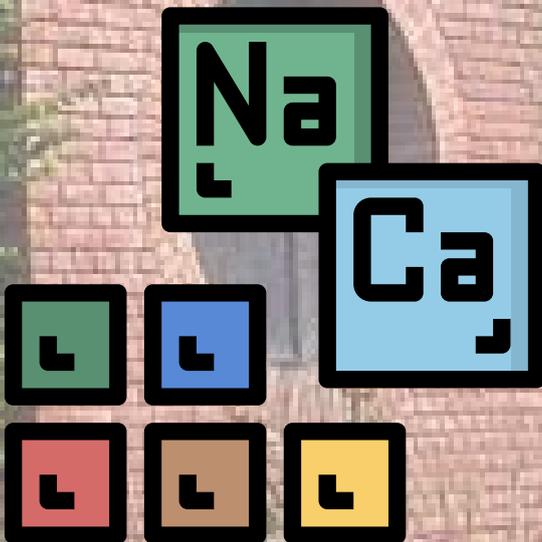


mod explorers



Mod Explorers

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50 Years of MSVV



Golden Jubilee Edition

For fifty years, Modern School, Vasant Vihar has inspired curiosity, discovery, and innovation. From our well-equipped science laboratories that ignite a love for experimentation, to the newly launched Innovations Lab offering robotics, artificial intelligence, and 3D printing, MSVV continues to push the boundaries of learning.

Our vision has always been clear: to nurture scientific temper and critical thinking while preparing students with soft skills that empower them for the future. This golden jubilee celebrates not just five decades of excellence, but the promise of many more years of exploration, creativity, and leadership in science and innovation

Visionary Of This Edition

Chandrasekhara Venkata Raman (1888–1970) was one of India's greatest physicists, renowned for his groundbreaking work in the field of light scattering. He discovered the Raman Effect in 1928, which showed that when light passes through a transparent medium, a small fraction of it is scattered with a change in wavelength. This discovery proved the quantum nature of light and earned him the Nobel Prize in Physics in 1930, making him the first Asian to receive this honor in science. Raman also contributed to the study of acoustics, musical instruments, and the physics of crystals and optics, spectroscopy.

The Way Forward

The way forward lies in how we, as students, contribute to science — by practicing reuse, recycle, and reinvent, embracing sustainability, and applying creativity to everyday challenges. Each conscious choice, whether in conserving resources, reducing waste, or finding new solutions, strengthens our role in shaping a better tomorrow. Small steps today can lead to big breakthroughs for the future.

AT MODERN SCHOOL, VASANT VIHAR, SCIENCE IS NOT TAUGHT AS FACTS, BUT AS A WAY OF THINKING, QUESTIONING, AND CREATING

Mysteries that still Baffle science

1. Dark Matter: The Shadow That Shapes the Universe

Astronomers estimate that dark matter makes up about 85% of the matter in the universe, yet we've never seen or touched it. It doesn't emit light, reflect it, or absorb it—it simply warps gravity around galaxies like an invisible skeleton holding everything together.

Scientists believe dark matter may be made of mysterious particles such as WIMPs (Weakly Interacting Massive Particles) or axions—ultra-light particles that might even behave like waves. Experiments like ADMX and XENON1T, deep underground and cooled to near absolute zero, are trying to detect these elusive signals. So far? Silence.

And yet, without dark matter, galaxies would fly apart. It shapes how stars orbit and how the universe evolved. It's like reading a story where the main character is invisible—but absolutely essential.

Source: National Geographic, NASA, CERN

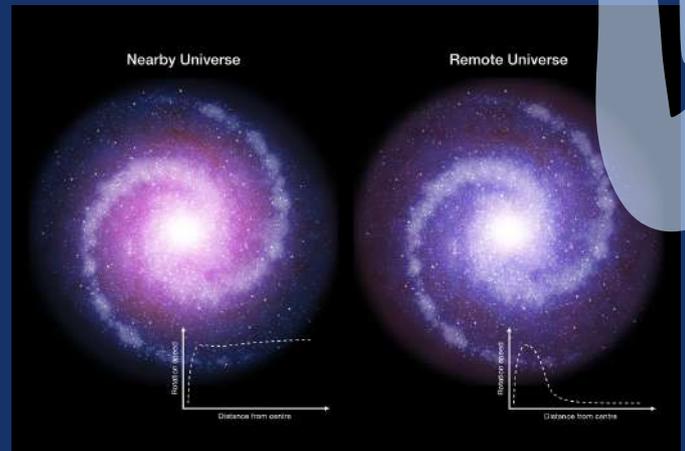
2. Dark Energy: The Force That's Ripping Space Apart

Even more mysterious than dark matter is dark energy—thought to make up nearly 70% of the entire universe. In the late 1990s, scientists discovered that the expansion of the universe is accelerating—something no one expected. What's fueling it? We still don't know.

One idea is Einstein's "cosmological constant," a form of energy built into the very vacuum of space. Another theory, quintessence, suggests dark energy might vary over time—changing the fate of the universe itself.

If we solve this riddle, we might finally predict whether the cosmos will keep expanding forever, tear itself apart in a "Big Rip," or eventually collapse.

Source: National Geographic, NY Times Science, NASA Science



3. What Lies Beyond the Observable Universe?

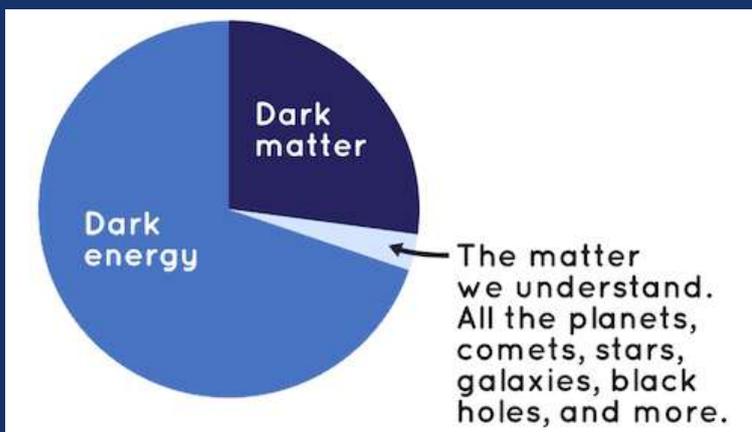
The furthest light we can see today has traveled about 46.5 billion light-years in all directions, forming what's called the "observable universe." But the universe could be infinite—or it might curve back on itself like the surface of a sphere. Could other parts of the universe have different laws of physics? Could there be parallel universes, as string theory and quantum inflation predict? Some physicists suggest our universe is just one "bubble" in a massive multiverse—an idea we may never be able to test.

And yet, this unseen expanse could hold clues to the deepest truths about our own existence.

Source: NY Times, Scientific American, Max Tegmark (MIT)

4. Consciousness: The Mystery Within

We know which brain regions light up when we think, dream, or remember. But we still don't understand how billions of electrical signals translate into feelings, awareness, or identity. Is consciousness just complex computation? Or something deeper—possibly quantum in nature? Scientists call it the "hard problem of consciousness." Despite advances in neuroscience, AI, and cognitive science, we still don't know why we experience being "us." Some believe the key lies in integrated information theory (IIT), which tries to quantify consciousness. Others think it may always remain a mystery—one that science can study but never fully explain.



The background is a dark blue space with a purple planet in the center. The planet has a textured surface and a ring system. Three yellow wavy lines curve across the top left and bottom right corners. The text 'The Space Edition' is written in a bold, yellow, sans-serif font, centered over the planet.

The Space Edition

The space section

Pushpak's Flight: ISRO's Big Step Toward Reusable Rockets

On June 23, 2024, the Indian Space Research Organisation (ISRO) achieved a significant milestone in its journey toward developing reusable space technology. In its third Reusable Launch Vehicle (RLV) landing experiment, ISRO not only demonstrated technical brilliance but also took a bold step into a future of more affordable and sustainable space missions. The test vehicle's name was Pushpak (the mythological flying chariot from Indian epics). The test, officially designated RLV-LEX-03, was carried out under complex conditions. Pushpak was lifted to an altitude of 4.5 kilometers by a Chinook helicopter operated by the Indian Air Force. From this height, the spaceplane was released mid-air at a distance far from the runway. From that point onward, Pushpak had no human assistance. It had to independently sense its position, orient itself, glide towards the runway, control its speed and angle of descent, and land safely.

