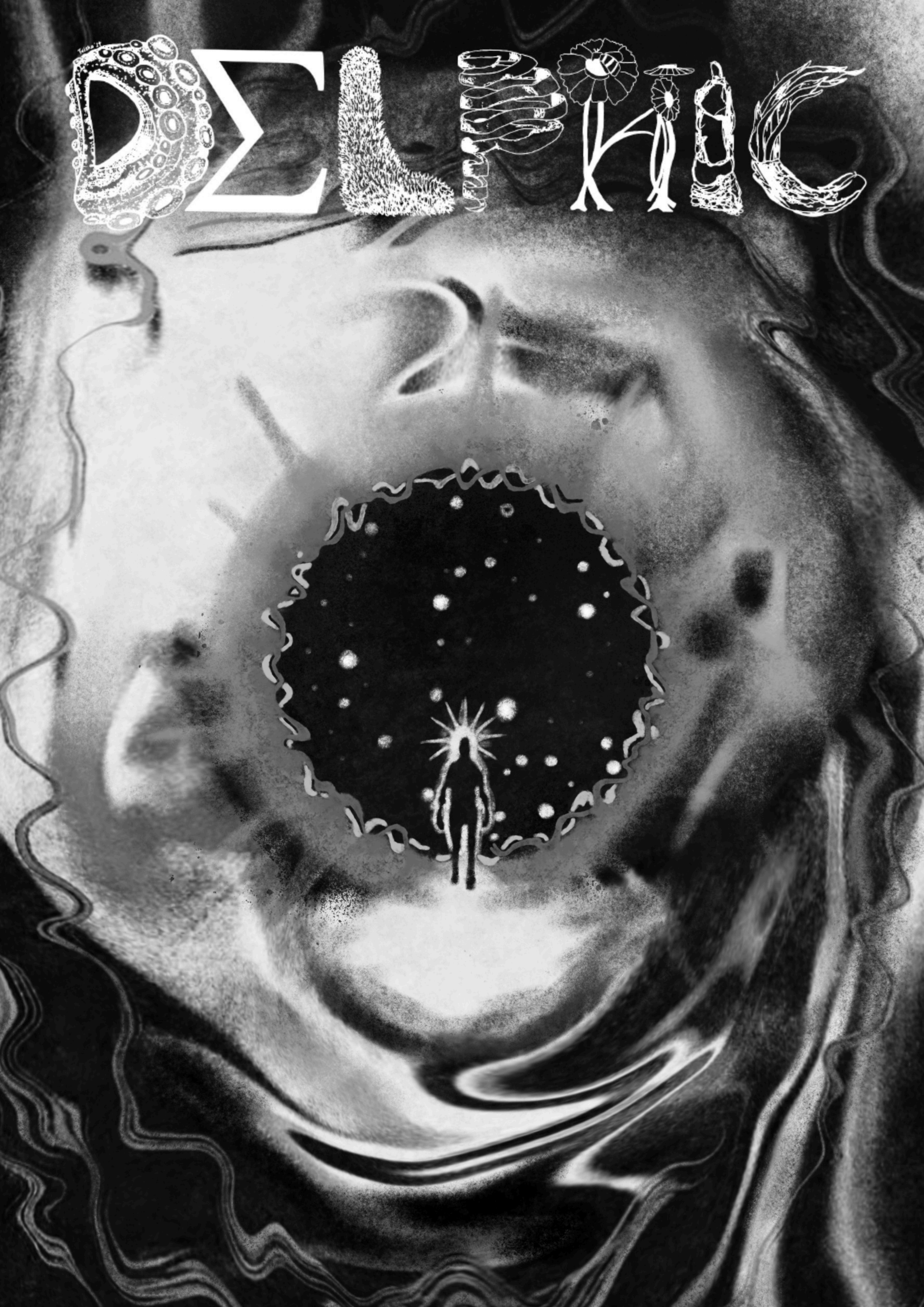
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