



Delhi Public School
Bangalore East

SCIENTIA

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SCIENTIA

Volume 1



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Message From The Managing Committee

1



Sri. K. Rahman Khan

Former Member of Parliament (Rajya Sabha)

Chairman - KKECT

Pro Vice-Chairman - DPS Bangalore/Mysore

It gives me great pleasure to share my thoughts with you through this platform. Delhi Public School, Bangalore East has come a long way. We have always believed in imparting quality education to our students. We have always desired to nurture and prepare our students as the torch-bearers of tomorrow. Infallible knowledge about science is the key to a successful future. Our attempt is to create a generation of students who are self-reliant and courageous to face the future with confidence and poise.

My best wishes to the Principal, Vice-Principal, staff, students and the editorial team of this magazine. God bless.

Message From The Managing Committee

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Mr. Maqsood Ali Khan

Secretary - KKECT
Member Board of Management
DPS Bangalore/Mysore

“The creation of something new is not accomplished by the intellect, but by the play instinct arising from inner necessity.”- Carl Jung

It is a matter of great pleasure and pride as Delhi Public School Bangalore East presents its first edition of Scientia, a venture into the world of science. The magazine is an attempt to explore the creative instincts of our students in the various areas that fall under the umbrella of science subjects. It is a platform for the students to think, express and exhibit their skills. I am sure the positive attitude, sustained efforts and innovative ideas displayed by the children will stir the minds of the readers and take them into a fantastic world of unalloyed amalgamation of imagination and originality. My best wishes to the Principal, Vice Principal, teachers, students and the editorial team of Scientia.

Message From The Managing Committee

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Mr. Mansoor Ali Khan

Treasurer - KKECT

Member Board of Management

DPS Bangalore/Mysore

“The science of today is the technology of tomorrow.” – Edward Teller

Just like how children of today are the future of tomorrow. "Scientia" is an attempt to explore the curiosity of our students in numerous fields. The finished product indeed looks impressive and makes us proud.

I congratulate the staff, the Editorial Team and the student writers for their efforts to celebrate science. This magazine has brought out the inquisitiveness in the students young minds. My good wishes to the Principal, Vice-Principal, staff, students and the editorial team of "Scientia".

Message From The Principal



4

Dr. Manila Carvalho

"Equipped with his five senses, man explores the universe around him and calls the adventure science." _ Edwin Powell Hubble

Science has completely changed our life, infact it has revolutionized our life. Practically, no field of our activity is untouched by the impact of science. It has turned the world into a small village, that is time and distance no longer remain barrierd. Thus humanity is immensely indebted to the remarkable achievements of the tireless work of our soaring ambitious-scientists. The achievements of science in the spheres of the industry, agriculture, entertainment, education, medicine and space research by inventive geniuses and resourceful scientists have undoubtably made our life happy and comfortable. The phenomenal development of modern technology and the spectacular successes of researchers in various branches of science are the bases of all those remarkable things which have sprung from the brains of our scientists.

This e-edition of the Scientia volume 1 proved to be a perfect platform for our young and enthusiastic students to tap into their imaginative minds and discover skills they were not aware they had, explore new ideas and discover their potential and inner strength. It has indeed given wings to their scientific temperaments.

My heartiest congratulations to all those who have strived to bring out Scientia, the first ever science e-magazine of Delhi Public School Bangalore East.

Message From The Vice-Principal

5



Mrs. Priti Ssoota

“ Humans are only so good as their technical developments allow them to be.” --George Orwell.

DPS Bangalore East is elated to unveil the maiden Science publication “SCIENTIA” which brings out the importance of scientific innovations and technology for continuous growth and progress of nations and mankind as a whole. “SCIENTIA” is designed to enthrall and captivate the students and teachers alike. It challenges the young minds to imagine the impossible and create new possibilities for the progress of human race. It is a matter of pride to share this with our readers and I am sure it will ignite excitement as well as passion for Science and technology.

Message From Science Department

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Mrs. Anjali Kumar
Head of Department of Biology

The future is open science!!

Let's rethink science together...

The open science publication invites you to discover science in the digital age. As children grow up in an increasingly technologically and scientifically advanced world, they need to be scientifically literate to succeed. Ideally, teaching the scientific method to students is teaching them how to think, learn, solve problems & what not! It's not always obvious that science shapes our daily lives, but the fact is science impacts countless decisions we make each day. From managing our health and well-being, choosing paper over plastic at the grocery store, or answering a child who asks why the sky is blue, science has an important role in our lives.* More than ever before, educators need to employ teaching strategies that inspire and prepare children to embrace science and potentially pursue it in their college and career choices. Keeping in mind the all-round development of students.. we are taking an initiative to have our school publication with full participation of students where they will get a platform to express their scientific knowledge. Reading the school publication motivate our young learners to brainstorm ideas on what can they contribute to the publication. This will sharpen their skills and will give them necessary confidence to express better.

Message From Science Department

7



Mrs. Shweta Gupta
Head of Department of Chemistry

Ever since the dawn of civilization, human beings have been on a quest for knowledge. This incredible journey that we have embarked upon would not be possible without exploration and research. Chemistry greatly influences our daily lives. It is the study of matter, the very basis of our existence, and the behavior of matter. Scientific research would not be nearly as advanced as it is today, if it weren't for the distinguished, curious thinkers of the past who had put forth assiduous collaborative effort. It is now in our hands to follow in the footsteps and to build upon the work of the great chemists. Although it may seem like a minor blip in the radar to many, the release of then publication will indeed be a historical moment for DPS Bangalore East, for it is the first of its kind and a step towards a greater goal in the domain of scientific education. I'm certain this initiative will take time to make its mark. But good things always come to those with patience and perseverance. The idea of this publication was merely dormant in our thoughts. This idea, with the hard work of many, has beautifully germinated. I hope the readers, along with gaining knowledge, also develop a passion for the subject. A passion similar to that with which each and every article in this magazine has been composed.

Message From Science Department

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Mrs. S Aparna Raju

Head of Department of Physics

“Ignite your fire of consciousness. Now invite others to contribute their fires to create a massive light of knowledge.”

— Debasish Mridha

Scientia is a platform for students to realize their scientific skills and knowledge and engage them in scientific education beyond curriculum. It plays an important role to integrate better understanding of nature and diversity of information sources. It provides science news to learners, parents and educators. The science bulletin section showcases the achievements of students at DPS Bangalore East in the field of science to further encourage students to participate and set higher goals.

Message From Editorial Team

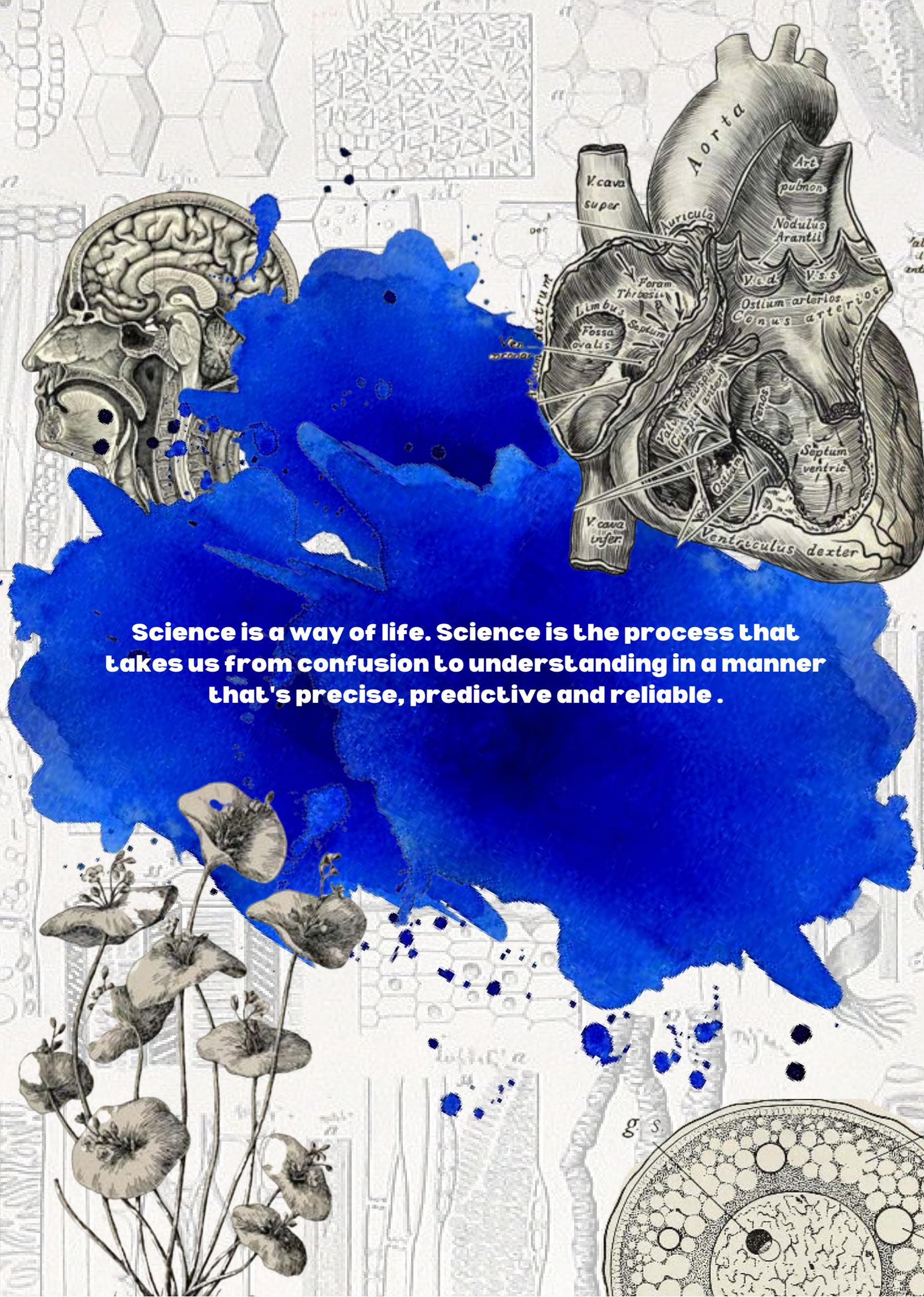
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Saigeeth D, A Akshara, Aditi C

Design students of Class 11

"Scientia", a magazine that discovered the inner scientist in all of us. It brought out one of mankind's most accelerating trait, curiosity. The cover page is inspired by how the human mind has adopted science as a part of humanity, becoming a crucial part in building a modern society. Collecting articles from ingenious young minds of tomorrow's future to collating them together, we the students of the editorial team thank each and everyone who played a role in bringing this magazine together.



Science is a way of life. Science is the process that takes us from confusion to understanding in a manner that's precise, predictive and reliable .

Dreams

Inside the Mind Why do we dream? How do dreams provide insight into the mind? Are dreams relevant to waking life?



Why humans dream remains one of behavioural science's great unanswered questions. Dreams have a purpose but it may not be to send us messages about self-improvement or the future, as many believe. Instead, many researchers now believe that dreaming mediates memory consolidation and mood regulation, a process a little like overnight therapy.

Although scientists continue to research the answers to these questions, they build their work on some commonly accepted dream theories.

The Nature of Dreams

A dream is a succession of images, ideas, emotions and sensations that usually occur involuntarily in the mind and arise several times per night during certain stages of sleep.

Dreams typically involve elements from waking life, such as known people or familiar locations, but they also often have a fantastical feel.