In a remarkable display of autonomous technology, the success of this flight proved that India has the technical capability to design, develop, and execute highly advanced autonomous aerospace systems. This test was not just a demonstration of a soft landing; it was proof that India can build reusable vehicles that could someday launch into orbit and return safely, just like a regular airplane.

Reusable Launch Vehicles (RLVs) are a major innovation in space exploration. Traditionally, most rockets are single-use, meaning they either burn up in the atmosphere or fall into the ocean after delivering their payload. This approach makes space missions extremely expensive and inefficient. However, reusable systems like Pushpak can be recovered, refurbished, and flown again—dramatically reducing the cost of each mission. SpaceX has already demonstrated this with its Falcon rockets, and now India is entering that elite club of spacefaring nations that are working on making rockets reusable.

In conclusion, the Pushpak test flight marks a major turning point in India's space program. It reflects not only the technological capabilities of Indian scientists and engineers but also their vision for the future, a future where spacecraft are not disposable, but durable and dependable. As the dream of reusable rockets edges closer to reality, ISRO is proving once again that space science is not just about reaching the stars, but also about coming back smarter.



The Ethical and Physical Dilemma of Growing Food on Mars

There is something ancient and grounding about growing food - hands in soil, green shoots rising, the quiet patience of life taking root. To imagine that process transplanted to Mars feels both wildly futuristic and deeply familiar. We've always grown things to survive. The question now is whether we can do it in a place so utterly unlike Earth. Because if we are to live on Mars - not just visit but stay - we will need more than oxygen and shelter. We will need food. Not freeze-dried calories rationed for survival, but something living, nourishing and real. And that is no small ask. Mars is not kind to life as we know it. Its air is thin, cold, and toxic. The soil - what we call regolith - is sharp and sterile, laced with perchlorates that would poison most plants. Sunlight is weaker, and vast dust storms can block it out entirely. Water exists, but not in any convenient form; it is locked in ice or hidden deep beneath the surface. And yet, despite these barriers, scientists are trying. The work begins here on Earth, in labs and simulation domes, with Martian soil substitutes made from volcanic rock. Researchers have grown lettuce, radishes, peas, even tomatoes in these analogs, adding nutrients and filtering out toxins. Some of the results are surprising. The plants don't just survive - they thrive, under the right conditions. But those conditions are tightly controlled: perfect lighting, regulated temperature, careful water cycles. In space, nothing is accidental. Climate change, resource scarcity, population pressure - these are not distant problems. They are already here. What we learn while preparing for Mars might end up saving lives long before we ever get there.

BLACK HOLES & EVENT HORIZONS

One of the most incredible things about black holes is the event horizon, the point of no return beyond which nothing can escape. It is the place where the escape velocity, or the speed needed to escape an object's gravity, is equal to the speed of light. As a result, anything that goes past this point is trapped there forever. To someone who is not nearby, time is weird around a black hole; time slows down around a black hole relative to someone further away. You would appear to become trapped in time to viewers from a distance if you were heading into a black hole.

Viewing black holes can be challenging since they do not emit light. Nevertheless, astronomers apply various techniques for their detection. One of the techniques is through the observation of the accretion disk, where gas and dust are being sucked into the black hole. When this material is heated up, it emits X-rays that can be observed with telescopes. Another technique is gravitational lensing, through which the immensely strong gravitational field of the black hole distorts the light near it, making background objects seem distorted. Last, the migration of proximal stars is followed by researchers whose motion verifies the existence of black holes that lie undetected, like the supermassive one that lurks at the Milky Way core within our own galaxy, Sagittarius A.

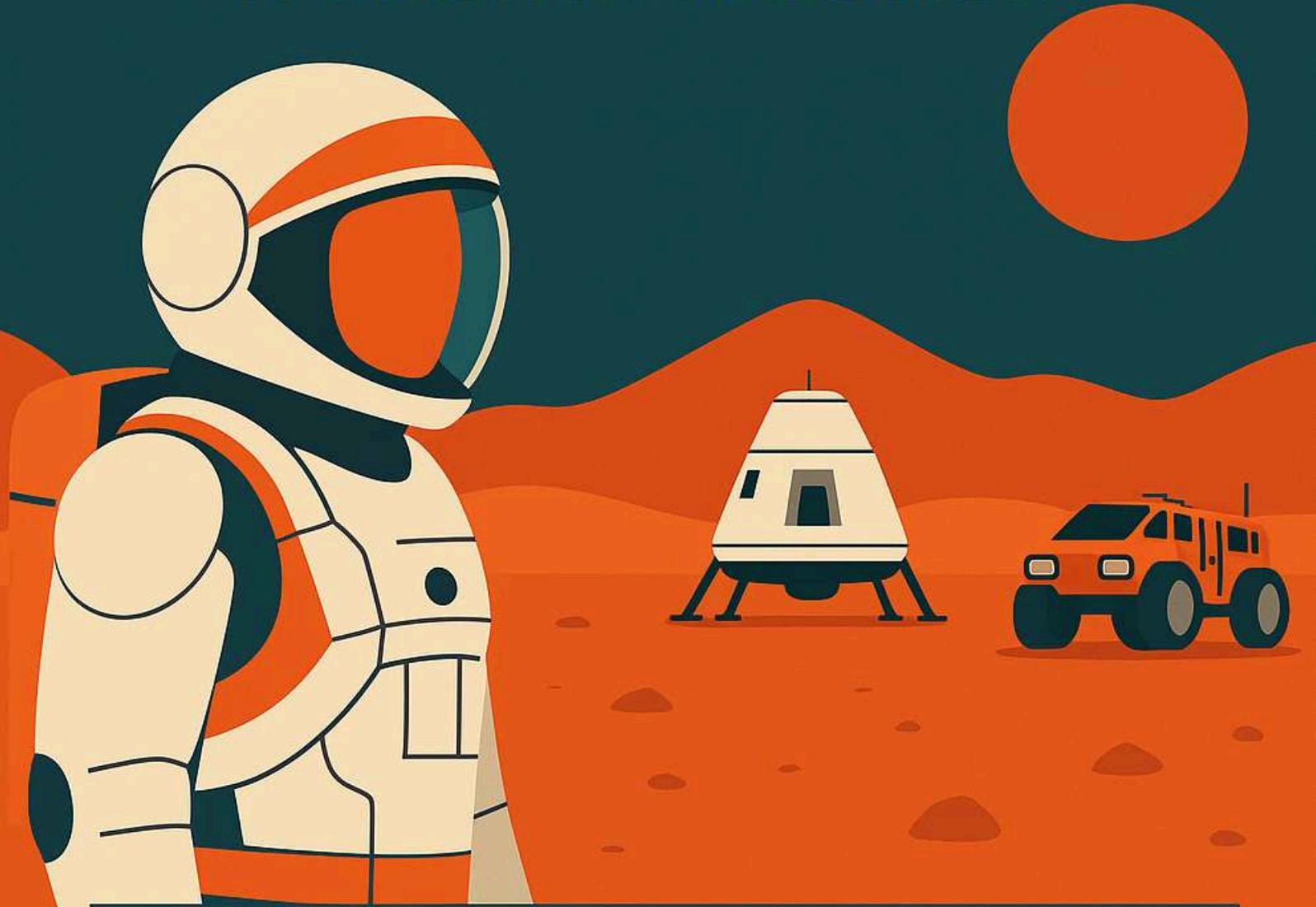
If you were to tumble into a black hole, the experience would be extraordinary and extreme. The first thing that would happen to you is spaghettification; where the powerful gravitational field of the black hole stretches you out into a long, thin string. As soon as you cross the event horizon, you would be trapped. No signal or information could ever come back out from within, and you would be on a one-way trip into the unknown.

Concepts regarding black holes have also ignited imagination. Black holes are believed by some scientists to be portals, connecting different parts of the universe or even allowing for time travel. These are, however, still speculations and not tested yet, but they continue to feed the interest for these mysterious objects.



THE MARTIAN

A SCIENTIFIC REVIEW

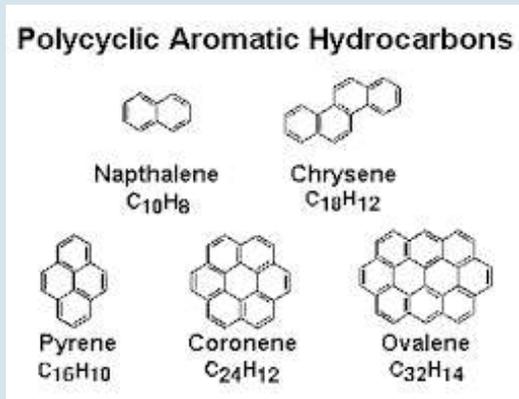


Ridley Scott's *The Martian* is widely praised for its realistic portrayal of space science. The film demonstrates principles of botany, engineering, and orbital mechanics through astronaut Mark Watney's survival on Mars. Growing potatoes in Martian soil using water from hydrogen combustion highlights practical applications of chemistry and biology. The mission rescue involves accurate orbital calculations, gravitational slingshots, and communication delays, all rooted in real physics. While some exaggerations exist (like violent Martian storms), the movie remains scientifically credible and educational. It balances cinematic drama with a strong foundation in STEM, inspiring audiences about problem-solving and space exploration.