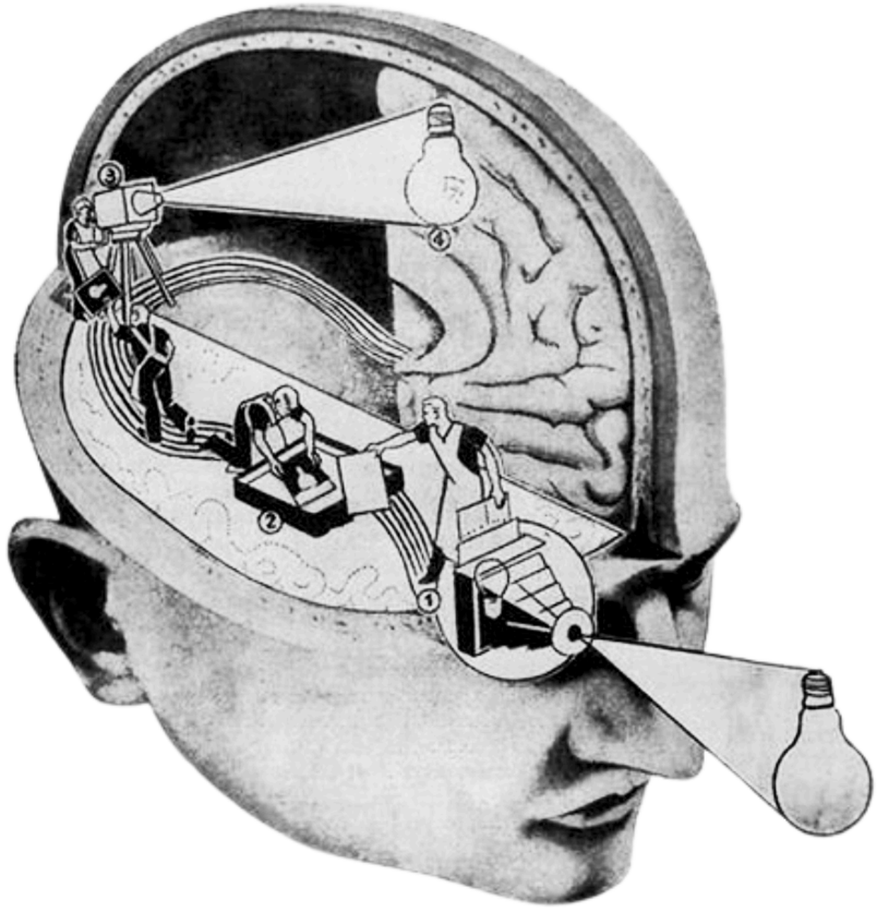


