

*Manarat Science*  
**Journal**

**MARVELS OF  
THE MINI-MOON**

*Earth's temporary second moon. page 4*  
*A rare once in a decade  
occurrence.*



Dear Readers,

Assalamu Alaikum and welcome to the first edition of the Manarat Science Club journal! I am thrilled to see this initiative come to life, and even more excited to share this space with curious minds like yours.

This journal represents our collective journey into the vast and fascinating world of science. From exploring groundbreaking discoveries to unraveling the mysteries of everyday phenomena, it is designed to spark your curiosity and encourage you to think critically about the world around you. We hope it inspires you to dig deeper, ask questions, and even consider contributing your own thoughts and ideas in future issues.

Our vision for this journal is to be a platform where we learn from one another and grow as a community of learners. Whether you're in Grade 7 or preparing for your A-levels, there is something here for everyone.

Let's continue to push the boundaries of our knowledge and make science a passion that unites us all!

Warm regards,

**Muhammad Mahmud Muntasir**

**President, Manarat Science Club 2024–2025**

Greetings to all of my esteemed teachers, dearest acquaintances and all the fellow science enthusiasts.

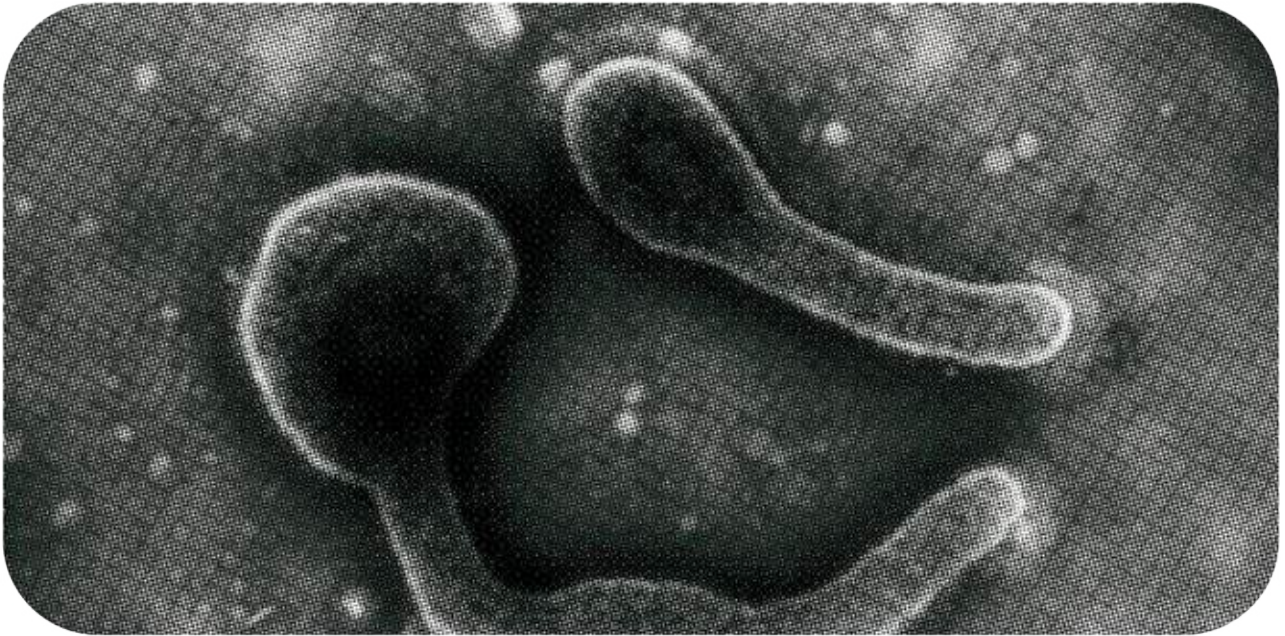
Today marks an exciting new chapter as we launch our science journal, a platform dedicated to advancing knowledge and fostering collaboration in the scientific community. I would like to start by thanking everyone who worked so hard to establish this journal- it truly fills my heart with honour and pride to be a witness to your achievement and hard work.

Science is all around us; it's in everything we see and sense. It is a journey fueled by curiosity, and this journal is a testament to our commitment to sharing knowledge and inspiring future generations. I encourage each of you to contribute, challenge ideas, and explore new horizons.

Together, let us celebrate the wonders of science and make our mark on the world.