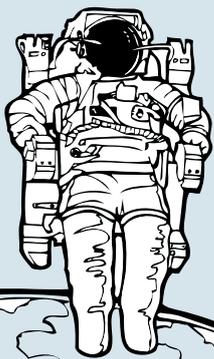
The Smell of Space: Why Astronauts Say Space Has a Scent

When astronauts return from a spacewalk, they don't just bring back tales of mind-blowing views; they bring back a scent. "It's like seared steak, walnuts, hot metal, and welding fumes from motorbikes all rolled into one," astronaut Greg Chamitoff once told NASA. Scott Kelly described the International Space Station as carrying notes of unwashed bodies, antiseptic, and rubbish, an aroma that seems to cling stubbornly to spacesuits and equipment after being out in the vacuum of space.

Smell is the most nostalgic of senses. A single whiff of fresh, juicy mangoes can instantly transport me to my grandfather's backyard. The earthy fragrance of the first rain sweeps me back to carefree afternoons with my cousins, all of us laughing and splashing barefoot in the downpour.



The signature scent comes from polycyclic aromatic hydrocarbons (PAHs), which are complex molecules made of carbon and hydrogen arranged in multiple ring-like structures. They form when stars die in fiery explosions or when high-energy radiation interacts with dust and gas in space. In other words, the smell of space is the combined byproduct of stardust and photochemistry.



You know those moments when a smell is so unmistakably familiar that it instantly clicks in your mind? That's precisely what this scent is like. PAHs are released

when we grill meat, toast marshmallows over a campfire, burn wood, or weld metal. It's that slightly bitter, smoky aroma—the same reason astronauts associate it with barbecues, campfires, and hot metal.

Of course, simply leaning out of a spacecraft and taking a deep sniff wouldn't work—space is a vacuum, and without air, scent molecules can't travel to your nose. The aroma only reveals itself when equipment and spacesuits return inside, carrying tiny traces of these compounds, which then mix with the station's breathable air.

So if space tourism takes off in the future, which it most definitely will (because who doesn't want to brag about their out-of-this-world vacation?), Maybe the "souvenir shop" won't just sell moon rocks or postcards. Instead, you might pick up a bottle of Eau de Space, capturing the smell of welding sparks and cosmic dust. Because honestly, if you're paying for a trip to space, you might as well bring home the full experience—scent and all.

As astronaut Chris Hadfield said, "Space smells like seared steak and hot metal—a scent you don't forget once you've experienced it." That's one souvenir you won't find anywhere else on Earth.



SCIENCE FACTS

LIGHTNING IS
HOTTER THAN
THE SURFACE
OF THE SUN



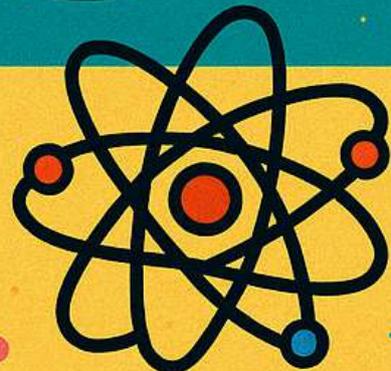
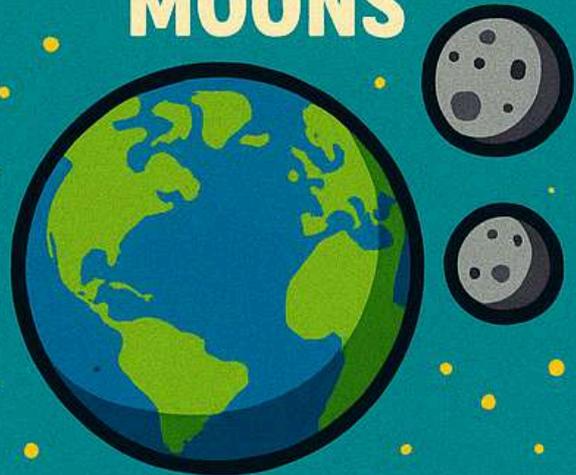
BANANAS ARE
RADIOACTIVE



A STRAND OF DNA
IS **THINNER** THAN
A HUMAN HAIR



EARTH ONCE
HAD TWO
MOONS



SCIENCE FACTS



JUPITER'S GREAT RED SPOT IS A GIGANTIC STORM THAT HAS BEEN RAGING FOR AT LEAST 300 YEARS

It could even fit Earth inside it.

DIAMONDS ARE FORMED DEEP WITHIN THE EARTH'S MANTLE

under conditions of extreme heat and pressure.



MANY NOCTURNAL ANIMALS GET THEIR VITAMIN D FROM THE OILY SECRETIONS

on their fur and skin.

EARTH'S CRUST IS VERY THIN COMPARED TO ITS DEEPER LAYERS –

it's like the skin of an apple



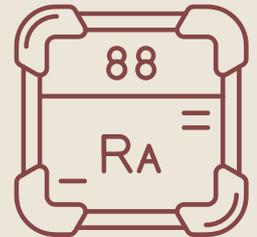
2024 Nobel Prizes in Science

Where Curiosity changed the World



Emmanuelle Charpentier is a French microbiologist and biochemist, co-developer of CRISPR-Cas9 gene-editing technology. Awarded the 2020 Nobel Prize in Chemistry, her work revolutionized genetics, enabling precise DNA editing with vast medical and scientific potential.

Marie Curie, born in 1867 in Warsaw, was a pioneering physicist and chemist whose groundbreaking work transformed science. She was the first woman to win a Nobel Prize and the only person to win in two scientific fields—Physics (1903) for her work on radioactivity and Chemistry (1911) for discovering radium and polonium. Curie's relentless pursuit of knowledge advanced medical treatments and deepened our understanding of atomic science. Despite facing gender barriers, she established research institutes that remain influential today. Her life symbolizes courage, perseverance, and dedication to science, inspiring generations of scientists to push boundaries and seek the unknown.



The Science of Possibilities

careers in science



Cybersecurity Analyst

A cybersecurity analyst protects systems and networks by detecting vulnerabilities, preventing attacks, monitoring threats, and ensuring sensitive data security.



Environmental Engineer

An environmental engineer designs solutions to reduce pollution, manage waste, develop sustainable systems, and protect natural resources for healthier ecosystems.



Medical Physicist

A medical physicist applies physics in healthcare, ensuring safe, accurate use of radiation in diagnosis and treatment, improving patient outcomes.



Space policy Analyst

A space policy analyst researches laws, treaties, and strategies guiding space exploration, ensuring responsible use, security, and international cooperation in space.



India Shines on Axiom 4

A Falcon 9 rocket lifted off from Kennedy Space Center on June 25, 2025, sending Axiom's Crew Dragon "Grace" toward the International Space Station. Among the four-person crew was Group Captain Shubhanshu "Shux" Shukla, marking India's first astronaut aboard the ISS and only the second Indian ever in space, following Rakesh Sharma in 1984. Docking occurred on June 26, and the crew immediately began a suite of around 60 experiments spanning biology, materials science, radiation safety, agriculture, cognitive research, and more.

Shukla himself took charge of seven experiments designed by ISRO and Indian research institutes. These include bone degradation and radiation exposure studies, the growth of methi and moong sprouts for nutrition, cyanobacteria and micro-algae cultivation, testing glucose monitors in

microgravity, and reviving tardigrades—nicknamed water bears—to explore their resistance in space. By the week of July 13, four experiments were completed and the remaining three were in their final stages. On July 6, Shukla phoned ISRO chairman V. Narayanan to discuss progress on radiation, bone health, and algae experiments—thanking the agency for its support.

This mission serves multiple purposes: Axiom Space is showcasing its role in commercial orbital access, NASA is supporting the transition of ISS operations to private partners, and ISRO is gaining hands-on experience ahead of its Gaganyaan crewed flights. The crew is set to undock on July 14 at about 4:30 PM IST and splash down off California the next day around 3 PM IST, capping with about a week-long rehabilitation for Shukla.