WHAT DO YOU CHOOSE TO SEE?

It is believed that we derive our meaning of the world through what we see. But when we approach the phenomenon through a scientific lens, this statement would hold untrue. What we see and what we perceive are two different aspects of our reality. Perception is sight with meaning. Therefore, what we objectively see may be the same as others but the meaning we associate with it may be wildly different. An example that hits close to home is that of the Swastika.

Originally used as a symbol of good luck and prosperity across cultures, the Swastika began to be associated with the Nazi movement in Hitler's Germany after he adopted it as his party's logo. This led to the icon being stigmatized as a symbol of hatred and racial bias, eventually outlawing its usage across multiple nations. Furthermore, there exist instances in which we process only that which we make the active choice to see. These can include views and opinions that align with our own thoughts. Therefore, perception holds great value in many fields, including those of scientific observation, human tendency and daily life.

In this issue of the Delphic, we aim to explore what perception means across the different paradigms of science. Finding its roots in psychology, we first discuss what exactly perception is. We then move on to talk about the relevance of substance use in altering our sensory output and the potential it holds in unorthodox psychiatric treatments. The final parts of our issue discuss the research being done in quantum computing and the student trip to CERN in July.

Perception teaches us the important lesson that all is not always as it seems. You, dear reader, have a choice to see what you wish to. What you choose to focus on is a decision that is completely yours. Make sure that you make it count.

Happy Reading!
Tvisha Mahajan
Editor-in-Chief

PERCEPTION

HOW WE UNDERSTAND THE WORLD

Perception is an essential psychological and cognitive process, the purpose of which is to interpret reality and frame our interactions with the world around us. Perception means more than just seeing, hearing, or feeling something; rather, it implies active interpretation of sensory information, which allows for our understanding of the environment. Be it art or recognizing a friend by the sound of their voice, perception is the reason we experience life the way we do.

Sensation marks the beginning of our journey in perceiving. Sensory input is received from the environment by our sensory organs: the eyes, ears, skin, nose, and tongue. This collected raw data is transmitted to the brain, where it is organised and interpreted into meaningful patterns. The process repeats itself not mechanically, but instead it adapts to several factors: attention, past experiences, and expectations.

For example, while walking down a busy street, you might suddenly feel the presence of a familiar face in the crowd. It will not be because the individual is more visually conspicuous but due to the fact that your brain has adapted to recognize certain patterns—like the face of your friend or even their gait—faster than others. This is a classic case of top-down processing where our expectations and previous knowledge guide perception.

Out of the various theories psychologists have formulated to explain the perception process, bottom-up and top-down processing are arguably two of the most influential ones. In bottom-up processing, it is believed that perception is realised starting from the input of sensory data, which then gets pieced together to form a complete picture. In such a data-driven model of processing, there is great reliance on the actual stimuli being sensed.

In top-down processing, the brain makes use of existing knowledge, experiences, and expectations in interpreting sensory information. According to this theory, perception is influenced not only by what we see or hear but also by what we anticipate seeing or hearing. A classic example of top-down processing is reading. When you read a sentence, you do not process every letter individually. Instead, you use your understanding of language to quickly make sense of the words, even if some letters are missing or jumbled.

It has been said that perception is the window to our world. Far beyond information, perception refers to the process by which we interpret the world around us and make our reality. Perception is the place to go, from the explanation of simple optical illusions to complicated social interactions—it rules how human experience comes to be. With the growth of technology and an improvement in our knowledge of the brain, research in perception will advance further in unravelling revelations on how it is we see, hear, and feel the world around us.

Ahaana Gupta
Class 11

Transcending the Confines of Reality

Throughout the annals of history, substance use has been a subject of both intrigue and taboo. One may think that their usage has been constrained to certain regions or segments of society, but this ignores their prevalence in society today. In fact, drugs are one of the very few things that evolve with society. Psychedelics like mescaline and psilocybin, extracted from the peyote cactus and certain varieties of mushrooms, have been used for millennia in various cultures. However, they only entered Western science in 1897, when Arthur Heffter isolated mescaline. Lysergic Acid Diethylamide (LSD) was first discovered by Albert Hofmann in 1943 when he accidentally ingested a small amount and perceived "extraordinary shapes with an intense, kaleidoscopic play of colours."

LSD and psilocybin research eventually flourished, leading to hundreds of papers being published on their effects on the human body. These papers particularly focussed on LSD, which was thought to mimic symptoms of acute psychosis, offering insights into schizophrenia. It also showed promise in psychotherapy by accessing repressed memories and emotions. Despite its potential, LSD research was halted in the 1960s due to the counterculture that it came to be associated with. LSD soon became synonymous with the hippie life and was though to be something that only societal outcasts indulged in. Nevertheless, early studies indicated that psychedelics were relatively safe compared to other psychotropic drugs of the time, with long-term follow-ups showing no significant psychiatric issues from their use.