As a process, sleep is cyclical. It occurs in five stages, each helping to further the body's goal of bolstering and regenerating itself. While stages 1-4 are simply named as such, the fifth stage is called Rapid Eye Movement, or REM. It makes up about 20 to 25 percent of adult sleep.



The REM stage is the most common time of dreaming, explains the National Sleep Foundation. Dreams themselves usually last between a few seconds to 30 minutes in length. On average, people dream about four to six times per night, with adults dreaming about two hours for every eight hours of sleep.

In addition to its association with dreams, the REM stage is a time when the body processes information, creates memories and increases depleted chemicals, such as serotonin. Although the necessity of sleep has long been observed, only in recent history did people consider that dreams may also serve a utilitarian function.

Lucid Dreams

A lucid dream is a type of dream in which the dreamer becomes aware that they are dreaming while dreaming. During a lucid dream, the dreamer may gain some amount of control over the dream characters, narrative, or environment.

These types of dreams occur commonly during late-stage REM sleep. Lucid dreamers report willing themselves to fly, fight, or act out recurring desires.

Lucid dreams might help your waking life with benefits like:

- Less anxiety
- Better motor skills
- Improved problem-solving
- More creativity

Lucid dreaming may also cause problems, including:

- Less sleep quality
- Confusion • Delirium
- Hallucinations



What can Dreams tell you?

Dreams tell you what you really know about something, what you really feel. They point you toward what you need for growth, integration, expression, and the health of your relationships to person, place, and thing. They can help you fine-tune your direction and show you your unfinished business.

**-By Arihant P Dash,
Shaswat S Mishra,
Kriti Krishna
Of Class 11 O**

Malaria

-A modern approach to an ancient problem

Mosquitos are the world's deadliest animal, directly causing a million deaths and over 200 million infections worldwide- of which an overwhelming percentage are cases of malaria. Despite being near-eradicated in developed countries, it continues to pose a serious threat to populations in underdeveloped countries. The disease has a low mortality rate when caught on time, but it can create severe and lifelong health complications in children, such as cerebral damage, anemia, respiratory problems, and more.



The World Health Organization has made significant plans to help eradicate the disease in areas of poor health-related infrastructure. A multi-faceted approach of

- Prevention, including mosquito nets, spraying DDT, vaccination, and controlling open stagnant water
- Early treatment with quinine or quinine derivatives
- Awareness programs, to reduce infections in children below the age of 5, and
- Identification of virus-breeding hot spots around densely populated communities

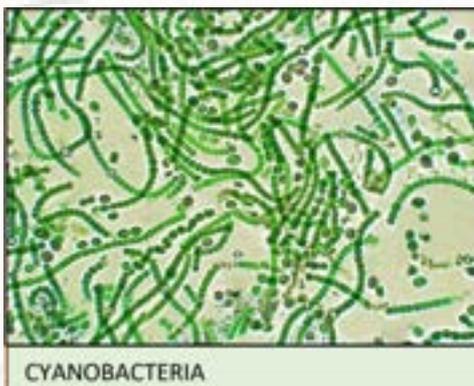
A long-term, head-on approach can lead to the eventual eradication of the disease, and provide us with new knowledge of how to combat and prevent other mosquito-borne illnesses.

**-By Dhruvi
of Class 12 O**

MICRO-ORGANISMS

We spend a lot of our time talking about animals especially human beings not just because we love talking about ourselves but also because animals in general are interesting and can be seen by the naked eyes. But let me introduce you all to the unicellular living world. These are the Archaeobacteria, Eubacteria and most Protists. All bacteria are prokaryotic—that is, single-celled organisms without a membrane-bound nucleus. Their DNA, instead of being contained in the nucleus, exists as a long, folded thread with no specific location within the cell. Protists are eukaryotes as they possess a nucleus and other membrane-bound organelles. Collectively algae, protozoa, and some lower fungi are frequently referred to as protists—some are unicellular and others are multicellular.

However, some organisms not only live and exist in the environment but also cause deadly diseases that could kill the most complex multicellular organisms including humans for example, coronavirus. Coronaviruses are enveloped positive-stranded RNA viruses, which replicate in the host cell cytoplasm. They possess a 5' capped RNA and also contain the longest RNA among all RNA viruses. Some of these organisms do the exact opposite, they make living possible, for example, Cyanobacteria or blue-green algae are responsible for the Earth's transition from a carbon dioxide-rich atmosphere to the present relatively oxygen-rich atmosphere by the process of oxygenic photosynthesis.



CYANOBACTERIA



CORONAVIRUS

It is interesting to note that, as of today, the mycoplasmas are thought to be the smallest living cells in the biological world. They have a minimal size of approximately 0.2 micrometers, which makes them smaller than some of the poxviruses while one of the world's largest unicellular organisms includes the sailor's eyeball also called bubble algae. As you can see, most of the living organisms are single celled organisms. By understanding these three groups, we begin to understand the true meaning of life on earth, its origins and how everything that came after them, including human beings, came to exist.



BUBBLE ALGAE

**-By Anshika Gupta
Of Class 12 Q**

Applications of CRISPR

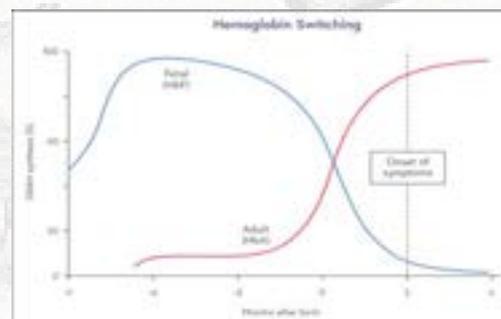
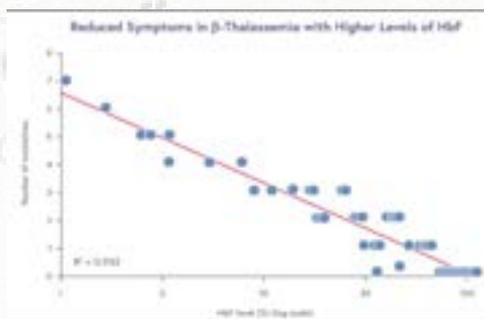
We think of our DNA as being set in stone. But what if it isn't? What if you could change your DNA? That's what CRISPR promises.

Clustered Regularly Interspaced Short Palindromic Repeat (CRISPR) technology is based on the natural system of bacterial immunity and has been adapted as a gene-editing tool.

It has made huge strides in treating beta thalassemia and sickle cell disease (SCD)— inherited blood disorders caused by mutations in the gene encoding haemoglobin.

The approach to treat β -thalassemia and SCD is designed to increase levels of foetal haemoglobin (HbF), which is present in all people before birth. It can substitute for the diseased haemoglobin (adult haemoglobin or HbA) in β -thalassemia and SCD patients, reducing or eliminating symptoms.

As levels of HbF begin to decline in the months preceding birth and levels of adult haemoglobin (HbA) increase, patients slowly start showing symptoms after birth (after haemoglobin switching has occurred). Individuals with Hereditary Persistence of Foetal Haemoglobin (HPFH) continue to express HbF into adulthood. β -thalassemia and SCD patients with HPFH have reduced disease symptoms or no symptoms at all.

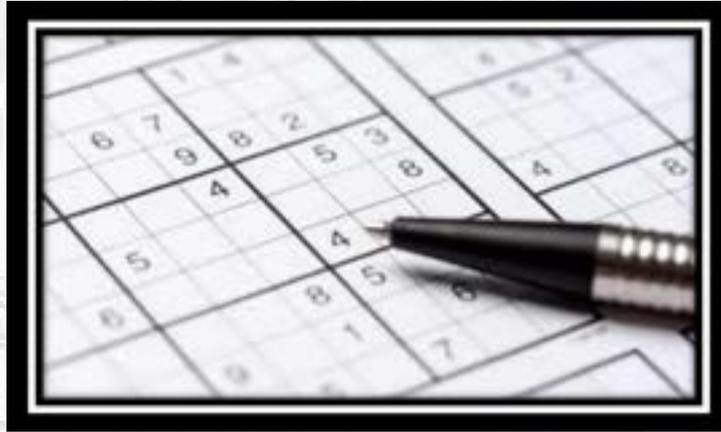


CRISPR holds promise for the treatment and prevention of diseases such as cystic fibrosis, haemophilia, cancer, heart disease, mental illness, AIDS, etc.

**-By Apurvi Sinha
Of Class 12 O**

A Case of Peculiar Seizures

When we are given a glimpse of the mysterious world beneath our own skin, these interesting processes start to unravel, feeding our fascination about human health and its wonders.



But every once in a while, disease does something to the body so rare that it warrants special attention. If I were to ask you, sudoku, one of the most popular games of all time that works as an efficient brain teaser and is enjoyed by many, could have an adverse effect on human health and prove to be fatal, what would you say?

Let's dive into an interesting case of a 25-year-old right-handed physical education student, on whom sudoku had an interesting effect.

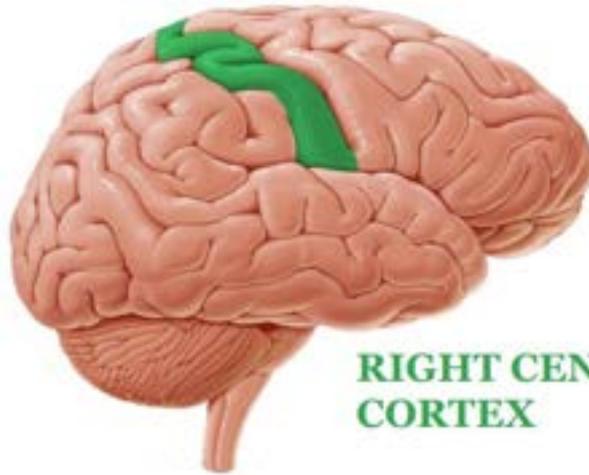
The 25-year-old was buried in an avalanche during a skiing holiday, as a result of which his brain was deprived of oxygen for some 15 minutes. He then developed shock-like myoclonic contractions of the muscles in his mouth when he tried to talk, and in his legs when he tried to walk.

Several weeks later, while trying to solve Sudoku puzzles, he developed clonic seizures* in his left arm. These produced repeated jerking movements, and were far rarer than tonic-clonic seizures. He did not experience anything as such when he read a book, wrote something down, or did calculations. The seizures stopped immediately when the patient stopped solving the Sudoku puzzle.

The doctors figured out that these seizures were triggered because the man had a very intense three-dimensional imagination that activated whenever he solved a Sudoku puzzle.

***A seizure is a sudden, uncontrolled electrical disturbance in the brain. It can cause changes in your behavior, movements or feelings. These are typically preceded by muscle stiffness, and cause loss of consciousness.**

They used functional magnetic resonance imaging (fMRI) to scan the patient's brain while he was solving a Sudoku puzzle, and found that the seizures were caused by abnormally high levels of activity in the right central parietal cortex, a part of the brain involved in processing visuo-spatial information.



RIGHT CENTRAL PARIETAL CORTEX

Normally, this area of the brain is activated when 3D imagination is used. But with fewer inhibitory fibers in this region, when the man used his 3D imagination, it led to an overactivation of this brain region, which resulted in clonic seizures in his left arm.

Diffusion tensor imaging (DTI) further revealed what appeared to be a complete loss of inhibitory fibers in the same part of the brain. This unique case is an example of reflex epilepsy, characterized by seizures that are induced by external stimuli.

The young man had no choice but to give up Sudoku.

