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Inside your skull lives your greatest superpower.

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The brain is not just an organ; it is the architecture of identity.

SCILOGI 4.0

HUMAN BRAIN: UNRAVELLING ENDLESS POSSIBILITIES

The human brain is one of the most powerful and fascinating organs in our body. Composed of billions of neurons interconnected through trillions of synapses, the brain is not merely an organ — it is the command center of thought, emotion, memory, creativity, and consciousness. It interprets the world around us, shapes our perceptions, and transforms experience into knowledge.

The theme "Human Brain: Endless Possibilities" celebrates this remarkable biological network — a dynamic system capable of innovation, resilience, and transformation. As we explore its structure, function, and mysteries, we are reminded that the limits of the brain are not fixed; they expand with curiosity, discovery, and perseverance. From the mechanisms of memory formation to the neuroscience of dreaming, from the biological basis of anxiety and depression to the cognitive and neural effects of meditation, the brain remains central to understanding both health and human potential. This edition explores these diverse dimensions — revealing how neural processes shape our thoughts, emotions, and well-being, and how scientific insights into the brain continue to open new pathways toward resilience, mental health, and self-discovery.

As we decode the science of the brain, we move closer to unlocking the limitless potential within every human mind.

FRONT COVER BY POORVI SAINI

EDITOR'S NOTE

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Reframing Brain Complexity in the Age of Molecular and Systems Neuroscience

The human brain represents the most intricate biological system known, integrating billions of neurons into highly dynamic networks that generate cognition, emotion, memory, and consciousness. Despite sustained advances in neuroscience, the principles governing brain function and dysfunction remain only partially understood. Recent conceptual and technological breakthroughs particularly at the molecular and systems levels, are now redefining how brain complexity is interrogated and translated into clinical insight. Comparisons between artificial intelligence and biological intelligence have intensified alongside rapid advances in machine learning. While artificial intelligence surpasses humans in speed, scalability, and pattern detection, it lacks consciousness, affective processing, and contextual reasoning.

Biological intelligence emerges from embodied experience, social interaction, and adaptive plasticity features rooted in neural circuit dynamics and molecular regulation. These distinctions emphasize the need to understand intelligence as an emergent property of multiscale biological processes rather than computational efficiency alone. At the core of this complexity lies the nervous system's hierarchical organization, spanning molecular signaling, cellular diversity, circuit dynamics, and large-scale network integration. Memory and neuroplasticity exemplify this multilevel coordination. Memory is increasingly recognized as a reconstructive process, continuously reshaped by experience, while neuroplasticity persists throughout life, supporting learning, recovery, and adaptation. Mental states and experiences also exert measurable effects on brain structure and function. Accumulating evidence indicates that meditation and mindfulness-based interventions modulate neural circuits involved in attention, emotion regulation, and stress responsiveness, reinforcing the concept that experience dependent plasticity and this is the key determinant of brain health.

Neurological and psychiatric disorders, including neurodegenerative diseases, reflect failures across multiple levels of brain organization. Molecular neuroscience has been pivotal in elucidating disease mechanisms, revealing roles for protein misfolding, mitochondrial dysfunction, synaptic failure, and neuroinflammation. Advances in genomics, transcriptomics, proteomics, and epigenomics coupled with single-cell and spatially resolved approaches have uncovered cell-type-specific vulnerabilities and previously unrecognized disease-associated pathways. Technologies such as CRISPR-based genome editing and optogenetics now permit causal interrogation of molecular and circuit level mechanisms with unprecedented precision. These discoveries are reshaping clinical neuroscience. Biomarker development, molecular imaging, and fluid-based diagnostics are enabling earlier detection, patient stratification, and longitudinal monitoring of disease progression. Large scale multi-omics studies further promise to capture the heterogeneity and temporal evolution of neurological disorders by integrating multiple biological layers. However, significant challenges persist, including limited access to longitudinal human brain tissue, computational complexity, cellular heterogeneity, ethical constraints, and barriers to data harmonization and sharing. Addressing these challenges will require coordinated international efforts, standardized analytical frameworks, advanced computational tools, and integrative model systems that bridge human and experimental neuroscience. As molecular and systems level insights converge, the field is increasingly positioned to translate mechanistic understanding into precision therapeutics.