Shukla's journey: from a test pilot in Lucknow to astronaut pilot aboard the ISS—captures global cooperation in space and stands as a testament to India's motto: "Space for Nation, Space for All." His work not only advances scientific frontiers but cements India's place in the next generation of human spaceflight.



Quantum Internet Just Took a Giant Leap with QNodeOS

In a quiet but revolutionary moment, scientists recently announced QNodeOS—the world's first full-fledged operating system for quantum networks. This breakthrough brings us closer than ever to a quantum internet, a next-generation communication system that uses entangled particles instead of traditional data packets. Unlike today's internet, which is vulnerable to hacking, a quantum network would be unhackable by design; making it the ultimate tool for secure communication.

The new OS, developed by researchers across Europe and Asia, allows quantum devices to connect, coordinate, and transmit information using quantum entanglement. It manages quantum memory, routes qubits, and syncs with classical systems—all while preserving fragile quantum states. This is a huge step because quantum systems are notoriously difficult to control over distance and time.

A working quantum internet would completely reshape industries. Governments could exchange classified data with perfect security. Banks could perform untraceable transactions. Scientific institutions could share sensitive data without risk. In the long run, this also lays the groundwork for distributed quantum computing, where quantum computers collaborate across vast distances to solve problems we can't yet imagine.

For now, QNodeOS is being tested in early networks in Europe and Asia. As more countries invest in quantum infrastructure, this technology could move from the lab to the real world within the next decade. It's not science fiction anymore; the quantum internet is coming.

When cells forget how to die

It begins with a single cell that forgets how to die. Not in some dramatic, cinematic burst - but in silence.

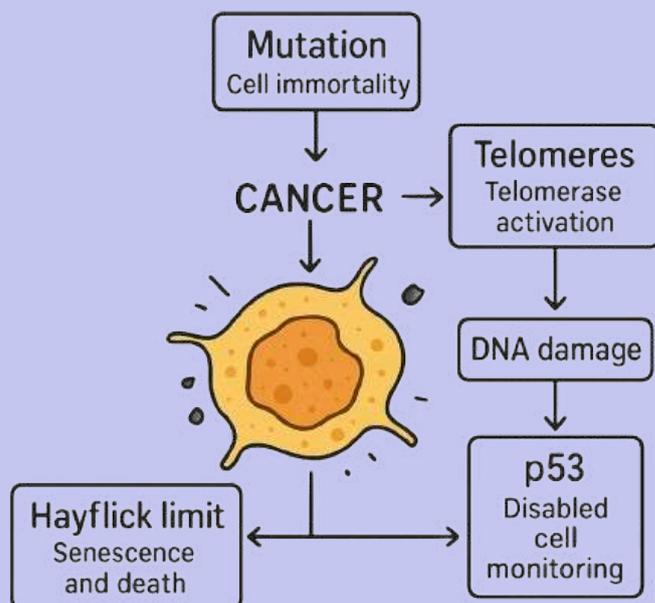
A quiet glitch, a skipped checkpoint, a mutation overlooked. And in that silence, something ancient is remembered. Because every cell in our body carries the instructions for endless life. Cancer is not an invader. It is us, rewritten. To understand cancer is to look at the very rules that govern life. Most of our cells are designed to divide only so many times - a built-in expiry known as the Hayflick limit. After about 50 or 60 divisions, they grow old, enter senescence, and die. This is not failure; it is a form of control, of biological modesty. But cancer breaks that rule. It finds a way to become immortal.

The key lies, in part, with telomeres - the repeating sequences of DNA that cap the ends of our chromosomes, like biological shoelace tips. Every time a cell divides, these telomeres wear down. Eventually, they fray too much, and the cell can no longer divide. But cancer cheats this erosion by reactivating an enzyme called telomerase, which rebuilds telomeres again and again. It is as if the cell has found a way to reset the clock.

But telomeres are just the beginning. Cancer also disables the mechanisms that monitor DNA damage - particularly p53, the so-called "guardian of the genome." In healthy cells, p53 pauses division, repairs errors, or initiates self-destruction. In many cancers, this gene is mutated or silenced. Without it, the cell becomes blind to its own instability, replicating errors with impunity.

Some cancers are caused by environmental triggers - radiation, smoking, toxins - that damage DNA directly. Others arise from inherited mutations. But what unites them is not just the capacity to grow - it is the refusal to stop. Cancer cells rewire their metabolism to feed themselves endlessly. They secrete signals to hijack blood vessels, ensuring a constant supply of oxygen. They slip past the immune system like ghosts, cloaked in molecular disguise.

CANCER AND CELL DEATH



And they spread. This is perhaps the most terrifying part. Through a process called epithelial-to-mesenchymal transition, some cancer cells break free from the tissue they began in. They lose their attachments, become mobile, and enter the bloodstream. This is metastasis - and it is what makes cancer deadly. But here's the unsettling paradox: the biology of cancer is not alien. It is life, pushed to its extreme. Growth, adaptation, resilience - all the things we admire in cells, in organisms - turned inward, uncontrolled. In this way, cancer becomes a mirror of evolution, running too fast and without brakes.

And still, the body fights back. Immunotherapies have begun to harness T-cells to recognize and destroy cancer. CAR-T cell therapy, which engineers a patient's own immune cells to attack tumors, has already saved lives. Checkpoint inhibitors remove the cancer's disguises. There is progress, and it's tangible. But every advance is matched by complexity. Tumors evolve, hide, change form. They resist treatment. They recur.

To call cancer a "battle" is too simple. It is a negotiation with biology's deepest logic. A conversation between what is permitted and what is possible.

LIFE LESSONS FROM A DOCTOR



Doctors are people who are qualified to treat the simply this definition. their journey is something After interviewing doctors who have been to understand both theirs and society's point number of reasons, from being compelled by gained patience, kindness, and humility during made by inexperienced doctors, according to health, and having irregular sleep schedules. balanced diet, exercise frequently, get enough prevalent misunderstanding about doctors is with just their touch. However, some believe others.

Doctors say the increase in online Sometimes patients try to tell the doctors ailment. Though it's beneficial feel that their treatment patients read.

injured. However, their journey is much greater than incredible and something worth learning from. practicing medicine for over 40 years, I was able of view. They pursued becoming doctors for a their parents to finding it fascinating. They their journey. The most frequent health errors the qualified doctors, are disregarding mental To lead a healthy lifestyle, doctors should eat a sleep, and control their stress. The most that they can cure patients of their ailments that physicians profit from the suffering of

self-diagnosis of illness is a serious issue. what to do after reading about their to be aware and involved, doctors also shouldn't be determined by what

QUANTUM COMPUTING

Quantum computing is moving fast, and by 2025, it is likely to contribute substantially to scientific research. The UN declared 2025 the International Year of Quantum Science and Technology to honor its increasing prominence as well. Although quantum computers are still not widely accessible for business applications, they are improving at rapid speed at resolving problems that even the most capable conventional computers have trouble with. One significant breakthrough is in healthcare.

The Cleveland Clinic and IBM have implemented the first dedicated quantum computer computer for medical research. Researchers are utilizing it to accelerate drug discovery by modeling the intricate molecular interactions and protein folding something that is extremely challenging for standard computers. This also has the potential to result in quicker development of new medicines and treatments. Quantum computing is also being developed for usage in the agriculture sector. Scientists are experimenting with its potential to maximize fertilizer use and track crops, which might increase food production while minimising environmental damage. Moreover, quantum technology might improve weather forecasting by processing huge amounts of data more precisely, enabling scientists to forecast extreme weather conditions earlier.



NEW AI MODELS OUT THERE





THE LANGUAGE OF DNA – BASICS OF GENETICS AND HEREDITY



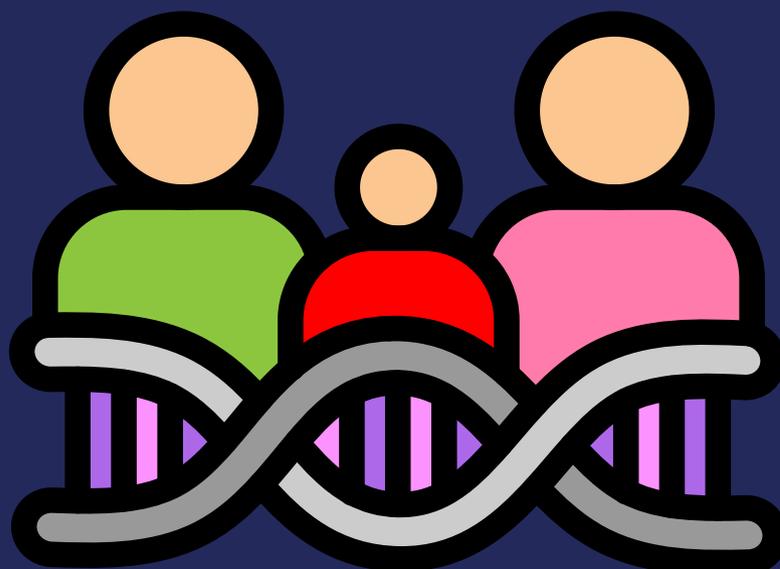
DNA, deoxyribonucleic acid, is the building block molecule that contains instructions for all forms of life. From the pigmentation of your eyes to why you might get a particular illness, DNA stores the genetic makeup that dictates what we are and how we do things. Basic genetics and inheritance not only assists us in realizing how individuals come about but how entire species of living things form over generations as well. Let's enter the interesting world of DNA, the molecules of life.