**-By Arihant P Dash,
Shaswat S Mishra,
Kriti Krishna
Of Class 11 O**

Genetic Risks for Brain Disorders and Addiction

It has been proclaimed for a long time that human brain disorders -such as neurological or psychiatric diseases run in families, suggesting some heritability. Conventionally, addiction was closely entwined with environmental factors and genetics, but now a shred of anthropological and evolutionary evidence has paved a firmer understanding. In line with this hypothesis, the researchers deciphered genetic risk factors for acquiring these illnesses.

An intriguing question that has clasped our minds is-

Why are genetic variants that increase the risk of diseases not eradicated in evolution?

Estonian Research Council unravelled the mind-boggling answer to this question: According to the council- when modern humans moved out of Africa more than 60,000 years ago, they met and mixed with other archaic humans such as Neanderthals. (Neanderthals are our closest extinct human relative).

Around 40% of the Neanderthal genome is found in present-day non-Africans, and each individual still carries approximately 2% of Neanderthal DNA.

Today, scientists can use this information to learn more about the impact of these genetic variants on human demeanour and the risk of developing diseases.

The study found that while Neanderthal DNA showed over-proportional numbers of associations with several traits associated with central nervous system diseases, the diseases themselves did not show any significant numbers of Neanderthal DNA associations. Thus, it portrays results that suggest, Neanderthals carried numerous variants that substantially increase the risk for brain disorders and addiction in people today.

The significant associations of Neanderthal DNAs might help us elucidate the evolutionary origin of addictive and reward-seeking aspects of human nature. Their findings support the supposition that it is not brain diseases that solely have evolutionary explanations, but natural selection also shapes traits that make people vulnerable to brain disorders and addiction to nicotine and alcohol use in the modern context.

In a nutshell, Neanderthal introgression partitions the genetic landscape of neuropsychiatric disorders, and associated endophenotypes by providing an example of how evolutionary information can help interpret the origin and genetic components of behavioural phenotypes.

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**-By Madhavi Ramesh
Of Class 12 Q**

Pseudo-obstruction motility disorder

This disorder, with such a complex name, is much more terrifying than its name lets on.

Chronic Intestinal pseudo-obstruction also known as CIP is a rare disorder of gastrointestinal motility in which peristalsis is affected. Peristalsis is the movement of food by wave-like contractions which are prevalent in the oesophagus.

One of the causes of this disorder is mutations in the genes which are involved and aid in smooth muscle contraction. Another reason for the cause of this disorder is the slow or complete stoppage of the movement of food, other fluids and waste through the intestinal tract due to certain nerve or muscle issues. Due to this, the nutritional requirements are often not met.



Common symptoms for this disorder are abdominal pain, nausea, vomiting and bloating and X rays are often used to diagnose this disorder.

Treatment for this disorder is often by implementing diet changes, nutrition supplements and even surgery in some cases.

This disorder is a rare one and is one that fascinates us with its new questions it arises in our minds, and it reiterates that medicine holds secrets that we've yet to unveil.

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**-By Aditi Gupta
Of Class 12 P**

Innovation in transplant surgery

Organ transplantation is a medical procedure in which an organ is removed from one body and placed in the body of a recipient, to replace a damaged or missing organ. The donor and recipient may be at the same location, or organs may be transported from a donor site to another location. Organs that have been successfully transplanted include the heart, kidneys, liver, lungs, pancreas, intestine, thymus and uterus. Tissues include bones, tendons, corneae, skin, heart valves, nerves and veins. Worldwide, the kidneys are the most commonly transplanted organs, followed by the liver and then the heart.

In order to advance in the field of surgery innovation is very important as it brings in new and improved techniques and ideas which minimise risk, provide better outcomes, give a scope for learning new things and inevitably help save lives.



Living Donor HIV to HIV Kidney Transplant

A multidisciplinary team led by Dorry Segev, professor of surgery at the Johns Hopkins University School of Medicine, performed a kidney transplant from a donor living with HIV to a recipient also living with HIV for the first time in the U.S. Segev and his colleagues determined that new HIV drugs are safe for the kidney and that those with well-controlled HIV have essentially the same risks as those without and are healthy enough to donate kidneys.



Keeping organs viable for longer, transplant teams at Johns Hopkins have been exploring ex vivo machine perfusion as a means to expand the donor pool, increase the range of donor hospitals, and gain extra time to determine an organ's health and performance before a transplant. This process involves continuously pumping blood through the donor organ to keep it warm and more viable for transplant. Shane Ottmann is the principal investigator for the liver transplant team and Errol Bush is leading the lung transplant team to test ex vivo machine perfusion.

Multiple organ transplant

During the 17-hour operation, surgeons removed the patient's diseased organs. He then received the following deceased donor's organs all together and at the same time: liver, stomach, pancreas and duodenum (pancreaticoduodenal complex), spleen, small intestine and right colon. The donor's spleen was initially transplanted to boost the immune protection of the newly transplanted organs and improve blood flow to the pancreas until fully transplanted. The donor's right colon was initially transplanted to help protect the new intestine from infection and improve its ability to absorb nutrients. Both the donor's spleen and right colon were removed prior to the completion of the transplant after they successfully served to protect the other organs during the operation. In turn, the patient would also be receiving a new lease on life. Following the diagnosis of an extremely rare form of appendix cancer called pseudomyxoma peritonei (PMP) and the failure of conventional treatments that included surgery and chemotherapy, the patient was told he had six months to live.

The patient became the first person in the world to successfully undergo a full multivisceral transplant to treat PMP.



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**-By Dhaiwik Naidu
Of Class 12 Q**

THE UNCANNY VALLEY

The uncanny valley is a phenomenon I've been interested in for quite a while. It's quite an interesting phenomenon and I hope this article encourages you to take a deep dive into it. Let's start by defining the term itself. The word uncanny means "strange or suspicious especially in an unsettling way" whereas we know valley means the dip between two mountains, however on a graph a valley means "a point whose y value is smaller than the y values of its immediate neighbours" and that's the definition we're gonna take into consideration here. The uncanny valley phenomenon is used to describe computer-generated figures usually so the actual meaning of the term would be "used in reference to the phenomenon whereby a computer-generated figure or humanoid robot bearing a near-identical resemblance to a human being arouses a sense of unease or revulsion in the person viewing it."

The uncanny valley, first postulated by Japanese roboticist Masahiro Mori in 1970, is the eerie, repulsive feeling we get when we see an organism that seems virtually human but lacks some vital feature of humanity.

Robotics, 3D computer animation, and realistic dolls are among examples. With the growing popularity of virtual reality, augmented reality, and photorealistic computer animation, the "valley" has been invoked in response to the creation's verisimilitude as it approaches indistinguishability from reality. So, according to the uncanny valley idea, a creature that appears virtually human risks generating chilly, unsettling sentiments among viewers.



Don't the pictures above make you uncomfortable in the slightest? But do you know why? It's hard to point out what exactly about these are so unsettling, isn't it?

It could be due to one of the below given reasons

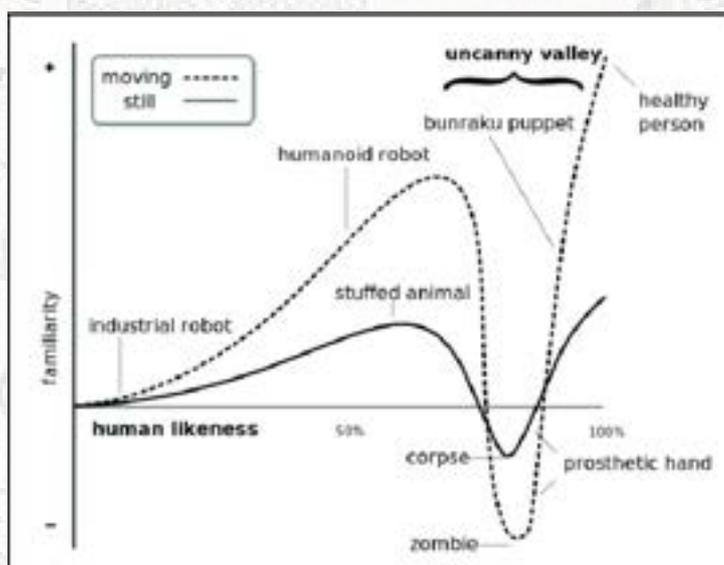
1. Boundaries between categories getting blurred – us humans love to be able to categorise and sort things and when our brain comes across something human-like but not quite, it gets confused and thus feels uneasy.
2. Perception of mind - People's perception that beings with human-like characteristics have human-like minds may contribute to the uncanny valley. Kurt Gray and Daniel Wegner discovered in a series of tests that machines were unnerving when individuals ascribed the ability to feel and sense to them, but not when people's only expectation of the machine was the ability to act. The researchers advocated this because people think that humans, but not robots, have the ability to feel and perceive.

3. Mismatch between appearance and behaviour - The uncanny valley might be caused by a mismatch between a near-human entity's appearance and its behaviour. For example, Angela Tinwell and her colleagues reported in one research that a human-like virtual being was deemed most unsettling when it did not respond to a scream with a noticeable startled response in the eye region. Participants regarded a creature exhibiting this behaviour to have psychopathic tendencies, implying a psychological cause for the uncanny valley.

4. Ambiguity – this is my personal hypothesis but I feel like the uncertainty of it all makes things a lot more disturbing than they ought to be. The very fact that we cannot be sure of what we are looking at causes great cognitive dissonance (the discomfort a person feels when a person holds two contradictory beliefs at the same time) and thus leading to the feeling of creepiness.



Given below is Mori's uncanny valley graph which plots for familiarity vs human likeness



Mori's original graph defined two unique paths to the uncanny valley: one for stationary creatures such as corpses and one for moving entities such as zombies. Mori projected that moving creatures will have a steeper uncanny valley.

To conclude I would like to talk about the future of the uncanny valley. As androids grow more interwoven into our lives to assist us in a number of ways, we must like and trust them to have the greatest relationships. Recent study, for example, reveals that when medical students practise with simulators that appear and react like humans, they perform better in real-life emergency scenarios. Understanding how to overcome the uncanny valley is crucial as we rely more and more on technology to help us in our daily lives.

Thank you for reading this think piece. Hope you gained something from it, dear reader

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What Makes the "Uncanny Valley" So Unsettling? – Thought.co

Why are things creepy? – Vsauce

**-By Lalitha Ganesh
Of Class 12 P**



"Life is a chemical reaction, it only requires balancing!"

The Fifth State Of Matter

- There are three states of matter that we have studied about: solid, liquid and gas. A fourth state of matter is also sometimes taken into consideration. When we bombard any atom with enough energy, we kick the electrons off of it, creating ionized plasma: the fourth state of matter.

- In the universe, every particle, fundamental or composite falls into two categories:

- **Fermion.** This is a particle that, when we measure its spin (or intrinsic angular momentum), we always get values that are quantized in half-integer values of Planck's constant: $\pm 1/2$, $\pm 3/2$, $\pm 5/2$, etc.

- **Boson.** This is a particle that, when we measure its spin, we always get values that are quantized in integer values of Planck's constant: 0, ± 1 , ± 2 , etc.

- **The main difference between the two being the obedience of Pauli's Exclusion principle.** This comes into play when we start putting electrons onto a fully ionized atomic nucleus. The first electron will sink down to the lowest-energy configuration possible: the ground state. If you add a second electron, it will also try to get down to the ground state, but will find that it's already occupied. To minimize the energy of its configuration, it drops into the same state, but needs to have its spin reversed: $+\frac{1}{2}$ if the first electron was $-\frac{1}{2}$; $-\frac{1}{2}$ if the first was $+\frac{1}{2}$. Any further electrons need to go into a progressively higher and higher energy state; no two electrons can have the same exact quantum configuration in the same physical system.