In this context, modern neuroscience stands at a pivotal moment. By integrating molecular resolution with circuit and behavioral frameworks, the discipline is moving beyond descriptive models toward predictive and mechanistic paradigms. Such convergence is essential for closing the gap between basic discovery and clinical impact, ultimately enabling more effective, personalized, and preventive strategies for neurological and psychiatric disease.

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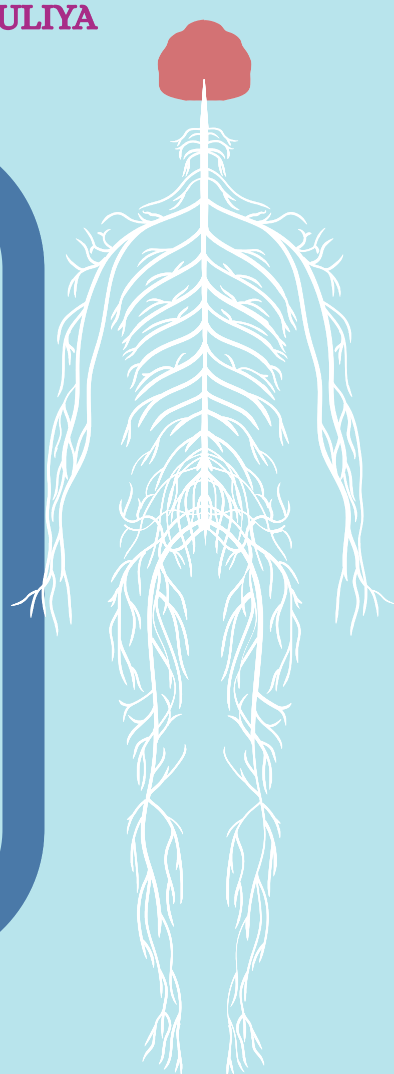
Brain Science Simplified