In essence, DNA is a double-helix molecule composed of four chemical bases: Thymine (T), Guanine (G), Cytosine (C), and Adenine (A). These bases come in pairs in a certain manner: G always with C, and A always with T. These base pairs make up the "rungs" of the DNA ladder, with the "sides" made of sugar and phosphate molecules. The unique arrangement of these base pairs makes up the genetic code, a collection of instructions to assemble proteins. These proteins are required for almost all cellular functions within the body, from metabolism to immunity. The instructions encoded by DNA instruct our cells to make the proteins essential for life itself.

DNA is like a cookbook with each recipe being a gene, a particular piece of DNA that has the instructions to manufacture a specific protein. A gene is really a "sentence" in the language of genetics, directing the manufacture of proteins responsible for a vast array of critical functions. These are the building and repair of tissues, controlling chemical reactions, transporting molecules through cell membranes, and protecting the body from infection. In humans, there are about 20,000 to 25,000 genes distributed over 23 pairs of chromosomes, each gene playing a role in our individual physical characteristics and biological processes.

DNA is not alone; rather, it is packaged into structures known as chromosomes. These compactly coiled DNA molecules reside inside the nucleus of every cell. Humans possess a total of 46 chromosomes, which are divided into 23 pairs. One chromosome from each parent makes up each pair. These chromosomes do not only harbor our genetic material but also assign biological sex. XX chromosomes give rise to a female, while XY chromosomes give rise to a male. Beyond this, chromosomes also carry genes that govern everything from our height and eye color to our susceptibility to certain diseases, influencing much of our biology.

Heredity is the process by which genetic traits are passed down from parents to offspring. Traits are determined by alleles, which are variations of the same gene. An individual inherits two alleles for each gene, one from each parent. How alleles are expressed is based on whether they are recessive or dominant. Dominant alleles are expressed if only one is inherited, but recessive alleles are expressed only if the two copies of the gene are identical. For instance, the brown eye gene is dominant to the blue eye gene, so an individual with one blue eye gene and one brown eye gene will have brown eyes. This explains why children inherit features from both their parents and why some features are more prevalent than others.



THE ETHICAL DILEMMAS OF GENE EDITING TECHNOLOGIES

It is a strange thing, how hope and unease can grow from the same discovery. CRISPR feels like that - a quiet revolution with edges we don't fully see yet. On some days, it is just a tool, a way to fix what has always seemed unfixable: inherited diseases that shadow families for generations, mutations that steal years before they begin.

There is something undeniably human in that impulse to mend our own blueprint. But beside this hope lies the question of how far we will take it. Because changing an embryo is not only about curing an illness - it is about making decisions that echo forward, decisions the person themselves will never be able to consent to. And if we can erase a disease, what stops us from choosing other traits - height, intelligence, even the shape of a face? That thought feels like crossing a threshold into something colder, where the value of a life could be measured against a checklist of desirability. The fear is not science itself but what we might do with it when ambition outruns wisdom.

There are other worries, too: the unintended consequences of editing a genome that is not a neat ledger but a vast, interconnected story. A single change could set off ripples we don't understand until it is too late. And all the while, there is the quiet truth that such technologies are unlikely to be shared equally. Who decides who gets to be cured, improved, designed? Who gets left behind? CRISPR is a reminder that progress is never only technical - it is also moral, and collective, and fraught. To pretend otherwise is to ignore the responsibility that comes with this power: not just to ask what we can change, but whether we should.

3D Printed Organs: Can We Print a Human Heart?

What if you could print a human project? This isn't science fiction. Scientists are now printing human tissues and in

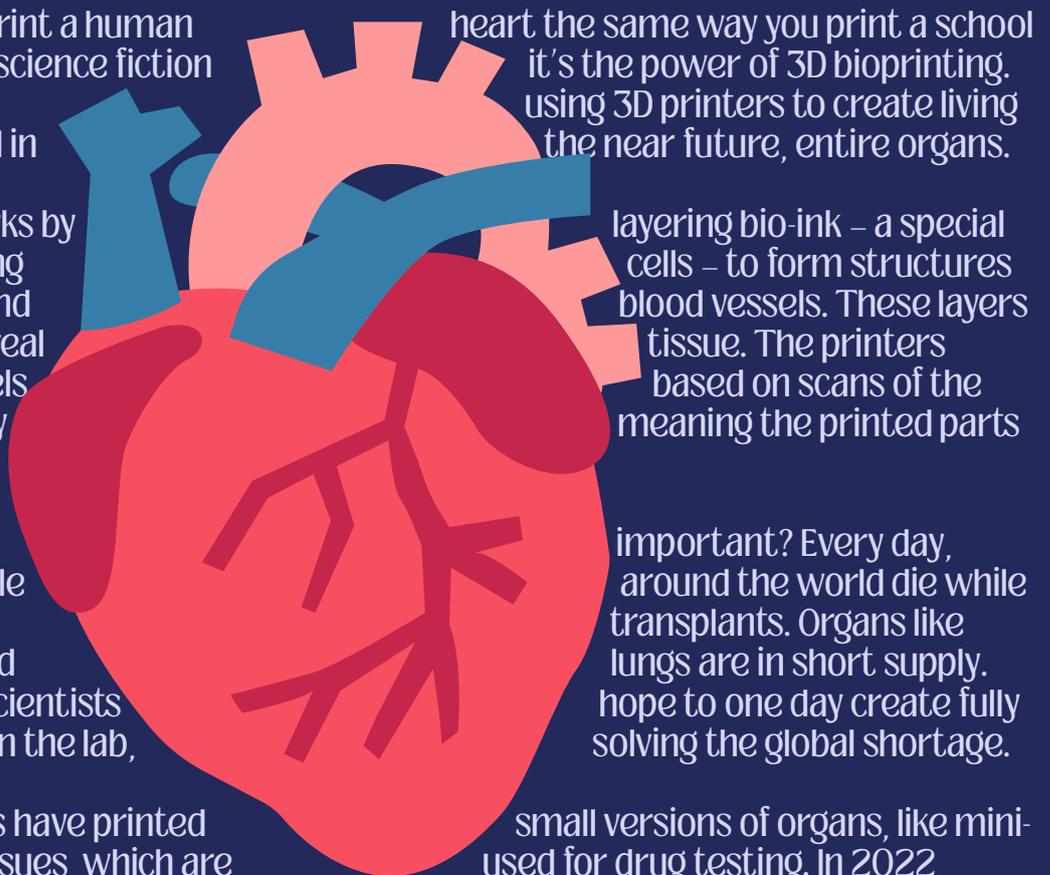
3D bioprinting works by layering gel made from living cells like skin, muscle, and blood vessels. These layers build up to create real tissue. The printers follow digital models based on scans of the patient's own body, meaning the printed parts are personalized.

Why is this important? Every day, thousands of people around the world die while waiting for organ transplants. Organs like kidneys, hearts, and lungs are in short supply. With 3D printing, scientists hope to one day create fully functional organs in the lab, solving the global shortage.

So far, researchers have printed small versions of organs, like mini-livers and heart tissues, which are used for drug testing. In 2022, scientists at Tel Aviv University even 3D printed a tiny heart with blood vessels – a major milestone. While these aren't ready for transplant yet, they're proof that printing complex organs is possible.

3D printed organs could revolutionize medicine. They would save lives, reduce transplant waiting times, and even allow doctors to test drugs safely on printed tissues before using them on people.

It's exciting to think that in the future, doctors might simply press "print" to save a life. For now, we're watching a medical revolution being built – one layer at a time.