But this is not true for bosons. You can place as many bosons in the ground-state configuration as you like, with no restrictions. If you create the right physical conditions — such as cooling a system of bosons and confining them to the same physical location — there is no limit to the number of bosons that you can fit into that lowest-energy state. When you reach this configuration, of many bosons all in the same, lowest-energy quantum state, you've achieved the fifth state of matter: a Bose-Einstein condensate.

- Sometimes referred to as the 'fifth state of matter', a Bose-Einstein Condensate is a state of matter created when particles, called bosons, are cooled to near absolute zero (-273.15 degrees Celsius, or -460 degrees Fahrenheit).

At such low temperatures there is insufficient energy for the particles to move into positions that might cause their distinct quantum characteristics to interfere with one another.

Without differences in energy to set particles apart, the whole group comes to share the same quantum identity, effectively becoming a single 'super-particle' cloud, operating under its own rules.

- Helium, an atom made of two protons, two neutrons, and four electrons, is a stable atom made of an even number of fermions, and therefore behaves as a boson. At low enough temperatures, it becomes a superfluid: a fluid with zero viscosity and no friction between itself or any container that it interacts with. These properties are a consequence of Bose-Einstein condensation

**-by Rohan Sharma
of Class 12 N**

Affect of Eucalyptus on Bangalore's Natural Environment

I. Its Affect On The Environment.

I can say for sure we have all seen acres of plantations of eucalyptus if you live anywhere near the Bangalore area, so what is it? And how do such plantations affect our environment? Eucalyptus is a tree species hailing from southeastern Australia. It has smooth bark and juvenile leaves that are whitish and waxy on the lower surface. It was first introduced in India in 1790 by Tipu Sultan in his palace garden, the tree has many uses ranging from timber all the way to homeopathic medicines. In its natural habitat eucalyptus exists in dry and arid regions of Australia. In India, this species is highly invasive and is responsible for destroying natural and endemic ecosystems as well as life. This is due to the reason that Eucalyptus is water-intensive and reduces available water for otherspecies by effectively out-competing them. In arid areas, it consequently suppresses different plant life, coupled with high waterdemand, reduces soil moisture, prevents groundwater recharge, and can reduce local water tables. Along with this Eucalyptus also is known to kill grass in its vicinity thereby reducing habitatsand areas of shelter for wildlife as well as fauna.



Eucalyptus Plantation In Bangalore



Native Forests Near Bangalore.

The water use of a Eucalyptus has been found to be 785 liters/kg of total biomass. This figure may seem less compared to other plants such as rice or cotton which take in 2000 liters/kg, but when we consider the size and difference of mass between these 2 crops it leads to a much more disturbing figure. We find that the average mass of eucalyptus is 21.9 to 26.9t/ha. If we multiply this value by the water consumption we get, 17,191,500 - 21,116,500 L per hectare. Couple this with the fact that these trees don't have an effective soil conservation system and thus cause erosion along with that most eucalyptus species to have a root depth of 1.5-2.0 meters and their root system is more specifically adapted to using rain-fed soil moisture from the upper soil profile, rather than from the groundwater table at considerable depth.

Thus we can see that these plantations:

- (i) take an enormous amount of surface groundwater
- (ii) do not effectively absorb much rainwater and cause soil erosion.

This dries up the surface water levels and surface fertility, thus preventing any meaningful undergrowth from growing. Their leaves also have a very slow decomposition process further preventing any native flora to grow. The branches of the trees are smooth which prevents any nest building from native birds. Thus from all the above arguments, we can clearly conclude that eucalyptus is a tree species incredibly harmful to the environment and is a rightful holder of the name "ecological terrorist".

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“The study of science is also an adventure. You will find it challenging, sometimes frustrating, occasionally painful, and often richly rewarding.”

Infinite Playground of the Stars

Humanity's greatest achievement
Was to learn how to fly
It was so beautiful that we weren't satisfied
And now we look beyond the sky

Take me to Saturn's Rings
They may be wintry, cold and covered in ice
But for me it's worth a thousand springs

I hear in space rockets don't rust
That's good, because I won't stop at Saturn
I would like to dance amongst moon dust
And admire the lunar landscape
From the conundrums I face on Earth,
Space would be a nice escape

If a forest were the universe
And the planets the trees
I would like to be an ape, swinging carefree
Hopping and exploring cheerfully

I want to marvel at the storms of Jupiter
Skydive through its thick atmosphere
Experience that planet's raging pressure
If I don't get crushed to death
I'll have enjoyed it with every breath

Stuck in just one planet, I feel so empty
This place is not the final stop for humanity
The stars shine in invitation, we must hurry

The story of our species will've truly begun
When we shall feel the power of the Sun
As the Commanders of a Dyson Sphere
This structure will be crucial as taming fire
To the human evolution

One day we'll mine for minerals on Mercury
You'll get a degree for that from a university
But make sure you stay beneath a crater
As Mercury is close to the sun
If you're not careful you'll burn

Maybe we can live on floating structures
Above the clouds of Venus
But make sure you don't land on the surface
It's full of Sulphur clouds that are poisonous
Your body crushed by greenhouse gases,
You'll realize how fragile human bodies are
Without a space suit you'll be worthless

I feel a deep longing
Space and time itself calling
Humanity's greatest endeavor
Would be to go interstellar
I wish to see it with my own eyes
It would bring me true pleasure

The act of landing on Mars
Is humanity's first step to reaching the stars
One of my most wistful goals
Is to drink water from the planet's icy poles
Jumping and dancing in its low gravity
Will allow me to experience a different reality
We'll all rejoice in a moment of glory
When Mars becomes a human colony

Humanity is like a child
Stuck in a cage
Space is a playground, just outside
The fact we can't enjoy it gives me rage

The blue planets are truly marvellous
Superficially similar Neptune and Uranus
I want to be in their deep atmospheres
Search for water in their icy interiors
Adventure in awe through these ice giants
Thick atmosphere, rocky cores, icy mantles
I want to see it all with my eyes
And get awed at their huge size

Despite the devastating collisions
In early solar history
These planets still stand, huge and mighty
They're the perfect pair of twins
Neptune's bluer but Uranus has more rings

The best job for a human is to be an explorer
To the light of consciousness
We are the bearer
To the infinite vastness of space
We are the admirer
Always caught up in the mission
To go ever further

**-By Hrishikesh Ghosh
of Class 12H**

Light Years

How many light-years away?

Earth is approximately...



8.3 light-minutes
from the Sun



4.3 light-years away
from Proxima Centauri,
our closest neighboring
star



320 light-years
from the North
Star, Polaris



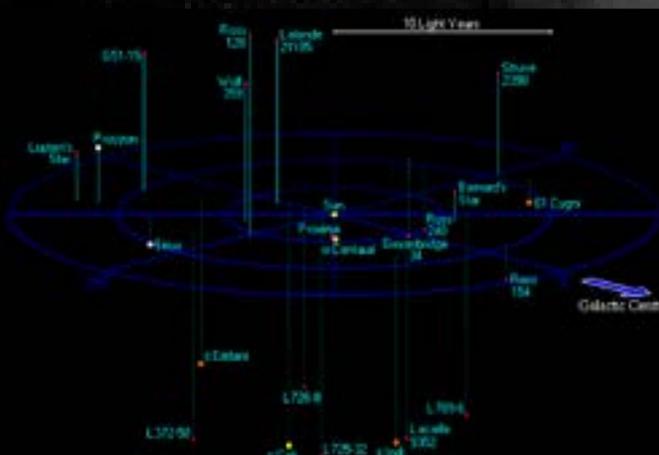
26,000 light-years
away from the center
of our galaxy, the Milky
Way



2.5 million light-years
from Andromeda, our
closest neighboring
galaxy

13.4 billion light-years
away from one of the
oldest galaxies ever
found, called GN-z11

- The nearest large galaxy to us, Andromeda, is 2.5 million light-years away.
- Moon is about 1/4 light seconds from Earth



Question: For example, when you see a star burn out, if the star was 5 light years away then the star actually burnt out 5 years ago. So, I am x years old, if I was x light years away from Earth and had a telescope strong enough to view Earth, could I theoretically view myself being born?

Yes, you can. And you do not even need to leave the Earth to do it. You are always viewing things in the past, just as you are always hearing things in the past. If you see someone do something, who is 30 meters away, you are seeing what happened $(30\text{m}) / (3 \times 10^8\text{m/s}) = 0.1\mu\text{s}$ in the past.

If you had a mirror on the moon (about 238K miles away), you could see about 2.5 seconds into earth's past. If that mirror was on Pluto, you could see about 13.4 hours into Earth's past. If you are relying on hearing, you hear an event at 30 m away about 0.1 s after it occurs. That is why runners often watch the starting pistol at an event, because they can see a more recent picture of the past than they can hear.

To more directly answer the intent of your question: Yes, if you could magically be transported x lightyears away, or had a mirror strategically placed 13.5 lightyears away, you could see yourself being born.

**-By Kashvi Mistry
Of Class 11 Q**

The James Webb Telescope

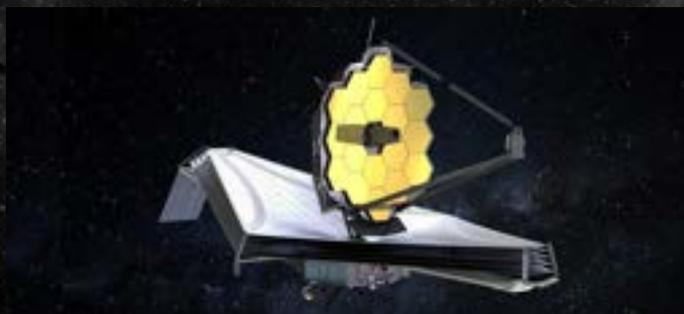
Imagine being able to see galaxies so far away that the light given off by them is almost as old as the universe itself. This is now a reality because of the James Webb Telescope. Launched on 25 December 2021 at 5:50 pm IST, the James Webb Telescope is NASA's largest and most powerful space science telescope till date.

This technological marvel is the largest optical telescope in space, as tall as a three-story building! Its greatly improved infrared resolution and sensitivity allow it to view objects too distant or faint for the Hubble Space Telescope. To see such far-off and faint objects, Webb needs a large mirror. Webb Telescope's primary mirror is 6.5 meters across. A mirror this large has never before been launched into space. To transport such a large mirror to space, the Webb Telescope team decided to build the mirror in 18 hexagonal segments that can fold up so that it could fit into the rocket. The mirror then unfolded after launch. This unfolding process was very precise and delicate and the mirror took more than 15 days to fully unfold in space.

The James Webb telescope can detect objects up to 100 times fainter than Hubble can. To see the first stars and galaxies in the early Universe, the telescope observes the infrared light given away by them. Because warm objects also give out infrared light, if the telescope were to be maintained at moderate temperatures, the faint infrared light from distant galaxies would be lost in the infrared glow of the mirror. Therefore, the mirrors are maintained at a temperature of 50K, colder than the surface of Pluto! The mirrors are protected by a five-layered tennis court sized sun shield, the largest sun shield ever flown, to protect it from heat radiated by the sun, moon and earth.

The first images taken by the telescope were released on Tuesday, July 12, 2022. Thousands of galaxies – including the faintest objects ever observed in the infrared – have appeared in Webb's view for the first time. James Webb Space Telescope has produced the deepest and sharpest infrared image of the distant universe to date.