The psychedelic realm refers to an altered state of consciousness, induced by substances such as LSD, psilocybin, and DMT. In this state, individuals experience altered perceptions and vivid hallucinations, which include interactions with complex entities or environments. Drugs could broadly be categorised into three types, based on the sort of changes they induce. The broadest of them all is psychoactive, which is used to describe any substance that affects the mind or behaviour, including common beverages like coffee. A psychotropic substance is anything that alters your biochemistry. These are substances that affect your perception of reality, mood, cognition and awareness. On the other hand, psychedelics are substances that primarily impact our sensory perception, thought patterns, and emotions, usually used for a mystical or spiritual experience. Neuroimaging studies with psilocybin, a classic psychedelic, show that this state is marked by elevated entropy, particularly in the brain's functional connectivity patterns.

In recent years, there has been a resurgence of interest in the therapeutic potential of psychedelics, with clinical and pharmacological studies exploring new models of psychedelic therapy. They involve methods of first ingesting a mild quantity of the drug while under a high level of supervision in a research laboratory and then the interpretation of the hallucinations experienced, so that the person may leave the facility in a more enriched state. With the trial being spearheaded at Johns Hopkins University by Dr. Matthew Johnson, a behavioral pharmacologist, the test subjects have shown an upward trajectory in recovery. Another study done to examine the effects of psilocybin-facilitated cessation of smoking showed that use of the drug along with CBT (Cognitive Behavioral Therapy) showed great promise in de-addiction studies. While microdosing and other unstructured uses of psychedelics show promise, structured, evidence-based psychotherapeutic interventions by trained therapists are likely the most effective way to maximise their therapeutic benefits.

While researching on how the intake of psychoactive substances influences our cognitive functioning, we found an analogy that summarises it a simple manner. Imagine that your mind is a hill, covered in snow. Every time you think, you ride down the hill in a sled. Over time, the snow tracks of the sled deepen, and you tend to align with them. What psychoactive substances do is that they lay a new layer of snow on the hill, temporarily erasing these patterns of thought. You can now ride down the slope in completely new patterns. This analogy can also explain how people report viewing everyday things in a completely new light under the influence of psychoactive substances.

Even though the resurgence in studying the effects of psychoactive substances shows promising results, it is important to realise that these trials are highly controlled and purely experimental. Substance abuse still is a highly prevalent social evil, creating addiction patterns in the brain that are self-reinforced. Furthermore, the mixing of different substances to make them more addictive also pose a great threat to the controlled medical usage of these substances.

Gauri Nanda
Shaurya Agarwal
Class 11

Quantumania

Ever wondered why governments around the globe are pouring millions into quantum computing research? It's not just about the next big tech trend—it's about revolutionizing the very foundation of computing.

Unlike classical computers, quantum computers are not simply faster but are designed for entirely different purposes, particularly for solving complex problems that traditional computers cannot. Classical computers use bits as the basic unit of information, which can be in the binary form of either 0 or 1. In contrast, quantum computers use qubits, which can exist in a state of 0, 1, or both simultaneously, resulting in a state of superposition, which allows them to store more information and process it faster. Additionally, qubits can be entangled, meaning the quantum state of one qubit is dependent on that of another, regardless of the distance between them. These phenomena allow quantum computers to solve specific problems more efficiently and quicker than classical computers.

However, qubits are inherently more fragile than classical bits, meaning they can easily lose their information due to external disturbances. Majorana qubits are a special type of qubit based on Majorana particles, which are theorized to be their own antiparticles. In physics, every 'ordinary' particle is said to have an antiparticle, one with the same mass but opposite physical charge. Majorana qubits are topologically protected, meaning they are resistant to small local disturbances, which makes them more stable and desirable for quantum computing. Creating a Majorana qubit requires engineering Majorana bound states (MBSs) and confirming their distinct properties. In the 2D setup, two quantum dots are connected through a region influenced by a nearby superconductor, a process known as proximitization.