Why Our Brains Erase To Remember Better



You walk into a room and stop. Something brought you here - you're sure of it - but the reason has already slipped away. We've all had that moment, that tiny failure that makes us think our memory is letting us down. But the truth is, it isn't. Forgetting isn't a flaw in the system. It's part of the design. Your brain erases on purpose.

All day, without pause, your brain is collecting things. Snippets of conversation, flashes of colour, the way the air smelled when you stepped outside this morning. Every one of those fragments passes through the hippocampus, a curled little structure deep in your brain that works like a sorting office. But there's no point in keeping everything. Too much information slows you down. That's where forgetting comes in.

One of the ways the brain tidies up is through something called synaptic pruning. When we're young, our brains are packed with connections between neurons - far more than we'll ever need. As we grow, the useful ones are reinforced, and the rest are trimmed back. It's not destruction. It's refinement. By cutting away the weak or unused connections, the brain makes sure the important ones are easier to find. Forgetting also helps us make better choices. Imagine trying to decide where to eat if you remembered every single meal you've ever had in perfect detail. You'd get stuck in the noise. Letting go of the small stuff leaves space for patterns, lessons, and new ideas. In fact, researchers have found that people who forget a little more easily can sometimes be more creative - their minds are freer to recombine ideas without getting tangled in the exact memories of the past. This is why diseases like Alzheimer's are so devastating. In a healthy brain, forgetting is selective and deliberate. In neurodegeneration, the process loses its balance. It's the difference between a gardener carefully trimming branches and a storm tearing through the whole garden. That's the image to hold onto - the brain as a living garden. Growth alone isn't enough. You have to clear space for what matters to flourish. Forgetting, in its quiet way, is just that. A bit of room made for the next thing worth remembering.





How The Ocean Rebuilds

The first thing I noticed was the light. It filtered through the water in shifting gold ribbons, landing on the outline of something huge below me. I kicked closer, and the shape sharpened a ship, tilted on its side, its surface no longer smooth metal but a garden of coral, anemones, and swaying sea fans. Fish darted in and out of the openings as if they'd lived there forever. It hit me then: this ship hadn't been abandoned. It had been claimed.

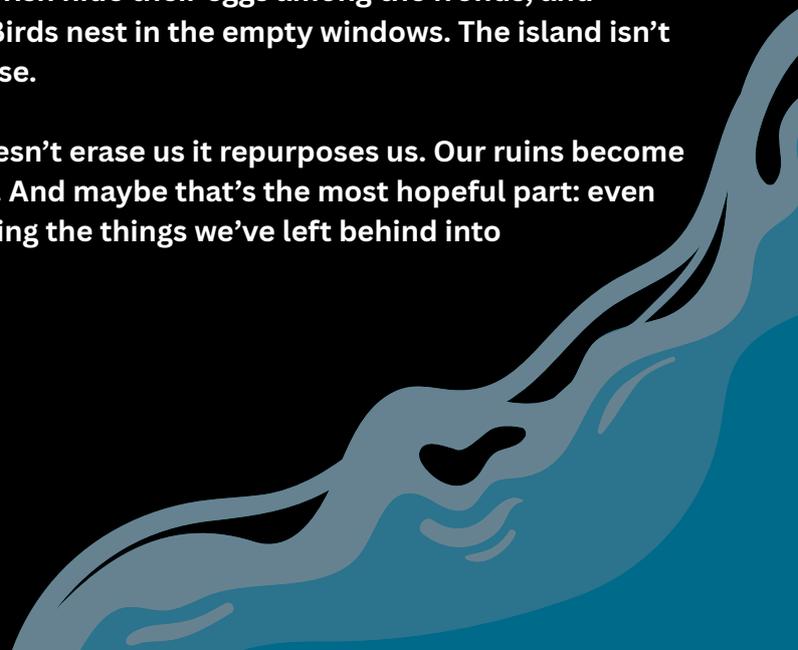
When we leave things behind in the ocean a wrecked freighter, an oil platform, even an old pier nature doesn't just let them sit there. It starts to work on them, patiently. Scientists call it rewilding, but to me, it feels like the ocean rewriting the story. First, microscopic algae and bacteria coat every surface. That thin layer draws in barnacles, mussels, and small creatures. Then come the fish, and with them, the predators. Over the years, coral polyps take root, until the structure is completely transformed.

Some sites are legendary now. In the Red Sea, the SS Thistlegorm, a British World War II cargo ship, sank in 1941 with its holds full of motorcycles and trucks. Today, it's surrounded by shimmering schools of glassfish, patrolled by sea turtles, and draped in coral. In the Gulf of Mexico, old oil rigs have been turned into "rigs-to-reefs," standing like skyscrapers for marine life in an otherwise flat seabed.

But it's not always perfect. If a wreck contains toxic paint or certain metals, it can poison the very waters it's in. Badly prepared structures can collapse, destroying the life that's taken hold. The ocean is tough, but it can't fix every mistake we make.

Then there are places like Hashima Island, Japan once a coal mining powerhouse, now a ghost town. Its seawalls are wrapped in kelp forests, cuttlefish hide their eggs among the fronds, and harbour seals stretch out on the cracked concrete. Birds nest in the empty windows. The island isn't silent; it's just speaking in a language we no longer use.

Seeing these places makes you realise the ocean doesn't erase us it repurposes us. Our ruins become nurseries. Our silence becomes home to new voices. And maybe that's the most hopeful part: even when we're gone, life finds a way to keep going, turning the things we've left behind into something beautiful again.



Solar Geoengineering: Can We Cool the Planet with Science?

Climate change is heating up our planet — glaciers are melting, storms are intensifying, and heatwaves are becoming more deadly. But what if we could cool Earth using science? This is the bold idea behind solar geoengineering.

Solar geoengineering, also known as solar radiation management, is the idea of reflecting a small portion of the sun's energy back into space. If less sunlight reaches the Earth, the planet would cool down — at least in theory.



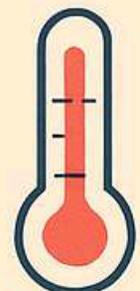
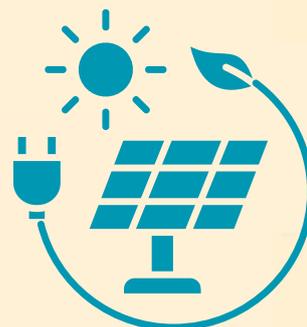
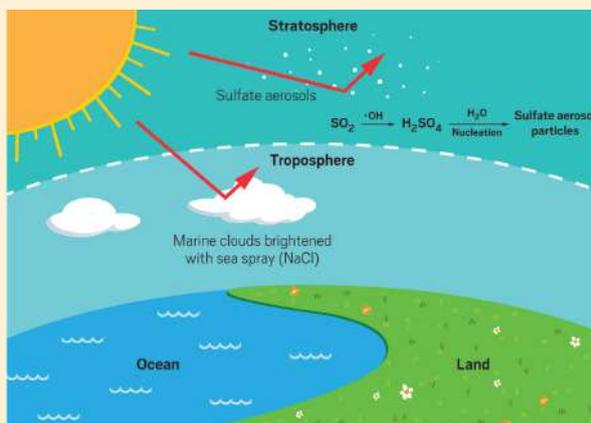
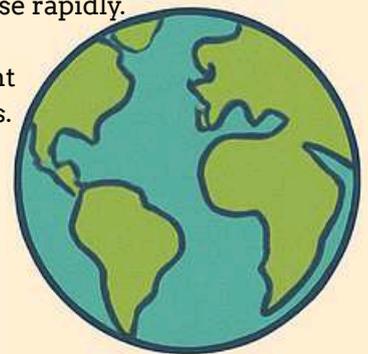
One method being researched is stratospheric aerosol injection. Scientists would spray tiny reflective particles (like sulfur dioxide) high into the atmosphere. These would scatter sunlight, much like how volcanic eruptions can cool the Earth. For example, after the 1991 Mount Pinatubo eruption, global temperatures dropped by 0.5°C for over a year.

Another idea is marine cloud brightening, where seawater is sprayed into clouds to make them whiter and more reflective. There's also talk of using space-based mirrors, although that's still far from possible.

These methods could help reduce extreme heat and slow ice melting.

But solar geoengineering is also controversial. It doesn't solve the root problem — greenhouse gas emissions. It might also change rainfall patterns, affect crops, and have unknown side effects. Plus, once we start, we might need to keep doing it forever, or temperatures could rise rapidly.