This is just the beginning of the exploration. The telescope can be used to look back in time and explore the first galaxies that formed after the big bang, to peer into atmospheres of planets orbiting the star, and to search for the life on distant planets. It is humanity's eyepiece to the uncharted, unknown, and unimagined.



The James Webb Telescope

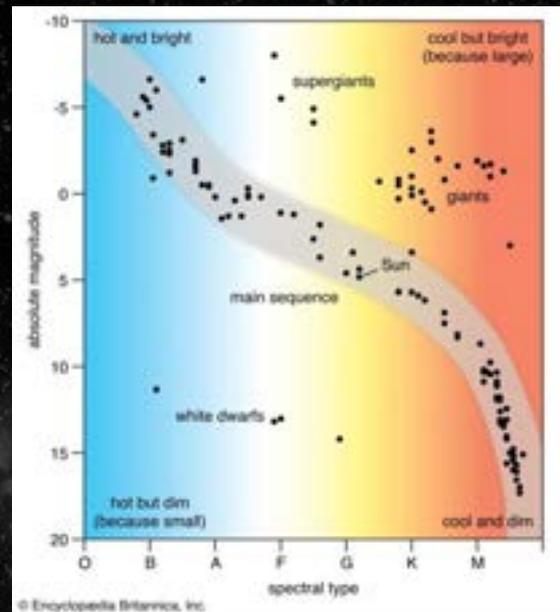


Picture of the Carina Nebula
(8500 light years away)
taken by the James Webb Telescope

**-By Atharv Nema
Of Class 12F**

Stellar Evolution

Stellar Evolution is the process which a star undergoes from its birth to its death. It consists of 3 stages: Protostar, Main sequence, and the death of the star. This is quantifiable by an important diagram in Stellar Physics: the HR diagram. The HR Diagram plots the magnitude(brightness) of a star against its spectral type(temperature). The HR diagram plots the hottest and brightest stars on the top left and the dimmest and coolest stars on the bottom right. This diagram gives us a plethora of information, including locations of several types of stars. By observations, we realise most stars occupy the diagonal line across the diagram, called the main sequence. The Sun lies in the lower main sequence and is a relatively small and dim star. The HR diagram helps in sequencing stars and predict the location of stars, and their ages through observations of brightness and temperature. Further, we can also predict the size of the star using this diagram.



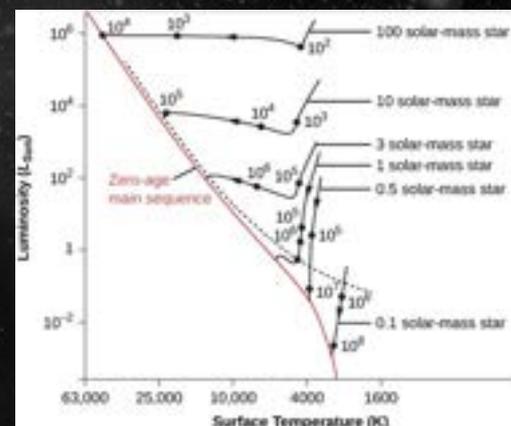
Stellar evolution is a fascinating process, and quite like human life. A star is born, spends most of its life as an adult, and then, finally dies, sometimes in spectacular fashion, outshining galaxies. First, of course, is the start of a star's journey: its birth, or the protostar phase.

The first step in the formation of a star is the formation of its dense cores. Stars are formed in vast clouds of hydrogen and helium. When a disturbance excites these clouds, they clump up and grow. Eventually, the size of these clouds overwhelms the pressure of the gas holding it up. These clouds rapidly collapse and density and temperature skyrocket. If the core is massive, it becomes set to become a true star. Note that the star is still not dense enough for nuclear fusion to occur, and hence is called a protostar.

Initially, the protostar remains fairly cool, with a large radius and low density. Thus, the gas pressure remains fairly low and the outer layers fall into the star unhindered. As a result, the protostar undergoes a rapid collapse. As the star shrinks, its surface area gets smaller, and the pressure and heat builds up. The collapse only stops when the heat generated by the falling gas can be stopped by the opacity of the dense gas. At this stage, the star becomes stable and stars start to fuse hydrogen into helium. They enter the main sequence of the HR diagram, and are called ZAMS(Zero age main sequence stars).

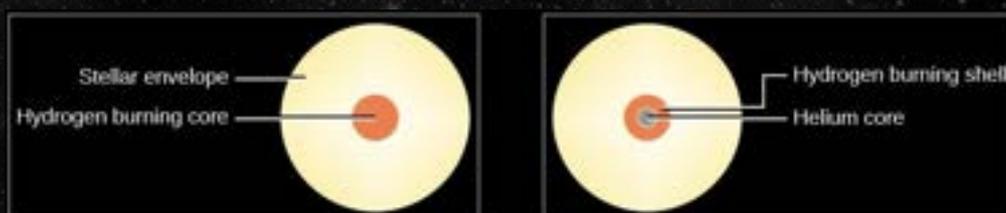
They are now a full fledged star.

Different stars spend different amounts of time on the main sequence. The larger and brighter the star, the smaller its lifetimes. This may seem counterintuitive, since a large star has more fuel to burn. However, its brightness is related to the fourth power of its size, while the material is only related to the second power. A small star like a red dwarf may spend trillions of years on the main sequence, but a supergiant may run out in a hundred million years. Our star has an expected lifetime on the Main sequence of 10 billion years, from which it has spent 4.8 Billion.

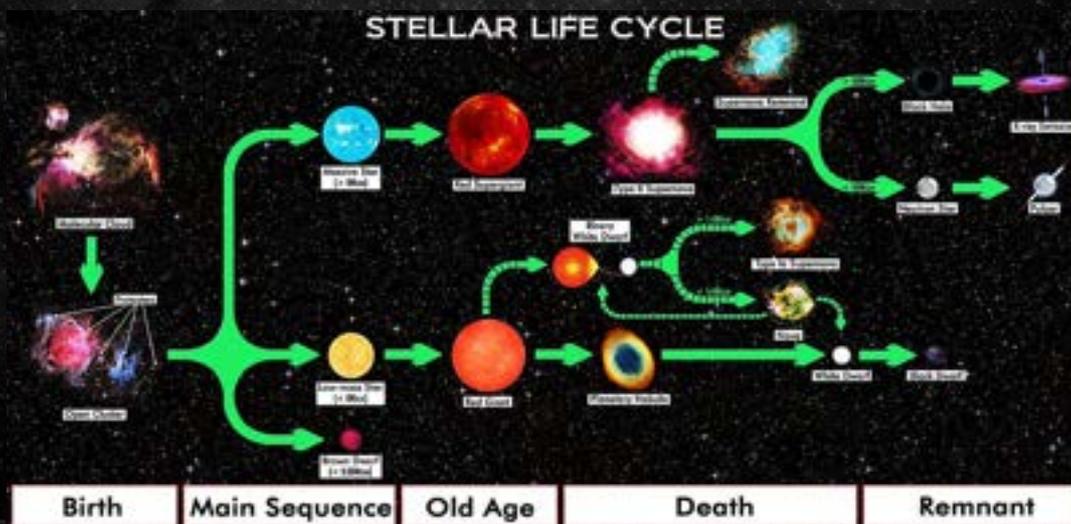


Spectral Type	Surface Temperature (K)	Mass (Mass of Sun = 1)	Lifetime on Main Sequence (years)
O5	54,000	40	1 million
B0	29,200	16	10 million
A0	9600	3.3	500 million
F0	7350	1.7	2.7 billion
G0	6050	1.1	9 billion
K0	5240	0.8	14 billion
M0	3750	0.4	200 billion

Finally, like everything a star has to die. A star dies in several ways dependent on its mass. Stars like the Sun eat up all the hydrogen in their core, causing the energy from radiation to drop. This causes the radiation pressure to decrease and gravity starts pressing the star inwards. However, when this happens, the pressure inside the star increases along with the temperature. When the temperature becomes hot enough to fuse the helium with each other, this renewed energy pushes the star outwards, causing it to expand to a state called a red giant.

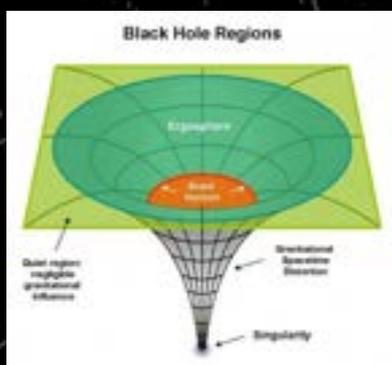


The star spends a few hundred thousand years in this stage, but then runs out of helium to fuse. Since the star is not massive enough to fuse larger elements, it continues to shrink, getting dimmer and turning into a white dwarf. White dwarfs are the remnants of the cores of stars, very dim but very hot due to their small size. This is the end which awaits our Sun in about another 5 Billion Years.



Black Holes

Huge, invisible, threatening space monsters that aren't afraid of the laws of physics aka black holes are huge bodies with a gravitational pull so strong that not even light can escape them. This also makes them invisible. As if they weren't threatening enough before. A black hole is so dense that one of them, the size of our Sun can be up to 300 times heavier than it. Now let us talk about something interesting.



The closest black hole to earth is the HR 6819 which is about 1100 light years away from us. In the second place, we have a black hole which is about 2500 light-years further away. There is a point in the effect of the gravitational pull of the black hole known as the event horizon aka the point of no return. As you travel towards this point you will get accelerated due to the massive gravitational pull. The pull is so strong that the shape of the space around you will begin to change. It will look like you are turning into a human spaghetti. This is known as spaghettification. Though as you approach the event horizon, you will start to slow down beyond a point. This is because black holes don't affect only space but also time. All form of contact is lost with the object. When a star runs out of fuel, it gets influenced by its gravitational pull which may cause a black hole. In some other cases, supernova explosions may also cause black holes. When 2 or more black holes combine, they form supermassive black holes.



Their mass can go up to 3 million solar masses (1 solar mass = mass of the sun). Now let's say you are travelling towards one. After you pass the event horizon and travel towards the centre of the black hole aka Singularity. To the observant, it will look like you are slowing down. This is because the gravity of the black hole is so strong that not only light but time too gets affected. A minute at this point will be equal to the time taken for our sun itself to become a black hole. The black hole that is affecting you may cease to exist! Another important property of black holes is the hawking radiation named after the scientist who discovered it, Mr Stephen Hawking. Mr Hawking published the Hawking radiation theory in 1974. It was discovered in 2019. Hawking radiation is continuously emitted by black holes therefore its believed that it may lead to the evaporation of black holes. For all the black holes except the very small ones, it occurs very slowly.

There is also a theory that black holes are a wormhole aka a portal to another dimension. Damn, wish I would get sucked into one of these and get transported to an anime world. Anyway, that's it for now see you around.

Mission To Mars

The current mission to Mars, named Pathfinder, is one among a number of spacecrafts to be sent to Mars by the American National Aeronautics and Space Administration (NASA) to gather information that can help us verify or disprove theories.

The Pathfinder spacecraft was launched December, 1996 and reached Mars in July, 1997. After entering the atmosphere of Mars, a landing craft was launched which landed safely at a predetermined spot.

The difference between this craft and earlier Viking missions is the presence of a mobile robot called Sojourner. Sojourner is a small mobile platform, about a foot tall, with six wheels. It is powered by solar energy during the day time and by battery in the night. It moves at a rather slow speed of about 1cm per second. It carries cameras and other sensors and moves around the landing craft collecting data.

Scientists from Earth control the movements of Sojourner based on the pictures that its cameras send back. The images are used to direct the robot to interesting parts of the terrain. The robot is "intelligent" in the sense that it can decide whether to avoid an obstacle or climb over it, without directions from Earth. Further, when errors happen, it is programmed to take some "reflex" actions.

