless of whether or not one loses weight.

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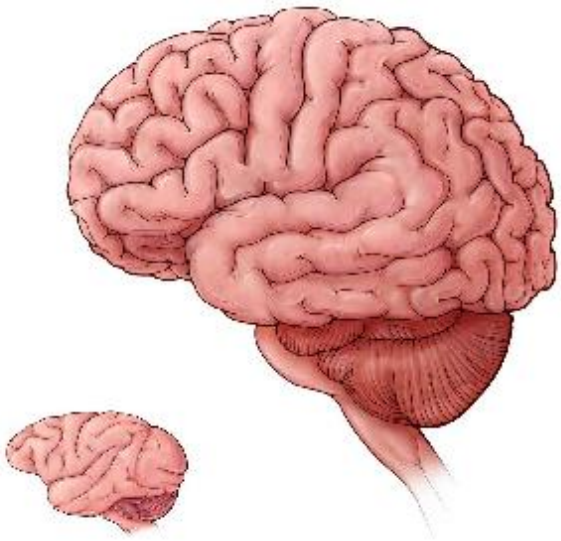
Human Gene Linked to Bigger Brains Was Born from Seemingly Useless DNA

Researchers discover how DNA sequences must mutate to free their RNA to make proteins



Newly formed genes helped make the human brain much bigger than the macaque brain.
Evan Oto/Science Sourceshare:

Biologists have long known that new protein-coding genes can arise through the duplication and modification of existing ones. But some protein genes can also arise from stretches of the genome that once encoded aimless strands of RNA instead. How new protein genes surface this way has been a mystery, however.

Now, a study identifies mutations that transform seemingly useless DNA sequences into potential genes by endowing their encoded RNA with the skill to escape the cell nucleus—a critical step toward becoming translated into a protein. The study's authors highlight 74 human protein genes that appear to have arisen in this de novo way—more than half of which emerged after the human lineage branched off from chimpanzees. Some of these newcomer genes may have played a role in the evolution of our relatively large and complex brains. When added to mice, one made the rodent brains grow bigger and more humanlike, the authors report this week in Nature Ecology & Evolution.

"This work is a big advance," says Anne-Ruxandra Carvunis, an evolutionary biologist at the University of Pittsburgh, who was not involved with the research. It "suggests that de novo gene birth may have played a role in human brain evolution."

Although some genes encode RNAs that have structural or regulatory purposes themselves, those that encode proteins instead create an intermediary RNA. Made in the nucleus like other RNAs, these messenger RNAs (mRNAs) exit into the cytoplasm and travel to organelles called ribosomes to tell them how to build the gene's proteins.

A decade ago, Chuan-Yun Li, an evolutionary biologist at Peking University, and colleagues discovered that some human protein genes bore a striking resemblance to DNA sequences in rhesus monkeys that got transcribed into long noncoding RNAs (lncRNAs), which didn't make proteins or have any other apparent purpose. Li couldn't figure out what it had taken for those stretches of monkey DNA to become true protein-coding genes in humans.

A clue emerged when Li's postdoc, Ni A. An, discovered that many lncRNAs have a hard time exiting the nucleus. The researchers used a sophisticated computer program to identify differences between protein-coding genes whose mRNA got out of the nucleus and the DNA sequences that produced RNAs that did not. The program homed in on stretches of DNA known as U1 elements, which when transcribed into RNA make the strand too sticky to make a clean escape. In protein-coding genes, these elements have mutations that make the RNA less sticky. So, for an lncRNA to escape the nucleus and give its instructions to a ribosome, the parental DNA must acquire those key U1 mutations or somehow make that transcribed section get cut out of the RNA strands altogether.