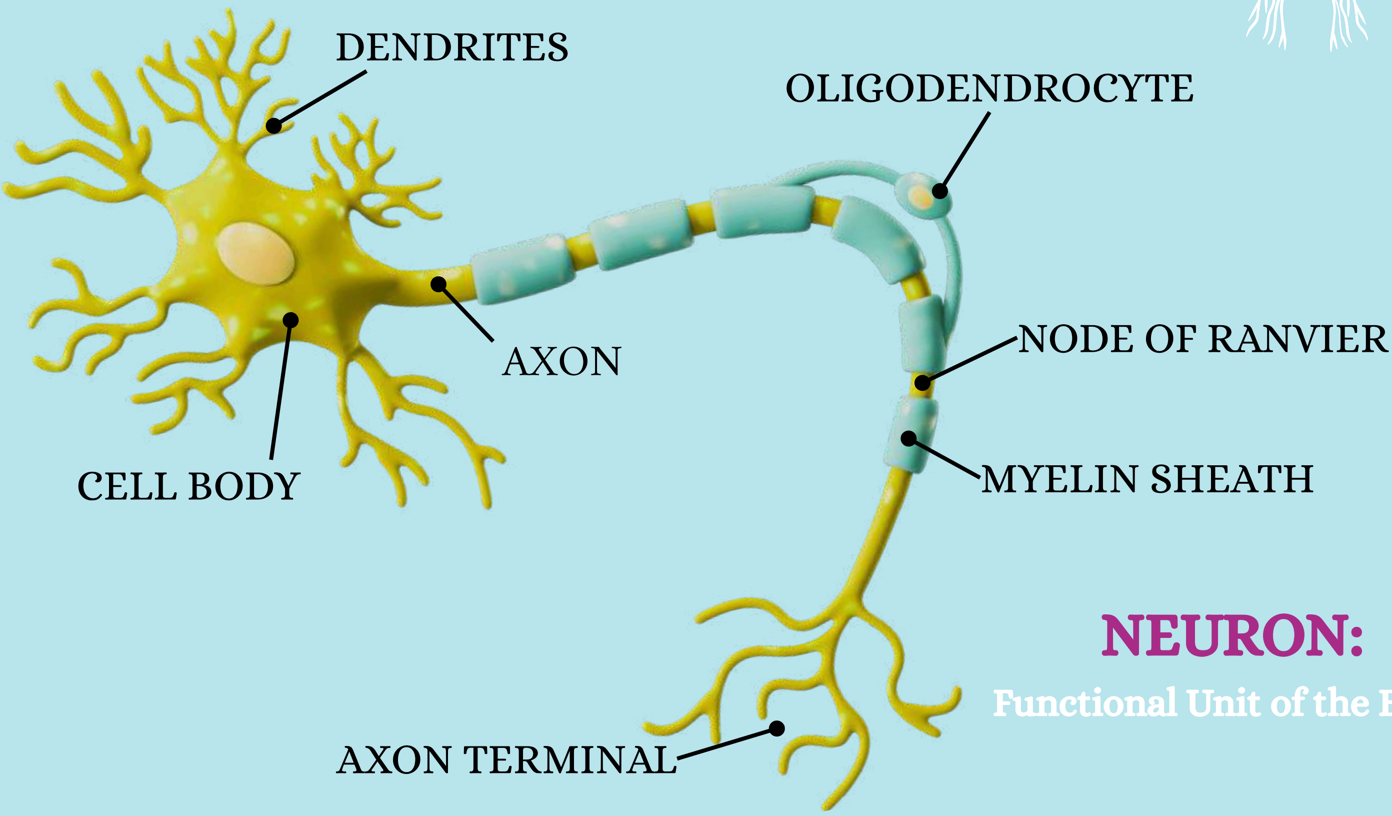
Essential Terms You Should Know

-NEHA GULIYA



NERVOUS SYSTEM

- **CENTRAL NERVOUS SYSTEM (CNS)**
  - Brain
  - Spinal Cord
- **PERIPHERAL NERVOUS SYSTEM (PNS)**
  - Somatic NS
  - Autonomic NS
    - Sympathetic (Fight/Flight)
    - Parasympathetic (Rest/Digest)
    - Enteric (Gut Control)

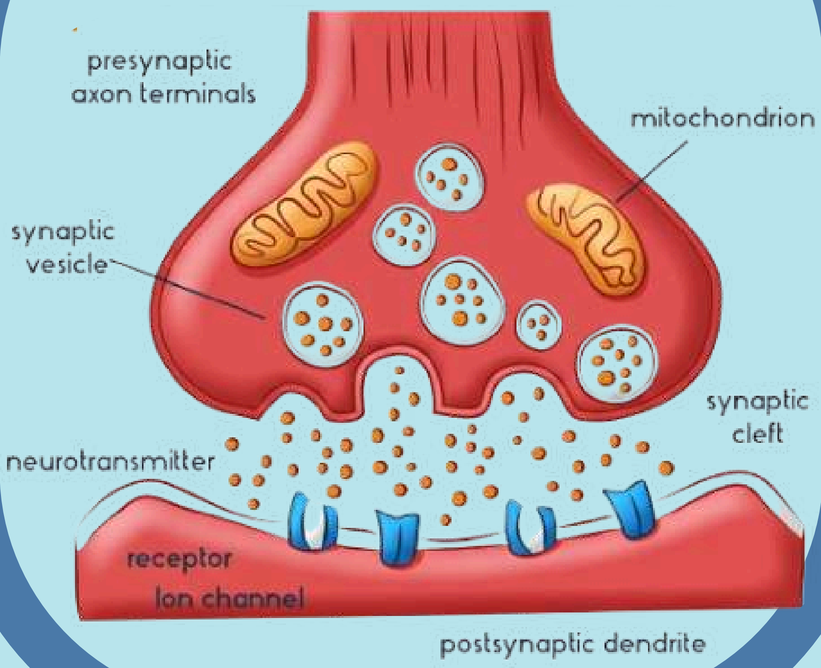


NEURON:

Functional Unit of the Brain

SYNAPSE:

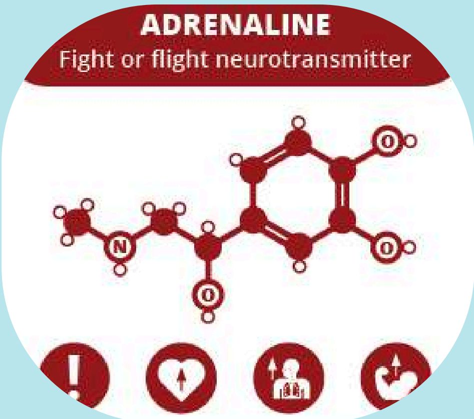
Junction between neurons

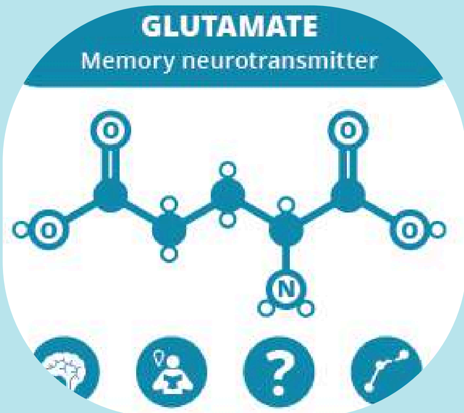


- The average human brain contains over 100 trillion synapses connecting billions of neurons!
- They are dynamic and constantly changing, which is the basis of learning and memory.