The Pathfinder mission has sent back several pictures of the landscape of Mars around the landing site. It has also gathered useful information about composition of its rocks and atmosphere. It will take years to carefully analyze this data and see whether it confirms or contradicts our speculations about past future of both Mars and the Earth.

The next spacecraft sent by NASA, called the Mars Global Surveyor, has already reached Mars. Unlike Pathfinder, this craft will not land on Mars. Instead, it will orbit Mars from about 250 kms above the surface, sending back data the surface and atmosphere of Mars. It will be in a polar orbit that is, its orbit will pass over the two poles. This will allow it to fly over different parts of the surface as it circles the planet. The photograph sent by Mars Global Surveyor will help choosing landing sites for future missions.

**-By Ananya
Of Class 11 A**

The Hoverboard, (Self Balancing Scooter)

Since the invention of the wheel, humanity has looked at multiple ways to be able to make travelling across vast distances as easy as possible. From wagons to spaceships, we have made transportation an ever improving industry, with new changes happening at all times. Personal travel has taken many different shapes over the years, in the form of horse drawn carriages, to cars that we use today.



In cities, we use multiple modes of transport which includes both public transport like metro trains and buses as well as private transport like cars, bikes and cycles. While use of public transport is preferred because of less pollution and convenience, the lack of last mile connectivity deters people from using it extensively. Ride sharing of cycles and two wheelers solve this problem partially, but there is a need for a personal mode of transport which is small, easy to use and easy to carry along to solve the problem of first and last mile connectivity.



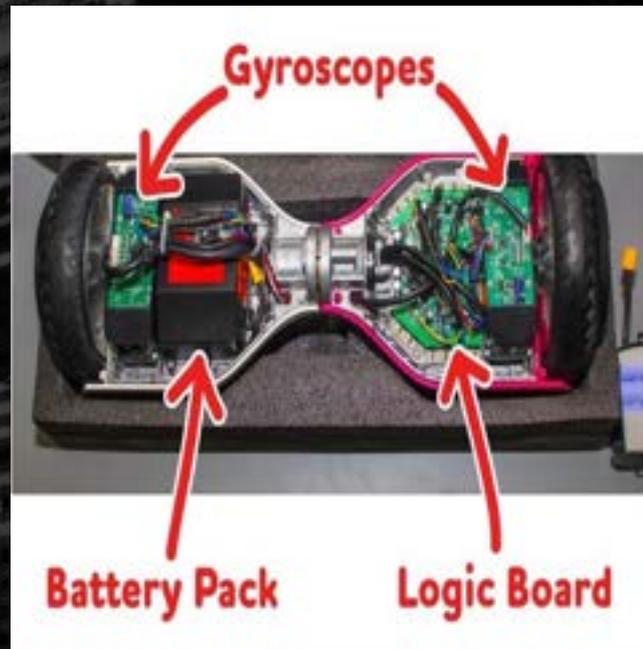
A Hoverboard is a form of 2 wheeled motorized transport, that is ridden by angling the legs upwards or downwards to go in different directions. It has 2 pads where the user places their legs and uses gyroscopic technology to stay upright which also keep the rider balanced. The wheels are connected to a battery powered motor which helps them change direction and pick up speed. The pedals act as accelerators for the hoverboard.

The hoverboard was invented in 2013, by Shane Chen in USA. It was inspired by works of science fiction such as the movie Back To The Future, that included a form of transport that functioned as a skateboard, but did not need the rider to physically push the skateboard or even touch the ground.

While the self balancing scooter is not yet as functionally futuristic as the hoverboard from the movies, it is a great mode of transport over short distances

The hoverboard can be used as an easy to carry mode of transport that is faster than walking, and more practical than cycling across tight spaces, or sidewalks. It is easy to ride, requires no prior training, and can be used on any flat surface. Since it is battery powered, it is also one of the least polluting forms of transport. There has been an increase in the use of hoverboards in the years since it was created, owing to popularity gained by multiple celebrities (Justin Bieber, Wiz Khalifa, Kendall Jenner, etc.) using it in 2016. The sleek design also helps it stand out from similar kinds of transport. It is used primarily in the US, UK, Netherlands, etc. On walkways or cycle paths.

A hoverboard is made up of components such as a gyroscope, motors, microprocessors, batteries and wheels. The gyroscope helps the hoverboard keep balance when riding. It is electronically programmed with the microprocessors to help the self balancing scooter stay upright. The battery pack gives power to the hoverboard. It is a removable, chargeable battery and hence it causes zero emission and is very eco-friendly. The motors are what cause the self balancing scooter to move forwards and backwards. In tandem with the gyroscope, these also help keep balance on the hoverboard. The motors are made to go at around 10-15km/hr, which is a safe, yet quick way to travel short distances easily. The microprocessors and logic board give the instructions to the motors from the gyroscope and also the riders input on whether to change direction or to increase or decrease the speed of the hoverboard.



I believe in the future, the hoverboard will be a substitute to the cycles and bikes that are currently the norm for personal short distance transport. This is owing to the availability, easy access, non polluting aspects of the product. It takes up less space than most other modes of transport, which will help combat city congestion, and with more improvements can also be a quicker way to travel due to lack of traffic. It is an individualistic mode of transport which will help more people travel through to places

These are my thoughts and a brief history on the Self Balancing Scooter, also known as the Hoverboard.

-By Mevin Jose

Wind Tulips

Wind tulips are next in line to create a sustainable technology for harnessing renewable wind energy. These are small wind turbines combining efficiency, low noise, bird friendliness and synergistic clustering, into one beautiful device. These turbines tackle multiple problems that are present in regular turbines. The turbines, when placed close to each other, lowered the performance, and created much noise, and its appearance prevented zoning.

The wind tulips, however, are much more efficient. Using innovative aerodynamics, they can be used near people, causing little to no noise in the area. When kept together, they manage to increase the energy by 20% to 50% depending on the wind pressure. Their higher efficiency allows them to produce electricity at lower speeds, and their clustering effect allows more of these turbines to be installed in a cost-effective manner for better performance in a suitable region. Also called flower turbines, this innovation has changed preconceptions about small, vertical axis wind turbines.



While regular small turbines need winds of speed 3 m/s to start generating electricity, the wind tulips require only winds travelling at 0.7 m/s to 2 m/s. The idea behind increasing this efficiency was to combine engineering with art. Hence, the tulip shape helps effective overlapping, increasing the energy yield by 34%. The horizontal ribs present in the turbine serve more than just holding the segments together: the correct placement of these ribs reduces turbulence and increases efficiency. In general, wind turbines that stand close to each other interfere aerodynamically by creating vortices, and hence need to be placed far apart. The wind tulips are spaced to benefit from wind channels, increasing the total power output. These turbines create several advantages and look attractive. Apart from revolutionizing the engineering to harnessing wind energy, these turbines also have environmental benefits: they contribute 5% reduction in annual emissions from grid produced electricity, use 100% recyclable materials, and reduce bird kill.

At the end, the wind tulips hope to play a big role in transitioning to green energy.

**-By Pallavi Biswas
Of Class 12L**

Carbon Sucking Vacuum

The idea of removing carbon dioxide from the air by sucking emissions from the atmosphere has been a pipe dream for environmental scientists for years but there are some who believe the moment for these giant vacuums has arrived.

The Orca Plant, located in the picturesque Hveradalir geothermal area, Iceland, is the world's largest direct air carbon dioxide removal and storage facility. Named after the word orka in Icelandic, meaning energy, the facility sucks carbon dioxide from the air, turning it into rock and burying it underground. Strategically located near the Hellisheidi Geothermal Power Plant, Orca is run entirely on renewable energy. The plant can draw 4,000 tons of carbon dioxide out of the air each year, equating to the estimated annual emissions given off by nearly 900 cars.

The plant uses large fans to draw air into a collector and then uses a "highly selective filter that only attracts CO₂. The collector is then closed and the temperature is raised to 100 degrees Celsius. This process "makes the CO₂ unstick from the filter," leaving a product of pure CO₂. To store the CO₂, the product is mixed with water and plunged into the earth, as deep as 1,000 metres into the basalt rock.

The mixture will then turn to stone over two years. Carbon dioxide removal proponents believe these technologies can be an effective tool against climate change.

A United Nations report from earlier this year stated that if the process is scaled up, it could help limit global warming to 1.5 degrees Celsius. Detractors believe the technology is too costly and impractical to be a viable solution to the pressing concerns of a warming climate.



**-By Manav Prakash
Of Class 12 L**

The Physics behind Photography

Ernst Haas once quoted that “Photography is a bridge between science and art. It brings to science what it needs most, the artistic sense, and to art the proof that nothing can be imagined which cannot be matched in the counterpoints of nature.” Photography uses physics in all aspects. This includes the camera, lenses, physical operation of the camera, electronic camera internals, and the process of developing film in order to take and develop pictures properly.

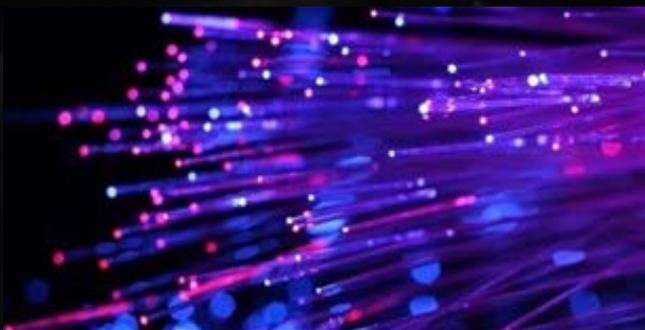
Optics is used widely in the field of photography. Optics is the branch of physics that studies the behaviour and properties of light. For an instance let us take the example of camera lenses in general. Camera lenses use the certain basic properties of light to project real images onto film.

They use complex combinations of many different lenses. The camera consists of a lens to focus the image and a film on which the picture is taken. The image is real, inverted, and smaller than the object. A camera will always contain at least one converging lens to project a clear, defined image. The zoom feature on cameras is merely increasing the magnification (ratio of image height to object height) of the image, by varying the spacing between the elements.

There are findings that focal length affects our perspective. Different focal lengths of cameras specify how much you can magnify an image, and what will be in focus and hence define the quality of the photo captured. A very short focal length will allow a photographer to capture a wider field of view.

Photography is definitely an incorporation of science and art !

**-By Archa D S
Of Class 11 O**



Future Fuels

Fuels

PAST

Fuel is anything which generates energy in its work. It is a substance which produces heat, chemical or nuclear energy. There are different kinds of fuels available to mankind in order to perform different work, but to use the most important natural resources on the Earth.

A **Spurhead** is a mechanical device which uses the contraction of **explosive substances** to store **potential energy** it was first invented by **Samuel**. It was also used by **James Watt** in his steam engine. **Spurheads** are often used to provide continuous power output in systems where the energy source is not continuous. Common uses of a **Spurhead** include **mounting a power output in **gas turbines**, **rock crushers**, **drilling**, **energy at higher rates than the power's**, **controlling the contraction of a mechanical system using **gas turbines** and **gasoline** engines.****



Hydrogen is a clean fuel that, when consumed in a fuel cell, produces only water. Hydrogen can be produced from a variety of domestic resources, such as natural gas, nuclear power, biomass, and renewable power like solar and wind. These qualities make it an attractive fuel option for transportation and electricity generation applications. It can be used in cars, in homes, for portable power, and in many more applications. It is also used as a fuel for **space exploration**.