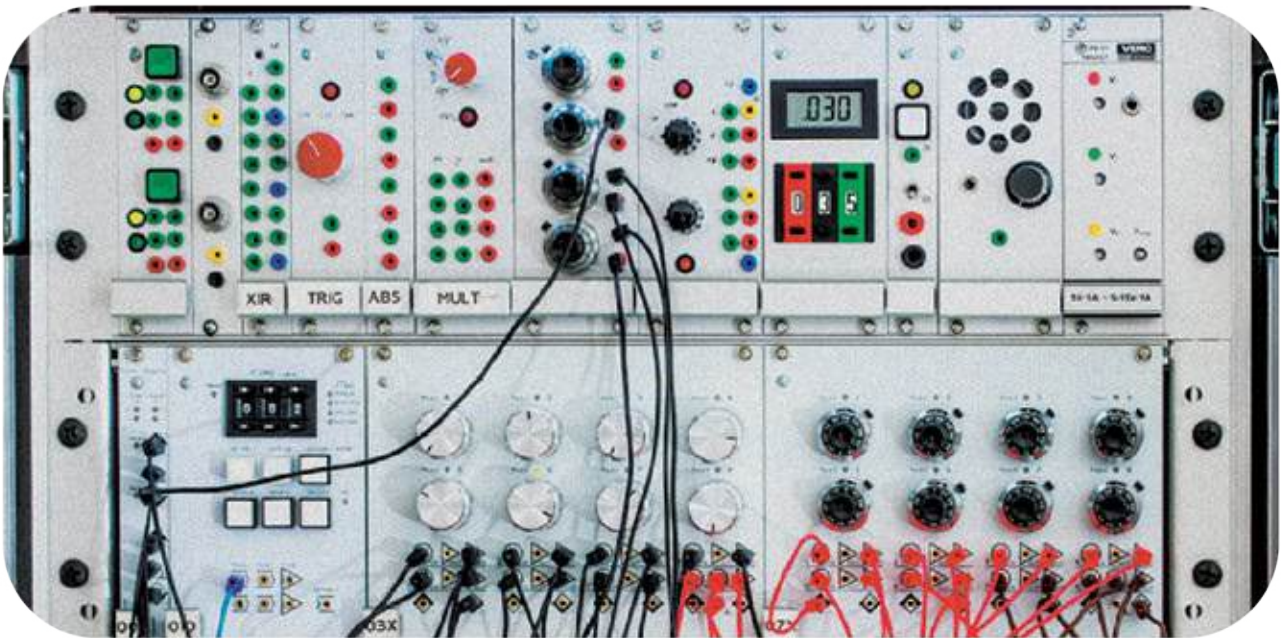
Thank you.

**-Rafidah Hasan, Ex-President, Manarat Science Club 2023–2024**



In The Name of

Allah



The Most Gracious

&

Most Merciful



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# Life Beneath the HYDROTHERMAL VENTS

by Sadiyah Nawar Reza  
and Siddratul Muntaha

**H**ydrothermal vents appear to be the most inhabitable habitat on Earth. These are surface breakages on the ocean floor from where hot mineral-laden water spews out. These vents can be scalding with estimated temperatures skimming as high as 400°C (750°F). Nevertheless, these terrifying environments are teeming with life, from enormous clams and voracious crabs to spindly octopuses and phantom eelpout fish.

With the help of off-the-shelf technology such as remotely operated vehicles (ROVs), researchers recently discovered a hidden ecosystem swarming with miniscule life underneath the vents themselves.

These geyser-like vents are hubs of deep-sea diversity, equipped to sustain themselves in the dark via bacteria that convert chemicals, especially hydrogen sulfide, into energy-producing sugar. A portion of these bacteria reside in the elongated structures of giant tube worms (*Riftia pachyptila*). These worms, with visible bright-red, feathery gills, form thick colonies around the vents, providing shelter for other vent inhabitants.

These tenacious worm fortresses are completely destroyed when volcanic activity in the vicinity changes due to eruptions or earthquakes. However, when new hydrothermal vents appear dozens or even hundreds of kilometers away, they are quickly colonized by soaring clumps of giant tube worms in

a matter of years. Researchers say it's unclear how these worms come and anchor themselves in new vents.

Scientists have discovered few tube worm larvae in the water column near vents, and the constant flow of supercharged fluid ought to make it difficult for the larvae to attach themselves from above. This prompted the researchers to speculate that tube worm larvae were wriggling through fissures beneath the seafloor to seek new vents.