Despite the risks, many scientists say we need to study it seriously, not as a replacement for climate action, but as a backup plan. In 2023, a U.S. government report encouraged more research into the technology and its possible impacts. For now, solar geoengineering is still experimental. But as climate change worsens, it might become part of the toolkit to protect the planet, if we use it wisely.





The Flying Future

Modified drones are small flying robots that people change to help with special jobs.

In Ukraine, a group called Escadrone turns racing drones into flying smart “mini-bombs.” These FPV (first-person view) drones guide themselves to targets and drop explosives.

They cost less than \$500 and by May 2023, Escadrone built about 1,000 of them every month. Another Ukrainian team, Aerorozvidka, converts basic store-bought drones into tools for army pilots. They added better cameras and stronger propellers so the drones can fly far, carry supplies, spot enemies, or drop small bombs. These drones fly up to 5km and hold payloads of about 5kg.

Switching from harm to help, Conservation Drones are used worldwide in wildlife protection. They carry cameras to monitor animals like elephants or rhinos without disturbing them. In one case, researchers counted 14,000 cranes in just four hours, something that would take days by walking. From classrooms to forests, drones are repurposed for education too. Simple drones in schools teach kids about science, math, and coding. Students learn how drones fly, how to steer them, and even how to write pilot programs. Drones aren't just toys anymore, they're tools.

People around the world modify them to help soldiers, scientists, conservationists, and students solve real problems.

De-extinction of Tasmanian tiger

Harvard geneticist George Church, co-founder of Colossal Biosciences, is spearheading one of the most ambitious de-extinction projects: resurrecting the Tasmanian tiger (thylacine). I (samaira malhotra) was able to gain a deeper insight into the world of gene-editing and resurrection through an interview with Mackenzie L. Boucher, a Harvard student under Professor Church who gave a talk about this at Boleyn Hall at Harvard.

Through a unique collaboration between Colossal and the University of Melbourne's TIGRR lab—established with a US\$5 million gift—this initiative seeks to restore a lost apex predator to the wild, reviving not simply an organism but a missing piece of Tasmania's ecosystem.

At the heart of the endeavor lies the reconstruction of a genome of extraordinary quality—over 99.9% complete, derived from century-old specimens preserved in ethanol that contained intact DNA and RNA.

Researchers have pinpointed “Thylacine Wolf Accelerated Regions” (TWARs); genetic sequences governing jaw and skull morphology—and transferred some 300 targeted edits into the closest living relative: the fat-tailed dunnart .

This process involves creating induced pluripotent stem cells from dunnarts, performing CRISPR edits to mirror thylacine DNA, and crafting novel assisted reproductive technologies (ARTs) to stimulate ovulation, fertilize eggs, and even support embryos in artificial marsupial wombs.

With these ART milestones and gene-edited cell lines—the most edited animal cells on record—the team edges closer to producing a surrogate-born thylacine-like joey.

Debate rages over feasibility and ethics. Critics point out that surrogacy in a distant marsupial may not recapitulate true thylacine behavior and caution against diverting conservation funding . Yet proponents assert ecological restoration—like controlling overabundant prey and curbing disease in Tasmanian devils—justifies pioneering proof-of-concept de-extinction.

Realistically, the project projects its first thylacine proxy within a decade. While never resurrecting the “true” thylacine, it could offer a genetically accurate and ecologically functional analogue, transforming de-extinction from science fiction to scientific reality.

THE MATHEMATICS OF SWARMS

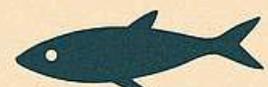
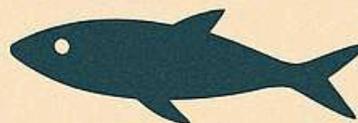
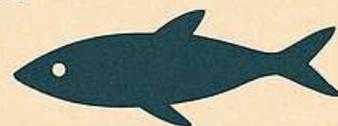
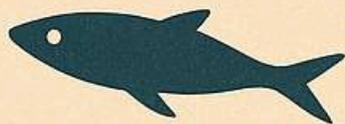
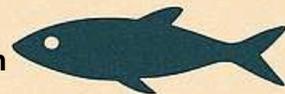
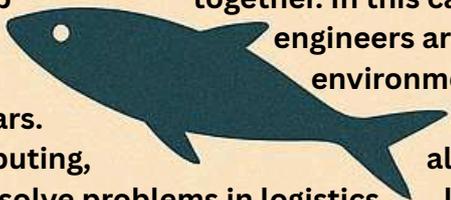
HOW ANIMALS DECIDE WITHOUT A LEADER

if you have ever witnessed birds turning around under the sky or ants carrying food on their backs in a straight line, then you have witnessed the Swarm behaviour. So how does this work? How do they decide without a leader? The answer might seem surprising- but in reality, it's just a collaboration of Mathematics and Science, together. Nature often holds the blueprint of science and innovation. It's just the art of observing and making use of it, that our scientists, have fortunately succeeded at. Scientists have discovered that swarms follow basic local interaction rules. Each individual- whether it's a bird, a fish or an ant- is not actually following the whole group.

For instance, in case of a bird- they just keep track of seven birds of their flock and no one else. This, naturally forms a pattern wherein each bird follows simple rules- stay close, don't bump into anyone and follow others' speed and direction. When thousands follow the same rules, something remarkable happens, that is, emergent behaviour. These rules together help in forming complex yet intelligent patterns. Even though, there is no leader bird telling others where to turn, the flock functions smoothly like ripples spreading through water.

Similarly, in a school- a fish simply follows the fish around it. It makes sure to maintain distance and follow the directions of the other fish. On the other hand, ants follow each other through scent trails. Once an ant finds food and lays a trail- the others follow and reinforce it.

This, thus, forms a self-organised system, where there is no leader yet there is proper functioning of the group together. In this case, if one individual loses its track, others won't get affected. This is how, engineers are working to build swarm robots to explore the unpredictable environment for humans- like collapsed buildings after earthquakes or the surface of Mars. Each robot follows simple rules, but they together work as a team. In computing, algorithms like Ant Colony Optimization and Particle Swarm Optimization help solve problems in logistics, like planning the most efficient delivery routes or managing airplane schedules. They're also used in medical research to model how diseases spread and how treatments might reach target cells.



LAB GROWN MEAT

THE FUTURE OF FOOD

Imagine eating a juicy burger - but no animal was harmed to make it. Sounds impossible?

Not anymore. Thanks to science, we now have lab-grown meat, also known as cultured meat. It's real meat, but grown from animal cells in a lab instead of coming from a slaughtered animal.

The process begins with a small sample of animal cells, usually taken through a harmless biopsy. These cells are placed in a nutrient-rich solution where they multiply rapidly. Over time, they form muscle tissue - the same stuff meat is made of. Scientists can even add fat and flavor to make it taste exactly like the real thing.

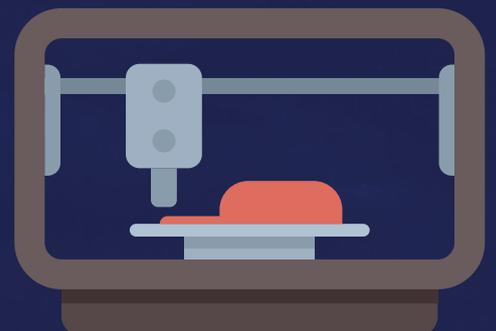
Why do we need lab-grown meat? Well, the traditional meat industry has a big environmental cost. It uses large amounts of water, land, and energy, and it produces greenhouse gases like methane. According to the United Nations, livestock farming is responsible for nearly 15% of all human-caused emissions. Also, factory farming raises concerns about animal cruelty and disease outbreaks.

Lab-grown meat offers a cleaner, cruelty-free alternative. It reduces the need for large-scale animal farming, cuts down greenhouse gases, and avoids the use of antibiotics - which can lead to antibiotic resistance in humans. It also uses far less water and land.

Some companies, like Upside Foods and GOOD Meat, have already gotten approval to sell their products in the U.S. and Singapore. In 2023, the first lab-grown chicken nuggets hit restaurant menus. While still expensive, prices are coming down as technology improves.

Of course, there are challenges. People may feel weird about eating meat grown in a lab. Also, large-scale production still needs to become more efficient and eco-friendly. But with continued research, experts believe lab-grown meat could become a normal part of our diets in the next 10-20 years.

In the end, lab-grown meat is not just a food revolution - it's a solution to some of the biggest problems facing our planet. And it might just be coming to your plate sooner than you think.



Sodium-Ion Batteries

In a major advance for sustainable energy, Indian scientists at the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) have unveiled a fast-charging sodium-ion battery that could one day rival lithium-ion technology.