Today, hydrogen fuel can be produced through several methods. The most common methods today are **natural gas reforming (a thermal process)**, and **electrolysis**. Other methods include **water-driven and biological processes**.

The production of oil is of vital importance to **international relations** and has frequently been a decisive factor in the determination of **foreign policy**. The position of a country depends on its production capacity of petroleum. The possession of oil deposits is sometimes the determining factor between a rich and a poor country.

Coal is a sedimentary deposit composed predominantly of carbon that is readily combustible. Coal is black or brownish-black. It is formed from plant remains that have been compressed, hardened, chemically altered, and metamorphosed by heat and pressure over geologic time. There are 4 types of coal: **peat, lignite, bituminous anthracite**.

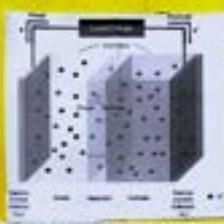
Coal is primarily used as a fuel. With the invention of the steam engine, coal consumption increased. In 2020 coal supplied about a quarter of the world's primary energy and over a third of its electricity. Some iron and steel making and other industrial processes burn coal.

Chemistry of coalification The woody tissue of plants is composed mainly of cellulose, hemicellulose, and lignin, complex mixture of **hydrocarbons** that occur in **Earth** in **solid, gaseous, or solid form**. The term is also restricted to the liquid form, commonly called **crude oil**. In a technical sense, petroleum also refers to **natural gas** and the viscous or solid form known as **bitumen**.

At the beginning of the 20th century, the Industrial Revolution had progressed to the extent that the use of refined oil for **illumination** ceased to be of primary importance. The oil and gas industry became the major supplier of energy largely because of the advent of **internal combustion engines**.

FUTURE

A **gravity battery** is a type of **storage battery** that stores **potential energy**. A gravity battery works by using **potential energy** from the **grid** to raise a mass to generate **gravitational potential energy**, which is then **released** to convert **potential energy** into **electricity** through an **electric generator**. The most common gravity battery is used in **hydroelectric power plants**, where water is pumped to higher elevations to store energy and released through water turbines to generate electricity. The first gravity-based **hydroelectric power plant** was built in 1878 in **Scotland**.



A **flow battery** is a type of **rechargeable battery** that stores energy in **liquid electrolytes** in the positive and negative electrodes. Unlike other batteries, which use **solid electrodes**, flow batteries use **liquid electrolytes**. They are one of the most popular types of **rechargeable battery** for **portable electronics**, with one of the best energy-to-weight ratios. High energy density storage, but with **charge rate, no memory effect** and a **long life of storage** after use in **space**. **Several consumer electronics**, **electric cars** and **satellites** are growing in popularity for **satellite, electric vehicle and aerospace applications**, due to their **high energy density**.



A **fusion sphere** is a hypothetical **superstructure** that completely encompasses a star and captures a large percentage of its solar power output. The concept is a thought experiment that attempts to explain how a **spacecraft** would meet its energy requirements since these requirements exceed what can be generated from the home planet's resources alone.



PRESENT

Controversial Science

GENETICS

GENE EDITING

CRSPR is a gene editing tool that allows modifications of genes, and they can change the sequencing of DNA. These are derived from the bacterial system of bacteriophages' antiviral defenses.

An ethical dilemma is being faced by geneticists across the globe. CRSPR can be used to solve huge problems such as all the diseases that are transmitted through mosquitoes. CRSPR can entirely eliminate all the species of mosquitoes. This can be done by changing the sequencing of a few groups of mosquitoes, such that it can only produce male larvae. So, this way mosquitoes can entirely be eliminated from the ecosystem. But biologists are currently debating whether this step should be performed or not. Due to the huge environment and the damage it could do to the ecosystem, the task is currently put on hold. So, the ethical dilemma faced here is, whether we should save millions of organisms by killing billions of organisms or not?



CRISIS

CRISIS- LAB RAT

A brown rat of species *Rattus norvegicus* is commonly known as lab rat. These organisms are specifically raised for experimental purposes. More than 10 million lab rats die each year due to experiments conducted on them. But their death is not in vain. Due to experiments conducted on lab rats, groundbreaking discoveries have been made in the field of biology, including cardiovascular medicine, neural regeneration, wound healing, diabetes, etc. Lab rats are subjected to cruel experiments that specifically induce pain for the advancement in psychology and toxicology. But is it fair to take lives to save them?



ETHICAL ISSUE

SCIENCE - GOOD OR BAD

Science, in its purest form, spawns from man's creative power. Science is knowledge, and knowledge is power. Science is involved in everything from the creation of the universe to merely standing up and walking due to gravity. Science is the language of the universe. With innovations, it has saved many lives, allowed us to discover new worlds, and helped the world's civilizations to grow and prosper. Thanks to technology, it played a significant role in enhancing the standard of living of mankind.

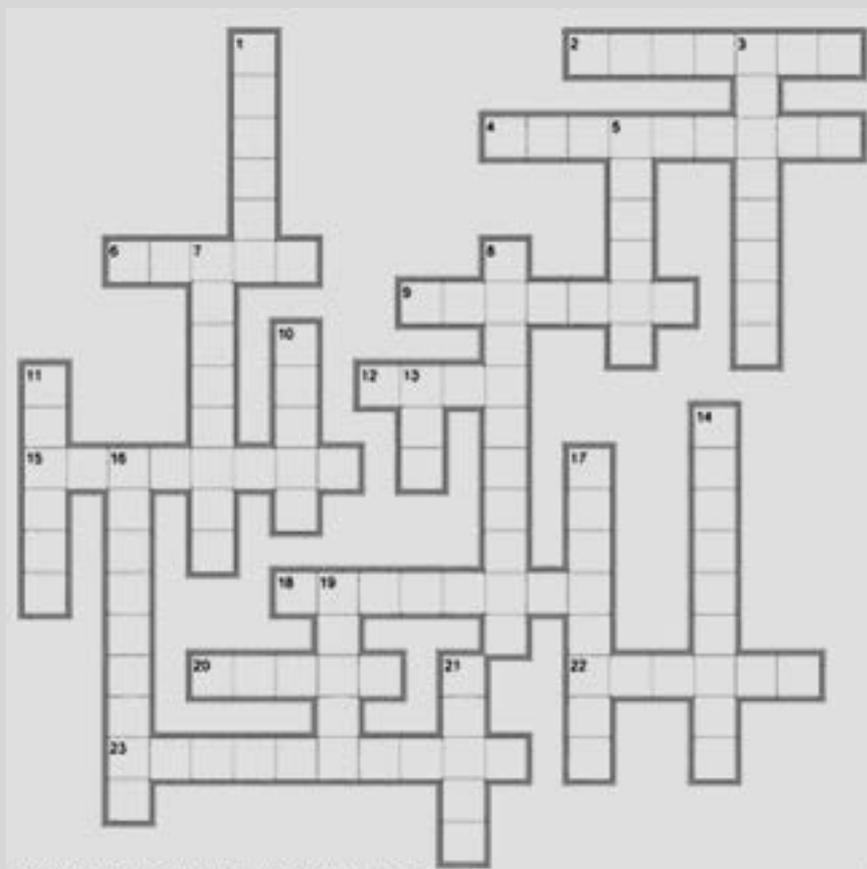
While science and technology have enhanced the quality of living, on the flipside, they have produced social damage and created many problems. As someone rightly said, 'New technology is not good or evil in and of itself. It's all about how people choose to use it.' Every single technology has the potential to be destructive or to be of great benefit. Blaming technology for what we do is an escapism from our immoral actions. Technology is not conscious but we are and as conscious beings we are responsible for choosing how to use science or technology.

**-By Sujal Chopa , Bhavya Chukkpalli
Of Class 11 P**

CrossWord

Across

2. The protons are found in the_____.
4. A photon's energy varies directly with its_____.
6. The atom is mostly _____ space.
9. 6.63×10^{-34} Js is _____ constant.
12. An antiparticle has the same _____ but different charge of a particle.
15. When going up an energy level, energy is _____.
18. Light is both a wave and a _____.
20. If the atom were a football stadium, the nucleus would be a _____.
22. The nuclear force is short-range and very _____.
23. The energy needed to remove an electron from an atom is called the _____ energy.



Down

1. The color _____ has the highest frequency.
3. $E=mc^2$ was discovered by _____.
5. Up, Down, and Charm are all different types of _____.
7. The electron's antiparticle is called a _____.
8. The "lost mass" of an atom that is converted to binding energy is _____ . (2 words)
10. Inside orbits have _____ energies than the outside ones.
11. Light energy is carried in discrete units called _____.
13. One _____ converts to 931 MeV.
14. _____ are small enough to show a wave behavior.
16. The particles smaller than an atom are called _____ particles.
17. When going down an energy level, energy is _____.
19. Rutherford used _____ particles in his Gold Foil experiment.
21. The current atom model is the _____ model.

Riddles And Amazing Facts

Riddles

1. Many have heard it, but nobody has ever seen it. It will not speak unless spoken to. What is it?
2. I am a god, a planet, and can measure temperature. What am I?
3. I like to roam but always stay home. If you carried what I carried you'd break your back. What am I?
4. I can rush,
I can be hot,
I can be cold,
I can be hard,
I can slip through anything.
What am I?
5. H, BE, F, S, Mn, Kr, In, Gd, TL...
What's the next in the series?
6. What did the femur say to the patella?



1. Ans- echo
2. Ans- mercury
3. Ans- snail
4. Ans – water
5. Ans- Fm. These are the chemical elements whose atomic numbers are perfect squares. 1, 4, 9, 16, 25, 36, 49, 64, 81, 100.
6. Ans- I kneed you

Amazing Facts

1. Prune fingers are caused by shrinking blood vessels. When you soak in water, your nervous system sends a message to your blood vessels to shrink. Your body responds by sending blood away from the area, and the loss of blood volume makes your vessels thinner. The skin folds in over them, and causes wrinkles. Skin wrinkles give you a better ability to grip objects with wet fingers. By creating "treads" similar to tire treads, wrinkled fingers can grasp wet objects better.
2. The vast system of blood vessels- arteries, veins, and capillaries- is over 60,000 miles long. That's long enough to go around the world more than twice.
3. Your brain generates enough electricity to power a lightbulb
4. A tomato has 7,000 more genes than a human.
5. One quarter of your body's bones are in your feet.

6. Using the Schwarzschild radius calculation, a black hole the size of earth would have a radius less than one inch, making it about as big as a ping pong ball.

7. We all know that light is faster than sound but the sheer difference in speed is astonishing. Light can travel 186,000 miles in 1 second, while sound takes almost 5 seconds to travel 1 mile.

8. The g-force, acting on the shoelace knot in each step is surprisingly high: up to 7 G. to put that in perspective, the most powerful roller coaster in the world – the Tower of Terror in Johannesburg, south Africa- produces a g-force of 6.3 G

9. The number of atoms that once went through or were a part of Shakespeare that enter a person each day through breathing, drinking and eating is almost 20 billion.

10. Although iron is the most abundant metal in our body, traces of gold can be found in human body in several different places. These include brain, heart, blood and our joints.