By rotating the magnetic field and adjusting the electrostatic gates, researchers were able to systematically control the coupling between these quantum dots. This precise control allowed them to observe robust zero-bias conductance peaks, a key indicator of strong MBS correlations.The shift to a 2D platform is particularly important because it provides a scalable and flexible environment for experimenting with multiple MBSs. This development could lead to more complex and advanced experiments, ultimately paving the way for practical applications in topological quantum computing. The work not only demonstrates the universal nature of the physics behind Majorana particles but also offers a realistic solution towards manipulating and reading out MBSs, which are critical steps in the development of quantum computing technologies. In the long term, the flexibility and scalability of the 2D platform should allow for creating networks of Majoranas and integrating the necessary control and readout elements for a functioning Majorana qubit to be integrated in quantum computers.

Syna Gupta
Class 12

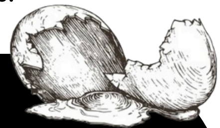
Trip to CERN

In the month of June, thirteen students from our school were given the opportunity to tour CERN, the European Organization for Nuclear Research. Not only did they learn about particle physics, but also enriched their knowledge of dark matter. CERN houses history's most advanced particle accelerator, the LHC (Large Hadron Collider). The LHC lies beneath the France-Switzerland border, spanning 27 kilometers and sits in a tunnel 100 meters underground.

Inside the LHC, particle beams are expelled from ultrahigh vacuum tubes, travelling in opposite directions in two different pipes. These high energy beams travel at a speed close to that of light, just before they are forced to collide. The superconducting magnets present in the accelerator are cooled to a temperature colder than that of outer space, thus helping the beams inside the accelerator to collide at four points corresponding to the positions of the four particle detectors. As visitors, we did not get to see the particle accelerator as it was being used to conduct experiments, but we were extremely thrilled to have been able to see models of the particle detectors, signed by the Nobel prize winners, Peter Higgs and Francois Englert. While on the trip, we were also fascinated to know that the World Wide Web was developed by Tim Berners-Lee while he was a scientist at CERN.

The ATLAS and CMS collaborations at CERN paved the way for discovering the second heaviest particle known today, the Higgs-Boson. Our discussions and lectures at CERN were primarily about this particle and the Higgs field. The Higgs Boson, with a lifespan of less than a trillionth of a billionth of a second, was capable of being produced in great numbers by the LHC. This particle is a manifestation of the Higgs field, which is what gives mass to other particles. This field is directly proportional to the mass of a body, thereby also proportional to the inertia of the body.

Throughout our trip, we interacted with renowned professors at CERN, one of them being Rolf Heuer, director general of CERN when the Higgs Boson was discovered. We could not be more indebted for being his audience during the lecture. All of us felt extremely grateful for witnessing groundbreaking research at this prestigious organization firsthand, fueling our passion for science and innovation even more.



MYTHBUSTERS:

ARE EGGS NON-VEG OR VEG?

Deciding whether eggs are vegetarian or non-vegetarian has puzzled many throughout the years and it continues to do so. Scientifically, eggs come from hens, and are considered non-vegetarian due to their animal origin. Most commercially available eggs are however, unfertilised i.e they would technically come in the same category as cheese, milk and silk.

Vegetarianism is often conceptualised as a diet including only plant-based items but for many, it is about avoiding the flesh of animals. According to this concept, eggs, being animal products, seem to contradict the vegetarian principle. However there are ovo-vegetarians who accept the consumption of eggs, while abstaining from eating chicken, pigs, fish, and other animals.

Pink Freud

CREDITS

Senior Editors
Paridhi Saboo
Syna Gupta

Senior Correspondants
Twisha Choudhary
Sukhmeet Kaur
Naisargi Nitin Patel
Drishti Mahajan

Artists
Advika Sasmal
Aarisha Jain

Teacher-in-Charge
Ms. Richa Joshi Pant

Editor-in-Chief
Tvisha Mahajan

Cover Artist
Advika Sasmal

Special Thanks:
Ms. Anindita Banerji

Junior Correspondants
Karen Sahdev
Yashita Jain

Go Beyond.