To put this notion to the test, scientists sent the ROV down to the Tica Vent, an extensively studied hydrothermal vent lying 2,500 meters beneath the sea's surface. Initially, the scientists bonded mesh cages over cavities in the seafloor to gather organisms that migrated between the rocky floor and the subsurface. When the boxes proved inconvenient, the crew took a more direct approach, tipping over huge pieces of seafloor with the ROV's robotic arm to gain access to what was beneath.

The researchers identified numerous tiny tubes beneath the vents, indicating that these below chambers function as tube worm

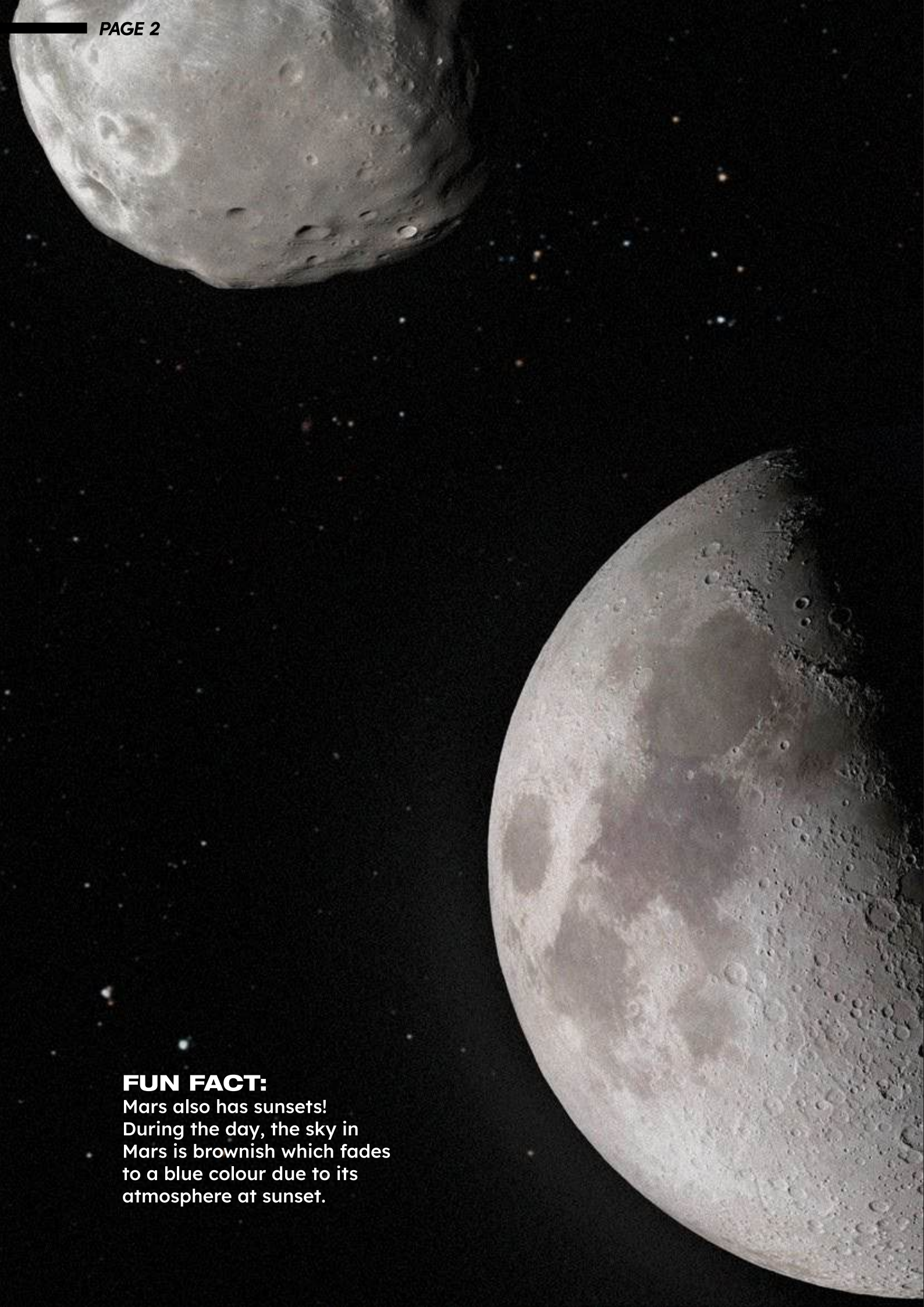
nurseries. The scientists believe that tube worm larvae migrate from vent to vent via a subsurface maze known as the "subseafloor conveyor belt," according to Huber. The tube worms begin their lives below ground before ascending to the vents, where they can grow up to 85 centimeters every year. Many mysteries remain regarding the world beneath hydrothermal vents, however scientists and researcher intend to sequence the DNA of animals and bacteria collected both above and below the bottom to investigate how these two ecosystems are related.