"This makes perfect sense because for an RNA to be translated, it needs to go the cytoplasm [where ribosomes are found] first," says Maria Del Mar Albà, an evolutionary biologist at Hospital del Mar Medical Research Institute.

i's team scoured the human and chimpanzee genomes for de novo protein-coding genes that had lncRNA counterparts in rhesus monkeys, as well as the crucial U1 element mutations needed to exit the nucleus. Eventually they came up with 45 exclusively human genes and 29 genes shared by humans and chimps that fit the bill. Next, the researchers homed in on nine of these protein genes that are active in the human brain to see whether they could learn what each was doing. Li's collaborator Baoyang Hu, a neuroscientist from the Chinese Academy of Sciences Institute of Zoology, grew clumps of human brain tissue called cortical organoids with and without each of these genes and identified two that made the organoids grow slightly bigger than normal.

When Hu introduced one of these genes into mice, their brains also grew larger than normal and developed a bigger cortex, the wrinkly outer layer of the mammalian brain

that in humans is responsible for high-level functions such as reasoning and language. The second gene did likewise in mice, and also caused the animals' brains to develop more humanlike ridges and grooves. Those mice performed better on tests of cognitive function and memory than mice lacking this gene, the team says it will report soon in Advanced Science.

Overall, the findings suggest these de novo human genes "may have a role in brain development and may have been a driver of cognition during the evolution of humans," says Erich Bornberg-Bauer, an evolutionary biophysicist at the University of Münster.

Manyuan Long, an evolutionary biologist at the University of Chicago, calls the new study "a breakthrough in the understanding of the molecular evolutionary processes that generate [new] genes." In an indication of how widespread those processes may be, Long's group has found that most of the recognizable de novo genes in rice were once lncRNAs, and that lncRNAs also helped form new genes in bamboo. But he is more cautious about interpreting the role of de novo genes in brain evolution. Organoids are far simpler tissues than the brain itself, he notes, and human and mouse brains have evolved along very different paths.

Xiaohua Shen, a molecular biologist at the Tsinghua University School of Medicine, adds that she wishes the authors had studied a larger sample of mice to be sure the differences in brain size from the gene additions couldn't be explained by natural variation.

The work suggests profoundly influential de novo genes might arise through subtle changes in their DNA sequence, Carvunis says, but there's still much to be learned about how escaped lncRNAs eventually become true genes. "There are a lot of barriers to gene birth," she says. "I hope this work will contribute to inspiring more research towards understanding what these barriers are and how emerging genes can overcome them."

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This Barrier Kept 35,000 Pounds of Trash Out of the Ocean

The Ocean Cleanup developed technology to catch trash in rivers before it flows into the ocean. During a recent storm in L.A., it was wildly successful.

https://bit.ly/3VMCFSb

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How Much Should You Tip?

https://bit.ly/3igY8oN

All well and good, but the amount should mirror the excellence of the service.

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Things Your GPS Can Do You Might Not Know About

https://bit.ly/3GKyIJL

Here I thought GPS was invented to help you find the best fishing hole.

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Ninety-Six Fascinating Finds Revealed in 2022

The year's most exciting discoveries included hidden portraits by Cézanne and van Gogh, sarcophagi buried beneath Notre-Dame, and a medieval wedding ring

https://bit.ly/3in0LoZ

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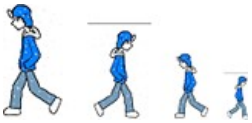
My Walking Thoughts



For Sunday January 15 2023

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Is DEI Supplanting Truth as the Mission of American Universities?

An obsession with Diversity, Equity and Inclusion threatens students, professors, and the very credibility of higher education in the U.S.

https://bit.ly/3ZkLaXH

A growing number of universities, such as UCLA now consider their faculty members' contributions to DEI as a criterion for hiring, promotion, and tenure. UC Berkeley's rubric for evaluating DEI contributions, which is used by universities around the country, dictates a low score for a candidate who professes a desire to "treat everyone the same."

There's not much doubt as to it's happening…even gaining more traction with each passing year. The question is whether it's leading to the destination we want.

Is this something you'd like to discuss?

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