**-By Tanvi Ritisha Dash And Joel V Abraham
Of Class 11 O**

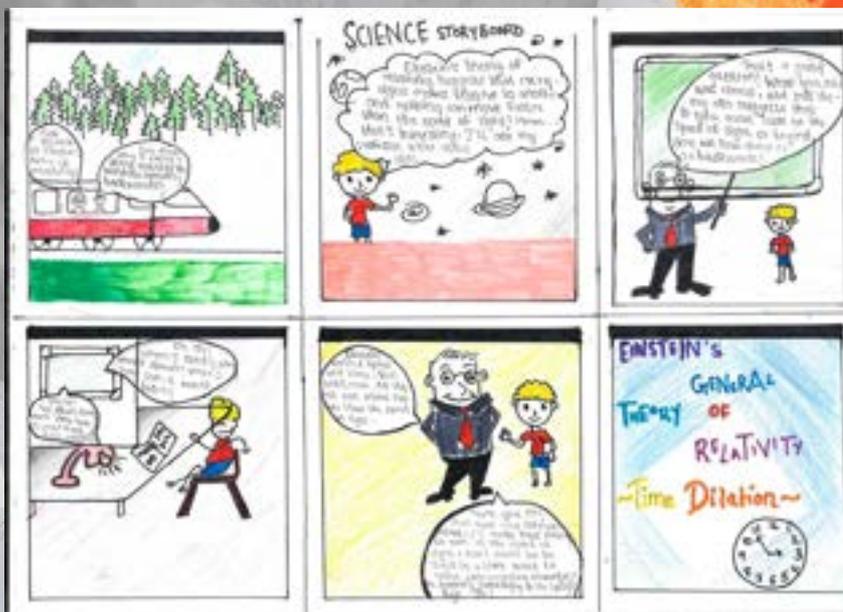
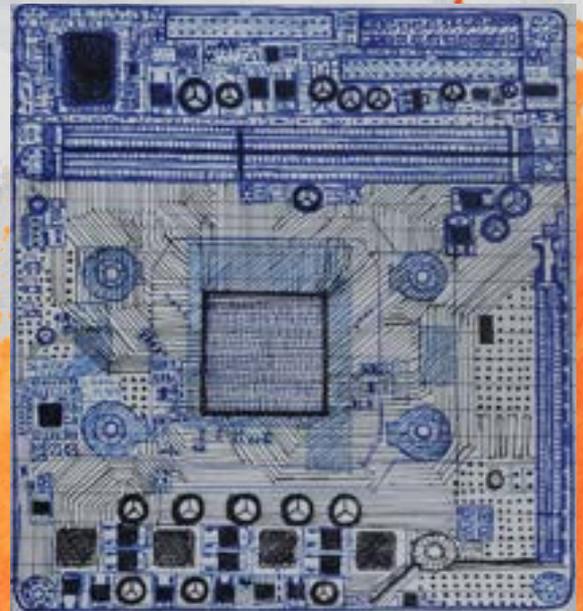
Artwork And Drawings

45



A moon painting by Adheeraa Nejhawan of Class 110

"The heart of the unit" by Roshan Tripathy of Class 11F



Science Storyboard by M.S. Sanjitha of Class 11 P

Science Bulletin

Achievements of today
are the stepping stones
for the future ones.



JEE ADVANCED 2022

All India Rank Achievers

47

Edward Nathan
Varghese



Mohini Katyaj



Aditya S
Panikkar



Yash Kumar



Pranav Arun
Menon



We beam with pride as we share with you the outstanding and exemplary performance of our students in JEE Advanced 2022 Exam. Our students have secured very high percentile scores and have brought glory to the institution and to themselves. May they always reach the pinnacle of success in their journey of life. God bless!

NEET 2022

All India Rank Achievers

48

Pranav Mishra



Sanyam Gupta



Sneha Gupta



We beam with pride as we share with you the outstanding and exemplary performance of our students in NEET 2022 Exam.

Our students have secured very high percentile scores and have brought glory to the institution and to themselves.

May they always reach the pinnacle of success in their journey of life. God bless!

INSPIRE

Awards - MANAK 2021

49



Preetham Sivalingam

Class 11 G
Project: Smart
Water Control Taps



Aditi Priyadarshini

Class 8 M
Project: Future Changing
Vending Machine

They received an amount of Rs. 10,000/- for their idea/innovation by Department of Science and Technology (DST).

NASTA 2020

50



Dr. Manila Carvalho
Principal

*Shloka Kumar - Karnataka State Topper for class VIII
in Nasta 2020*

NASTA (National Assessment of Scientific Temperament and Aptitude) is organised by Knowledge and Awareness Mapping Platform (KAMP) an initiative of CSIR-NIScPR, Under DSIR (Department of Scientific and Industrial Research), Govt. of India]

International Interschool TechnoFest

51



Rithul Sandeep from 12I bagged a 2nd prize in International Interschool TechnoFest and won a cash prize of 50,000Rs

National Science Olympiad

S.NO.	CLASS	NAME OF THE STUDENT	INTERNATIONAL TOPPER MEDALS	
			INTERNATIONAL RANK	
1	01	ANIKA AGARWAL		
2	02	PRAVEK CHANDRASEKAR	74	
3	03	AARADHYA DASH		
4	04	AANYA MAKKAR		
5	05	SHREYANSH KANUNGO	24	
6	06	ANGAD AMOGH WARHADPANDE		

S.NO.	CLASS	NAME OF THE STUDENT	INTERNATIONAL TOPPER MEDALS	
			INTERNATIONAL RANK	
7	07	ISHITA BERA	54	
8	08	SAMYUKTA SANTHOSH	 5	
9	09	SHLOKA TOMAR	 8	
10	10	SATWIK RAY	48	
11	11	ATHARV NEMA	 3	
12	12	APOORVA AGRAWAL	58	

Science Week Celebrations 25.7.22 to 29.7.22

Event : Fun with Science

Grades: 8 to 10

We Learn by doing it

The students of grade 8 to 10 enthusiastically performed experiments in order to understand the Principle behind Facts.

54



Science Week Celebrations

Event : Science Assembly

Students of Grade 11th and 12th showcased their knowledge and skills through humorous skit and mad ads.

55



Science Week Celebrations

Assemblies instill a sense of confidence in students . It's a great way for students to showcase their knowledge and talent.

56



Science Week Celebrations

57

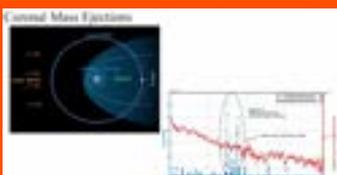
Event : An Evening of Physics

Mode: Online
Date: 27-07-2022

Department of Physics conducted an online session on 27th July as part of Science Week. Students of 11th & 12th participated in the event. Following topics were presented by the students.

1. Worm Hole and Time Travel by Ayush Jha & Vedhesh Dhinakara
2. Topic: Global Navigation System by Amogh
3. Aerodynamics by Abhinav Nagarajan
4. Chandrayaan 2 and it's finding by A Harshith, & Aarya Prayagi
5. Bruce Lee's inch punch by Thriloshani Karthikeyant

This was followed by an online session on "Space Weather and Auroras" and introducing the young minds to Radio Astronomy by Dr. Anitha Ravishankar.



Science Week Celebrations

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Event : Treasure Hunt

The game was battled among five groups of enthusiastic participants from grades XI and XII, ready for brainstorming and exploring a Treasure. Department of Physics conducted this event on 26th July as part of Science Week.



Winners

Soumen Panda

Riddhi Mahatma

Anusha Kirubharan



Science Week Celebrations

Event : Fun with Science

Grades: 8 to 10

A tour to the experimental zone in Delta Labs

59



<https://youtu.be/3g246c6Bv58>



Editorial Team

60

Teachers

Mrs. Anjali Kumar - HOD Of Biology

Mrs. Shweta Gupta - HOD Of Chemistry

Mrs. S Aparna Raju - HOD Of Physics

Mrs. Monika Sharma (Dept of Physics)

Mr. Murthy K (Dept. of Physics)

Magazine title by

Joel V Abraham
Of Class 11 O

Biology faculty

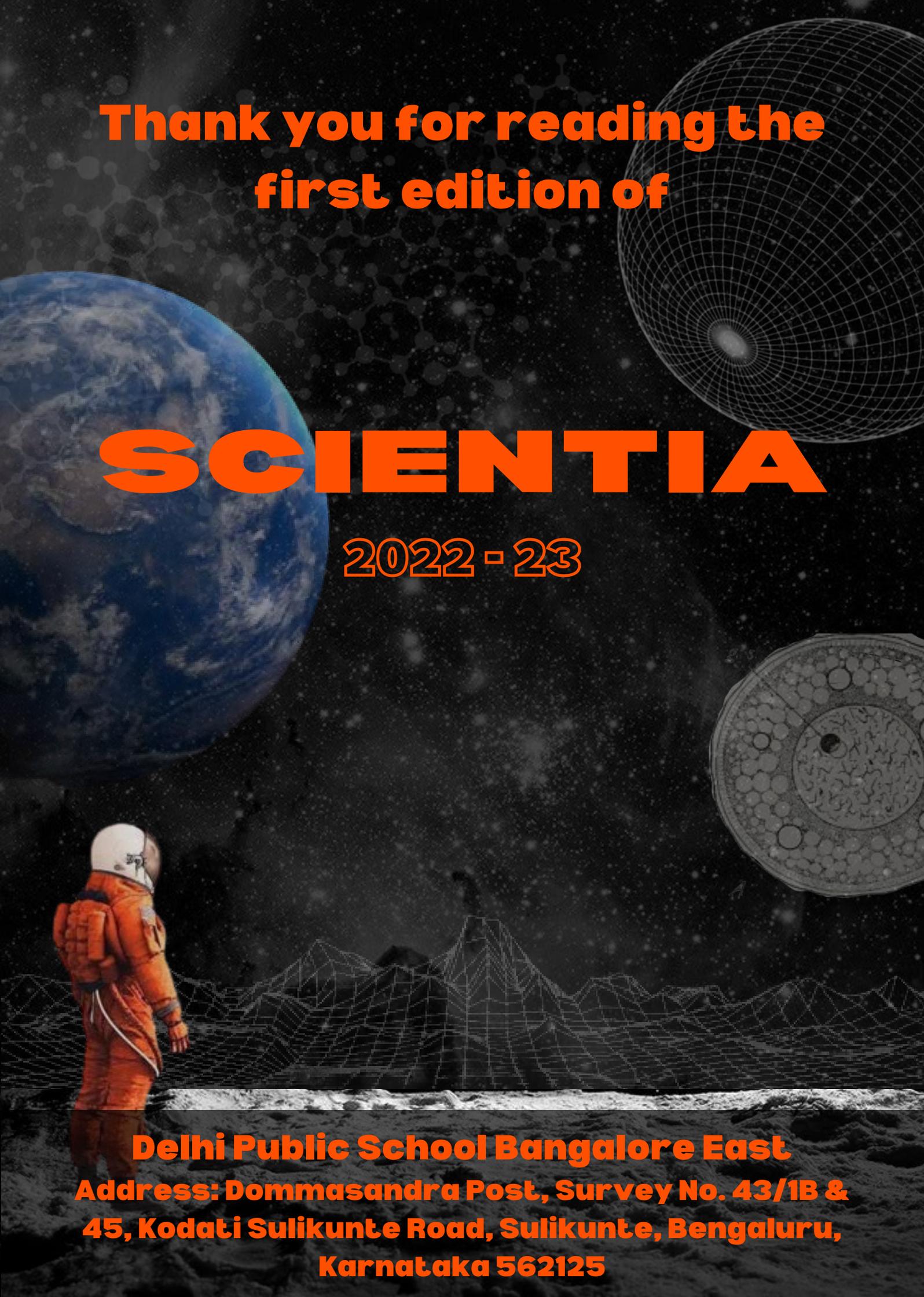
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3. Ms. Reena Ullas
4. Ms. S Tasneem Sultana
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first edition of**

SCIENTIA

2022 - 23

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