*Riftia pachyptila*

**FUN FACT:**

Mars also has sunsets!  
During the day, the sky in Mars is brownish which fades to a blue colour due to its atmosphere at sunset.



# MARVELS OF THE MINI-MOON

by Kashfee Rahman

Did you know that Earth just got itself its second moon?

The 'mini-moon', called 2024 PT5, is a space rock, a part of the Arjuna asteroid belt, which is not too far from Earth in space terms, just 2.8 million miles (4.5 million kilometres) away. The asteroid will orbit our blue planet in a horseshoe shape, before returning to a heliocentric orbit (around the Sun).

Astronomers first spotted the asteroid on August 7 using the South Africa-based observatory of the NASA-funded Asteroid Terrestrial-impact Last Alert System, or ATLAS and is said to be 37 feet in diameter. Marcos De La Fuente and his colleagues plan to observe 2024 PT5 to collect more data and details using the Gran Telescopio Canarias and the Two-Meter Twin Telescope, both on Spain's Canary Islands.

Contrary to popular belief, this is not the first time we are getting ourselves a second moon. In February 2020, a tiny asteroid named 2020 CD3 was found to have been orbiting Earth for a few years. So what makes this incident so alien?

“Short mini-moon events can occur several times per decade, but long mini-moon events are rare and only occur every 10 or 20 years”

What essentially makes this 'mini-moon' sighting so special is that despite it being a short-capture moon, this is the last time we'll see a second moon in 31 years. Asteroid 2020 CD3 is considered a long-capture mini-moon, while the newly detected Asteroid 2024 PT5 is a short-capture one. It is not a permanent fixture, but this second moon will stay until 25th November, nearly two months after its anticipated start on 29th September. After a staggering 56.6 days, the sun's gravitational pull will bring Asteroid 2024 PT5 back into its normal heliocentric orbit. According to predictions, this rock will not come into Earth's orbit again until 2055.

When Asteroid 2024 PT5 does come back around again, astronomers expect it to become Earth's mini-moon for a few days in November 2055 and again for a few weeks in early 2084. We don't know if we will live that long to witness it, so here's hoping that we can make the most out of the event right now.

Whilst the prospect of seeing this brand-new second moon is definitely enticing, sadly, if you're not a professional, chances are you won't be able to see it for yourself. This event can't be seen by the naked eye, binoculars or even with a consumer-grade telescope as it will be too faint to see. High-tech equipment is essential to see the 'mini-moon' but even then many professional telescopes will struggle to provide a crystalline look at the asteroid.

# An Intriguingly Cautionary Tale of Cyber Crime

**XBOX®** Underground

by Talukder Muhammad Abdullah

**X**box was the spectacle of the early 2000s. Nearly everyone recalled the Xbox. Some remembered it for the revolutionary games, others as it being the medium of some of the deadliest hacks known to man. This is the anecdote of Xbox Underground (the hacker team that shook the foundation of cybersecurity).

In 2008, David and some friends (Nathan, Dylan, Sanad, Austin, and Justin) obtained several developer versions of Xbox and entered the partner net, a place to test beta versions of new games. Innumerable legal cautions were bypassed, and countless crossed as their list of crimes accumulated. Furthermore, their offences escalated to an entirely distinct eschelon. They hacked into an Epic Games employee's mail and got into the server (Epic Games Server). Mayhem commenced as they rummaged through the servers, tattling any information they could uncover. Bedlam ensued in the following months at Epic Games. With no alternative, they had to call the FBI to launch a formal investigation; however, this did not deter them; it only inspired them to go ampler.



Nathan Leroux,  
Sanadodeh Nesheiwat,  
David Poroka and  
Dylan Wheeler.

In the following years, they were on the servers of Microsoft, Activision, Blizzard, EA, Valve, Intel, AMD, WB, Disney, and even Google. Millions of customer details were all under the tip of their fingers. In their two years of rein, they had hacked over twenty-five large companies and the US and Australian military. This absolute obliteration of privacy and security fed into their pride and made them feel invincible, so they craved more, continuing their rampage. They ultimately stole the blueprints for Xbox One and built it themselves. They even put it on eBay to taunt the FBI but to no avail as the FBI took the sale down. That occasion struck a sense of dread in them. The dread turned to paranoia. They all asked themselves the one question they never thought:

"What if they catch us?"