NEUROTRANSMITTERS:

Chemical messengers that transmit signals across a synapse





INSIDE THE HUMAN BRAIN

BY DAVINDER

Have you ever wondered, what controls you when you want to have some sweets, watch movies with your friends, hang out, and get involved in childish crime with them or while making important life decisions like choosing your life partner, it is the master organ in human body: THE BRAIN.

Human Brain

The human Brain comprises of 100 billion specialized cells known as neurons. Neurons are responsible for receiving and transmitting information from one part of the body to another. It can communicate using electrical signals or chemical messengers. Electrical signals travel down the axon and trigger the release of chemicals that cross the synaptic gap to carry the signal to other neurons. There are different kinds of neuron such as sensory neuron [transmit signal from environment (light, touch and sound) to CNS], motor neuron (transmit signal from CNS to muscles) and interneuron (connect other neurons, forming complex networks within the brain and spinal cord, crucial for processing and higher functions like thinking). Central nervous system (CNS) consists of your brain and spinal cord. Your CNS collects information from sensory nerves to process and respond to them. It regulates everything your body does. It is the central information processing organ of our body, and acts as the 'command and control system'. It performs various functions such as movement, sensory processing, emotional regulation, language comprehension, communication, cognitive processes and memory formation.

How is the Brain Protected?

The Brain is well protected by the Skull. Inside the skull, brain is covered by cranial meninges.

Dura Mater (Hard Mother)

- Outer
- Fibrous
- Double layered
- Non-Vascular

Arachnoid Mater (Spider like Mother)

- Middle
- Web-like Structure
- Subarachnoid Space contains CSF (cerebrospinal Fluid)
- Highly vascular

Pia Mater (Soft Mother)

- Inner
- Thin Layered
- Attaches with cerebrum

How does the brain work?

The brain sends and receives chemical and electrical signals throughout the body. Different signals control different processes, and your brain interprets each. Some make you feel happy, while others make you feel sad. Some messages are kept within the brain, while others are relayed through the spine and across the body's vast network of nerves to distant extremities. To do this, the central nervous system relies on billions of neurons.

White and Gray Matter

Gray and white matter are two different regions of the central nervous system. In the brain, gray matter (gray due to cyton part of neuron) refers to the darker, outer portion, while white (white due to myelinated axons) matter describes the lighter, inner section underneath. In the spinal cord, this order is reversed: The white matter is on the outside, and the gray matter sits within.

Structure and Function of different parts of brain

Brain Mainly divided into three parts:
Fore brain
Mid brain
Hind brain

Thermoregulation

Fore brain

The forebrain is the largest and most advanced part of the brain. It controls intelligence, memory, emotions, senses, and voluntary actions

Speech production

1). Cerebrum

- Can be considered as a ROM of human Brain. (involved in long term memory storage).
- Largest Part of the brain, comprises of two cerebral hemispheres connected through corpus callosum (thick Bundle of Neurons, which coordinate between both the hemisphere) which is only present in mammals.
- Cerebral hemisphere has four lobes: frontal, parietal, occipital and temporal.

1. Frontal Lobe - plays a crucial role in higher cognitive functions like long- term planning, interpretation, idea organization and Speech production (Motor Speech Area) (Broca's area).
2. Temporal Lobe - contributing to memory and Sensory Speech area (Wernicke's area).
3. Occipital Lobe - housing visual functions.
4. Parietal Lobe – It is responsible for touch perception, body orientation, and sensory discrimination

- Cerebral cortex: convoluted outer layer of cerebral hemisphere

2). Hypothalamus

- It regulates smooth muscle, impacting heart rate, digestive processes, and bladder contraction.
- It acts as an endocrine gland which release hormones such as releasing hormones (GH-RH, PL-RH, ACTH-RH, TSH-RH) and inhibiting hormones (PL-IH, ACTH-IH, TSH-IH and somatostatin (GH-IH)).
- It monitors body temperature.
- It is control center for hunger & thirst