Their prototype can reach 80% charge in just six minutes, maintains stability over 3,000 charge cycles, and relies on abundant and low-cost sodium instead of rare lithium.

This is especially important because lithium mining poses environmental and geopolitical challenges. Sodium, by contrast, is plentiful, safe, and globally distributed. Until now, the major hurdle was performance: sodium-ion batteries couldn't match lithium in energy density or charging speed. The JNCASR breakthrough changes that equation, delivering high-speed charging with strong longevity and lower cost—making it ideal for electric vehicles, grid storage, and developing economies.

Fast-charging, stable batteries are the foundation of a clean energy future. If scaled, this sodium-ion innovation could reduce our reliance on expensive lithium, democratize battery access, and help stabilize solar and wind power grids.

The next step is industrial testing and commercialization. If successful, it may usher in a new generation of affordable, sustainable batteries that power the world without extracting a heavy toll from the planet.



RIDDLES

Here are 5 fun and interesting riddles for you to solve! Have fun!

I zip through wires, unseen but felt, Powering cities, machines, and wealth. Flip a switch—I'm there in a spark. But I'm not lightning, though I leave my mark.	Born of bones, I make you whole, I move your limbs—I'm in control. Flex me or stretch me, I won't resist, But tear me and you'll get the gist.	I'm in your lungs but also in stars, Essential for life, from Earth to Mars. You can't see me, but I help you live— With each breath, it's me you give.	They say I'm noble, yet I don't rule, I float in signs and fill your pool. I shine in lights without a flame, And end each round in the periodic game.	I'm not alive, yet I reproduce, I hijack cells for my own use. Too small to see with just your eyes— In pandemics, I'm the nasty surprise.
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Answers are provided below!

Electricity	Muscle	Oxygen	Neon	Virus
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The Case Of A Petri Dish

In a high school microbiology class, one petri dish ended up contaminated. Four students were working at the station. Who caused the contamination?

Upon questioning each of the students, they all revealed different things. Alex: "I didn't touch the petri dish, and neither did Bella."

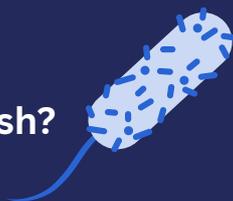
Bella: "I wore gloves, but I saw Daniel open a plate with bare hands."

Casey: "I didn't even enter the lab today!"

Daniel: "Bella is lying. She sneezed near the samples without a mask."

The rules of this game are as follows: Only ONE person is telling the truth. The rest are lying.

So, who contaminated the Petri dish?



ANSWER

Daniel contaminated the sample. Only Casey is telling the truth (that they weren't in the lab). Daniel opened a plate with bare hands - Bella's claim - making her statement true if Daniel did it. But that would mean two people are truthful, which breaks the rule. Casey being the sole truth-teller fits the logic, and makes Daniel the guilty one.

SCIENCE QUIZ

1. Which of these elements is liquid at room temperature?

- A) Mercury
- B) Bromine
- C) Both
- D) Neither



2. True or False: The Moon has no gravity.

3. Fill in the Blank: The human brain uses about ___ % of the body's energy.

4. Who invented the first practical electric battery?

- A) Michael Faraday
- B) Alessandro Volta
- C) Marie Curie
- D) Thomas Edison



5. True or False: Sharks are older than trees.

6. Fill in the Blank: The layer of the atmosphere where weather happens is called the ___.

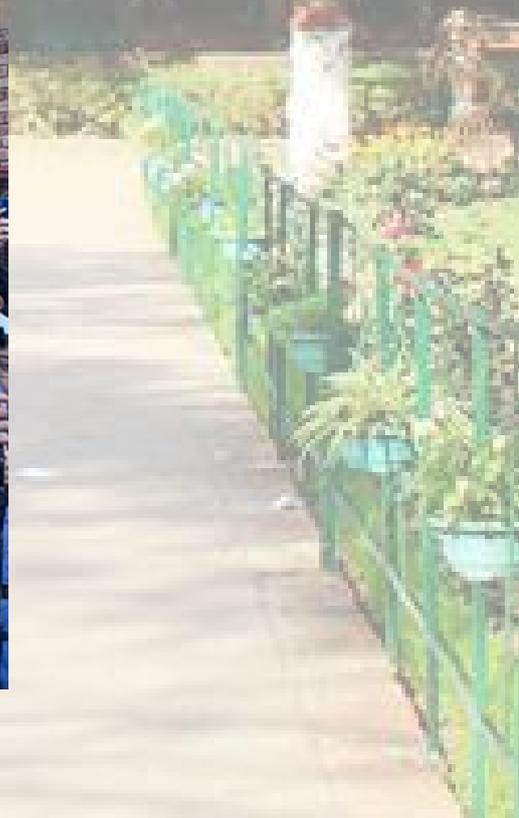
- 1. C 2) False 3) ~20% 4) B 5) True 6) Troposphere

SCIENCE FACTS

1. A bolt of lightning is five times hotter than the surface of the sun.
2. Octopuses have three hearts, and two of them stop beating when they swim.
3. Earth is hit by about 100 tons of space dust every day.



school's science initiatives



A photograph of an empty classroom or lab. The room is viewed through an open blue door. In the foreground, several rows of white plastic chairs with metal frames are arranged. The floor is light-colored wood. In the background, there are white tables, a circular window with a view of greenery, and a wall covered with various posters or charts. The lighting is bright, suggesting natural light from the window.

OUR INNOVATIONS LAB



The silent Architects

How microbes shape the weather

The monsoon has been very active this year and it's been raining heavily almost every other day. When we look at those dark dense clouds in the sky we imagine them to be filled with water droplets but did you know that ... clouds are actually floating islands of life where organisms from thousands of species live, many of which are responsible for the rains! Did you also know that these microbes are the original globe trotters!!! Yes.... the clouds help indefinable numbers of bacteria, fungi, viruses and single-celled organisms to travel across the globe. Let's first understand what these tiny globe travellers or Aerobiome are. Aerobiome is the collection of microorganisms in an airspace, along with their cellular fragments and by-products of metabolism. Their composition and function can differ depending on environmental conditions like air pressure and temperature. Aerobiome has a capability to alter the weather and exerts a powerful influence on the chemistry of the atmosphere. How do these tiny beings reach the clouds? It could be an ocean wave hurling fine droplets of sea water into the air or winds pickin them up from the ground or through water evaporating into the air. Forest fires too help in sending them up in smoke after stripping the organisms off the ground, trunks and leaves of trees. These microbes travel far and wide for kilometres. During their journey, they may fly into a region of the air where the water vapor is condensing into droplets and get enveloped in one of those droplets. Eventually they become a part of cloud. As clouds form, they lift water-laden air to high altitudes that are cold enough to turn the water to ice. The ice then falls back down. If the air near the ground is cold, it may land as snow. If it is warm, it turns to rain.

What is Ice Nucleation ?

Even at temperatures far below the freezing point, water molecules can remain liquid. As water molecules stick to a microbe's surface, they bond to one another, a process known as nucleation. Other water molecules then lock onto them and assemble into a crystal structure, which when heavy enough, will fall out of the sky. This is Ice Seeding by Microbes. Biological molecules and cell walls are exceptionally good at triggering rain. Fungi, algae, pollen, lichens, bacteria and even viruses can seed ice in clouds.

This shows that clouds and life are interlinked, as microbes not just live in the clouds, but also help them to form in the first place. The biomolecules responsible for bacterial ice nucleation are large ice nucleation proteins (INPs) anchored to the outer membranes of the bacterial cells. Main function of the INPs is to order water molecules into an "ice-like" arrangement, thereby facilitating phase transition

from water to ice. Ice-nucleation (IN) activity in bacteria was first discovered in *Pseudomonas* in the 1970s.

Subsequently, several other ice nucleating bacteria belonging to species in the *Pseudomonadaceae*, *Enterobacteriaceae*, *Xanthomonadaceae*, and *Lysinibacillus* families

have been identified. The best-characterized bacterial INs are *Pseudomonas syringae*, which enable ice nucleation at temperatures at -2°C . This unique characteristic of *P. syringae* as a source of exceptional bacterial INs is commercially utilised as an artificial snowmaking product. The world of microbes is incredibly intriguing, interesting and mysterious too and they indeed are the silent architects of ecosystems, human health, and future technologies. On a lighter note, next time you feel a drop of rain on your head, it could be a microbe returning from an epic journey!!

By Aanya Nariani

Send in your science related articles to [-msvmodexplorers@gmail.com](mailto:msvmodexplorers@gmail.com)

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