And thus Xbox Underground split.

The members laid low, but the thrill could not keep them away for long. They got news of prototypes of Xbox One being kept at Microsoft. Therefore, they orchestrated a scheme to steal three Xbox prototypes for themselves and succeeded. However, this slip-up in their judgment gave the FBI enough security camera footage to seize them, ending their reign of terror in the world of cybersecurity.

Their sentences were harsh, varying from person to person. Some got eighteen months, some two years, and one eight years. Whatever their punishment was, life after prison was more destructive. Most suffered from depression for the preponderance of their lives, and one even ended up taking their own life. The hacks might have given them ecstasy for the moment, but the price was high. The surviving members of Xbox Underground look back at their lives in regret, wishing that no other person ever goes down that trail.



2001 **XBOX®** motherboard,  
the first console Microsoft® ever released!  
Image Source: Wikimedia Commons



# The Golden State Killer

*How Forensics Closed a 44 Year Old Case*

By Yumna Zaima

This is the story of Joseph De Angelo aka The Phantom of California, known to have one of the most captivating capture tales. For decades, Joseph De Angelo had operated under the belief that he had outsmarted the system, skillfully evading capture. Yet, in an ironic twist, his DNA was what ended up being his worst nemesis.

In 2018, a team of six investigators finally succeeded in unravelling the identity of the night stalker, that too within four and a half months, with a distinctive approach.

The Golden State killer's M.O. included stalking his targets, familiarising himself with their patterns and breaking into their residence through windows and balconies; whilst making sure to keep no fingerprints around. Couples were his primary targets, with him sexually exploiting the female victim whilst tying up the male and forcing him to witness the scene.

Furthermore, he would psychologically torture his victims, instilling fear in them about his return. 'Visalia Ransacker' and 'Diamond Knot Killer' were some of his other most prominent aliases. However, by mid-1980, the terror abruptly stopped, leaving behind approximately 50 rape and 12 murder victims and over 100 burglaries.

The Golden State Killer's identity was shrouded in mystery until 2018 when everything changed. The core of cracking the Golden State Killer case was rather a silent one, awaiting technology to catch up to its potential.

For years, the DNA left at crime scenes felt like a prop rather than a clue. But by 2018, futuristic advancements in DNA technology changed the game. Single Nucleotide Polymorphisms (SNPs)- These tiny but significant variations in our genetic code are what distinguish us from everyone else and are the foundation of forensic genealogy. SNPs trace even distant relatives, people who share just a shred (even 1%) of the same DNA as the suspect.

The investigators uploaded the DNA from a crime scene to a public genealogy website called GEDmatch, which allows people to search for relatives who have submitted their genetic profiles publicly. They used a method called 'triangulation'. They identified common ancestors and looked through their generations before narrowing it down to 5 suspects. After further eliminations, former police officer Joseph De-Angelo was named the prime suspect. Soon they covertly picked up items he discarded to obtain his DNA and bingo, the once seemingly impossible cold case turned into an astonishing reality. With this breakthrough for the forensic department, they were making history. Thanks to this new strategic DNA analysis, gradually but steadily the victims and their families obtained justice they had long been denied.

To this day, Joseph De Angelo's case serves as a mnemonic of how forensic technology advancements possess the ability to resurface centuries-old past, so much so that even the phantom in the dark did not make it.

A picture of the golden state killer around the time period of the countless murders, rapes and burglaries. He was in active duty during two out of his three known and separate crime sprees, hiding in plain sight.



police sketches



• Forensic Science: Glitter is PERFECT when it comes to evidence. It's easily transferable from one person to another and not so obvious (unlike blood), suspects probably won't wash it off immediately and it's easy to find with the shine of a flashlight. The likelihood that a crime scene involves glitter is not very likely, but... the more you know.

Since the onset of civilization, emotions have pulled the strings behind human action while remaining a mystery to us. Some attributed emotions to the soul, seeing them as the antithesis of logic and reason, but this approach only complicated matters further.

Since then humanity has made countless scientific breakthroughs including in fields that investigate the processes behind human emotions. They discovered neurotransmitters, chemicals that influence our feelings following our experiences or thoughts.

A product of all this is suggested by the Basic Emotion Theory, every basic emotion has a specific brain locus. Studies with fMRI (body scan used to map neural activity in the brain or spinal cord) provided evidence for this theory. However, a number of recent studies have shown that while a single basic emotion may be linked to several brain structures, multiple basic emotions may be linked to a single location.