3). Thalamus

- Thalamus is responsible for modulating mood and motivation, regulating sleep and wakefulness.
- It also acts as relay center for sensory & motor signal

4). Amygdala

- The amygdala plays a crucial role in regulating various emotional responses, such as anxiety, aggression, and fear, along with processing emotional memories and social cognition

5). Hippocampus

- RAM of human brain (short term memory storage occurs here)
- Part of limbic system

6). Limbic System

- hypothalamus, epithalamus, hippocampus, & amygdala are parts of limbic system.
- It is considered as emotional Brain which controls anger, fear, love, pleasure, excitement, motivation & regulation of sexual behavior.
- The limbic system regulates both autonomic activities, such as blood pressure and heart rate, and cognitive functions, such as attention, emotional processing, and short- and long-term memory

Brain stem

Mid brain

The midbrain is a tiny but crucial region of the brainstem between the forebrain (thalamus and hypothalamus) and hindbrain (pons and medulla)

Corpora Quadrigemina

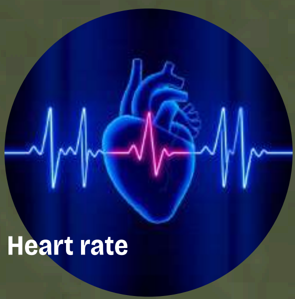
Divided into four parts

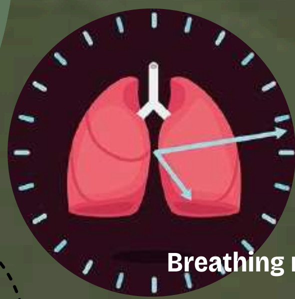
- Two superior colliculi which controls visual reflex (Movement of neck muscles for vision)
- Two inferior colliculi which controls auditory reflex (Movement of neck muscles for auditory purpose)

Auditory reflex

Hind Brain

The hindbrain is essential for regulating vital bodily functions such as breathing, heart rate, and motor control, and it consists of the medulla oblongata, pons, and cerebellum.





1). Medulla Oblongata

- It acts together to transmit motor and sensory information between the brain and the spinal cord.
- It controls automatic processes like blood pressure, respiration, heart rate, and reflexive behaviors like vomiting and swallowing.

2). Pons

- Function as coordination and breathing regulation and also serve as relay center, transmitting signal between different parts of the brain.
- It is involved in functions like facial movement and taste sensation

3). Cerebellum

- Coordinating voluntary muscle movements and maintaining posture and balance.

After reading this content, you now have a basic understanding of the human brain and are ready to explore the main idea. Before moving ahead, answer one question."

Q. As you understand the human brain, imagine that one day god appears and asks you what you want in your life?

Sto p reading, take a moment, and answer.

If I were to ask God for something, then as a science student, I would ask for proper activation of the frontal lobe of the human brain, as it is the main center for creative ideas, reasoning, learning, and memory.

THE HUMAN BRAIN : FACTS THAT SHAPE WHO WE ARE

By NIKETA

Weighing only about 1.4 kg, this remarkable organ controls everything from breathing and movement to emotions, memory, creativity and decision-making.

A SMALL ORGAN WITH ENORMOUS POWER

Although the brain makes up only about 2% of body weight, it consumes nearly 20% of the body's total energy. This energy fuels billions of brain cells called neurons, which constantly communicate with each other using electrical and chemical signals. In fact, the electrical activity generated by the brain is so strong that it could power a small light bulb.

THE BRAIN CANNOT FEEL PAIN

While the brain processes pain signals from all parts of the body, the brain itself has no pain receptors. This is why surgeons can perform certain brain operations on awake patients, allowing doctors to monitor brain function without causing discomfort.

LEARNING LITERALLY CHANGES THE BRAIN

The brain is not fixed or unchangeable. Its ability to adapt and reorganize itself is known as neuroplasticity. Every time we learn a new skill, study a concept, or practice a habit, new neural connections are formed or strengthened.

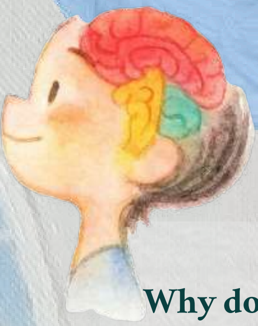
SLEEP: WHEN THE BRAIN GETS TO WORK

Sleep may feel like a break for the body, but for the brain it is a busy time. During Rapid Eye Movement (REM) sleep, the brain becomes almost as active as when we are awake. This stage of sleep is when most dreaming occurs.

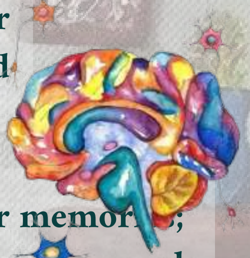
- **Multitasking reduces efficiency** – the brain works best when focusing on one task at a time.
- Music activates multiple areas of the brain, including those related to memory, emotion, and movement.
- The brain continues developing until around 25 years of age, especially the area responsible for decision-making and self-control.
- The human brain is about 60% fat, making it the fattiest organ in the body.

Memory: How the Brain Remembers and Forgets

By Komal saini



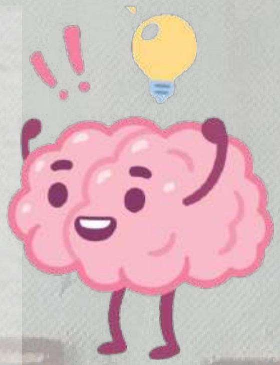
Why do some moments stay with us for a lifetime, while some others disappear within minutes? One may remember how someone was dressed at a particular wedding when they were five, but not remember what they had for breakfast just a few hours ago. Memory feels effortless, yet neuroscience reveals it to be one of the most complex and dynamic functions of the brain. Memory is what makes us who we are. It's not just recalling facts for exams or dates for birthdays - it's the brain's way of storing experiences, shaping decisions, and even defining our sense of self.

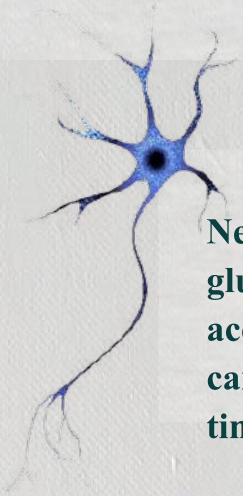


Neuroscience shows that there isn't a single region responsible for memories; rather, they emerge from the coordinated activity of networks of neurons and systems of the brain. Different kinds of memory rely on different neural circuits. Working memory allows us to hold and manipulate information for a brief amount of time, for example, remembering a phone number long enough to dial it. It depends largely on the prefrontal cortex. Long-term memory is more diverse. Declarative memory, which consists of facts and personal experiences, relies on the hippocampus and medial temporal lobe. In contrast, procedural memory, which is related to skills and habits, engages the basal ganglia and cerebellum. Emotional memories are strengthened by the interactions between the amygdala and hippocampus, which helps us remember emotionally significant events more vividly.

Memory formation evolves in stages. The first step is encoding, where the brain selects what to notice and store. Attention, novelty, and emotions play a crucial role at this stage, determining what is more likely to be remembered. Then comes consolidation, where short-term memories gradually stabilize into long-term storage. This often happens during sleep, as slow-wave and REM sleep help the brain "replay" experiences, strengthening important connections.

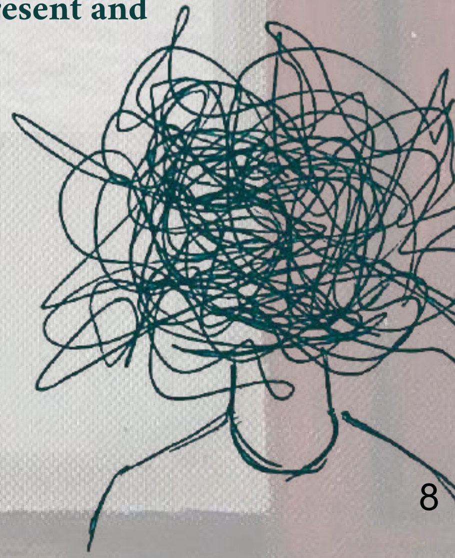
Next comes remembering. One often thinks that it's like playing a video, but it's not. Memory retrieval is a reconstructive process, meaning that memories are actively rebuilt each time they are recalled. This reconstruction allows memories to be updated with new information, but at the same time, it makes them vulnerable to distortion. As a result, two people can remember the same event differently, and memories can even change over time. Moreover, memories of events that never actually happened may exist.