The most widely-accepted notion in Basic Emotion Theory lists six basic emotions: anger, disgust, fear, happiness, sadness and surprise. What makes these six distinct is the fact that humans from anywhere around the world can inherently recognize them.

You could show a tribe member from the Amazon rainforest a picture of someone angry and they would be able to recognize the emotion being displayed. It is moreover evident as someone who was born blind will use the same facial expressions as everyone for these emotions albeit never having seen them worn on the faces of other people.

This reinforces why our emotions work with the same mechanisms. The various components of neurotransmitters have accelerated our understanding of how emotions work. Since its discovery, monoamine has been regarded as the basis for emotions. Some well-known monoamine neurotransmitters are dopamine, norepinephrine and serotonin for the three basic emotions of joy, fear and disgust. Antidepressants that target monoamine neuromodulators have been utilised to treat practically all affective disorders. Even decades later, monoamine-targeted medications remain the primary pharmacological treatment for affective disorders such as anxiety, phobia, and depression. What makes this possible is how different neurotransmitters do not just have their sole influences, but also combine to have different ramifications. This allows the introduction of these neurochemicals to be able to occupy the synapses against other neurotransmitters.

Numerous neurotransmitters may be important emotional substrates, as evidenced by recent research. This is how the basic emotions we have branch off to more complex emotions such as guilt or jealousy; emotions that are not easily comprehensible by even our own minds when we are going through them. Slightly contrary to the inclusivity of the basic emotions, the more complex emotions over time get influenced by our environment and culture, resulting in variation between our behaviours. Emotions develop from a subjective experience which makes us go through physiological responses, and the output of these emotions are behavioural responses.

If you have ever wondered why so many stereotypes exist, and if we have the same neurochemicals going around our nerves, here's your answer: it is because the environment we live in has an influence on the physiological processes in our body, where emotions and responses travel in a two-way street.

# Do Emotions Only Exist Within Our Minds?

By Sadman Ahmed

Manarat Science Journal was written and designed by the Manarat Science Club and funded Manarat Dhaka International School and College (MDIC).

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<b>article 1</b>	Life Beneath The Hydrothermal Vents	Sadiyah Nawar Reza and Sidratul Muntaha	Maisha Siddiqua
<b>article 2</b>	The Golden State Killer	Yumna Zaima	Ramisa Maliha
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<b>article 5</b>	Do Emotions Exist Within Humans?	Sadman Ahmed	Zahi Showkat

# The Straw Siphon Experiment

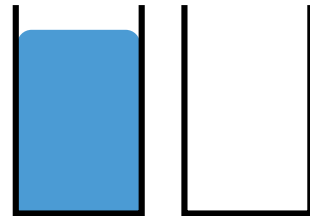
DIY SCIENCE

You will need a plastic straw, water and two cups or any other suitable containers to carry out this experiment.

Remember to read all steps before starting.

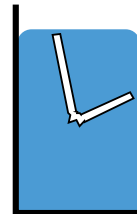
## STEP 1 :

Fill one container with water



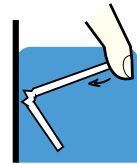
## STEP 2 :

Submerge the plastic straw into the water. Make sure the straw has no air left inside



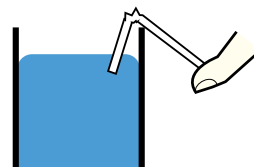
## STEP 3 :

Use one of your fingers to plug one end of the plastic straw.



## STEP 4 :

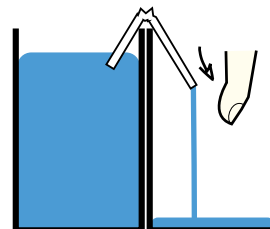
Move that end out of the container carefully while keeping the other end submerged. Make sure no water is lost and the straw is full



## STEP 5 :

Place the other container below the end you moved out and carefully lower that end to a height below the submerged end and then remove your finger.

A continuous flow of water should start!



## EXPLANATION:

The flow in a siphon is initiated by two key factors: gravity and atmospheric pressure. When the end of the tube outside the liquid is placed lower than the end in the container with liquid and the water is allowed to flow, gravity pulls the liquid down, starting the flow.

Simultaneously, atmospheric pressure acts on the surface of the liquid in the container, pushing the liquid up into the tube.

This combination of gravity pulling down and atmospheric pressure pushing up keeps the siphon flowing as long as the end in the empty container is lower than the end in the filled container.