Neurochemicals play a key role in these processes; for example, glutamate facilitates encoding, dopamine links memory to reward, acetylcholine supports attention, and stress hormones such as cortisol can either enhance or impair memory depending on intensity and timing.

Memory is also fragile. Disorders like Alzheimer's disease, amnesia, and PTSD illustrate how brain changes can disrupt it, yet they also reveal memory's ability to adapt. Far from being a perfect recording device, memory is dynamic, selective, and reconstructive, shaped by our emotions. In the end, forgetting is not a failure of memory but a feature of it. Forgetting can happen due to various reasons like encoding failure, memory decay over time, interference due to other memories, retrieval failure, and sometimes by motivated forgetting. Just as deleting unnecessary files from a phone or computer frees up storage and improves performance, the brain maintains efficiency and adaptability by retaining meaningful information while letting go of irrelevant details, preventing cognitive overload and allowing new learning to occur smoothly. Memory, therefore, is not merely a window into the past but an active process that shows how we understand the present and prepare for the future.



NEUROPLASTICITY

-APURVA

The term neuroplasticity can be broken down into two basic terms : neuro- plastic; with the “plastic” originally meaning “suitable for molding” as it comes from the Latin “plasticus”. As a concept, neuroplasticity means the nervous system’s ability to reorganize its structure and functioning in response to some stimuli, be it intrinsic or extrinsic .It the brain's remarkable ability to form new neural connections, enhancing already-existing ones or eliminating underutilized ones, enabling it to adapt, pick up new abilities, develop routines, and heal from wounds throughout life

Some key benefits of neuroplasticity are -

- It improves cognition and memory
- Helps acquiring new skills
- Reduce chronic pain
- Helps in recovering from injuries

TYPES OF NEUROPLASTICITY

Neuroplasticity can be divided into two main types-

1)Functional plasticity- Reassignment of functions from damaged brain areas to undamaged ones.In this way , brain regions adapt to maintain function after injury.
2)Structural plasticity- Physical changes in the brain’s structure. This can include growth or loss of synapses,changes in dendritic branching,neurogenesis etc.

MECHANISM

Neuroplasticity is mediated by activity-dependent changes at the synaptic and molecular level modifying the strength and efficiency of neuronal communication.
Synaptic plasticity is the major mechanism underlying learning and memory and occurs mainly in two forms: Long-Term Potentiation (LTP) and Long-Term Depression (LTD). LTP represents a continuous strengthening of synaptic transmission succeeding high-frequency stimulation, whereas LTD involves long-lasting synaptic weakening induced by low-frequency activity.
An important component of synaptic plasticity is the NMDA receptor, which is a detector requiring both postsynaptic depolarization and presynaptic glutamate release for activation. NMDA receptor activation initiates intracellular signaling cascades that determine the direction of synaptic plasticity by allowing calcium to enter the postsynaptic neuron.
Another key factor in plasticity is calcium signaling.While phosphatases are triggered by smaller or longer calcium elevation levels leading to LTD, protein kinases are activated by massive, rapid increases in intracellular calcium that induce LTP. AMPA receptor trafficking is controlled by calcium-dependent pathways, synapses are strengthened by increased AMPA receptor insertion and weakened otherwise.
Additionally, gene expression and protein synthesis are necessary for long-lasting forms of neuroplasticity. Genes linked to plasticity are expressed by activity-dependent transcription factors including CREB, stabilizing synaptic changes and promoting structural remodeling.

ROLE OF NEUROTRANSMITTERS IN NEUROPLASTICITY

By modifying synaptic strength and circuit remodeling, neurotransmitters are essential for controlling neuroplasticity. Through the activation of NMDA and AMPA receptors, glutamate is the primary driver of synaptic plasticity. Long-term potentiation (LTP) and long- term depression (LTD) are supported by intracellular signaling cascades that are initiated by NMDA receptor-mediated calcium influx. The primary inhibitory neurotransmitter, GABA, regulates the balance between excitation and inhibition and shapes crucial stages of cortical development to regulate plasticity.Neuromodulators such as dopamine, serotonin, acetylcholine, and norepinephrine do not directly encode information but regulate the threshold and persistence of plastic changes.

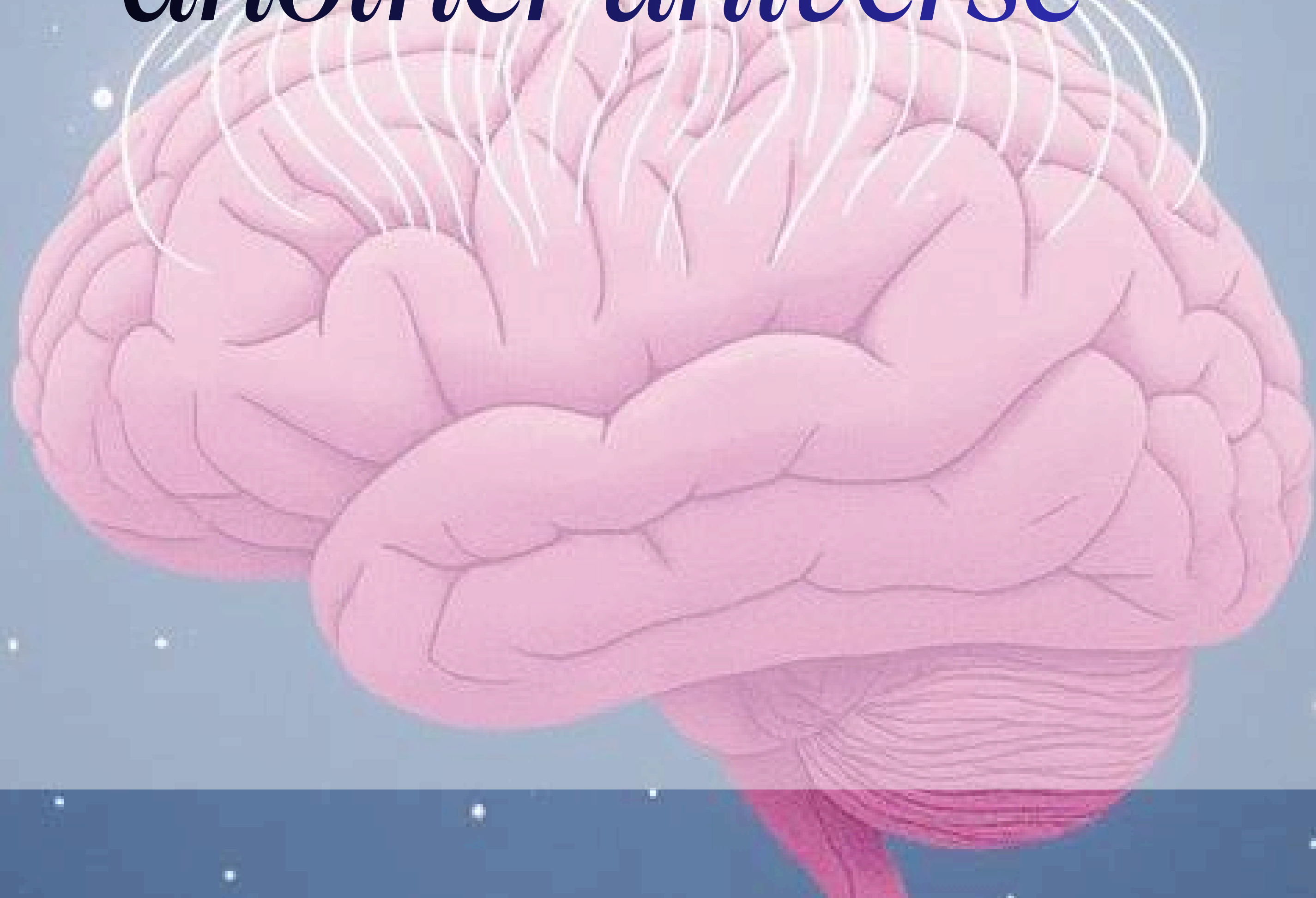
WHAT HAPPENS IN NEURODEGENERATIVE DISEASES

Neuropsychiatric and neurodegenerative diseases cause severe disruptions to neuroplasticity, which impairs synaptic connection and circuit function. While neurodegenerative disorders like Alzheimer's and Parkinson's are characterized by early synaptic loss conditions like depression and schizophrenia include aberrant synaptic remodeling and neurotransmitter signaling. Neuroplasticity is an important therapeutic target because persistent disease eventually causes cognitive, emotional, and motor deficits

THERAPEUTIC IMPLICATIONS

Treatment for neuropsychiatric and neurodegenerative disorders will be significantly impacted by a better knowledge of neuroplastic pathways. Cognitive, affective, and motor outcomes may be improved by therapeutic approaches that limit maladaptive circuit remodeling, improving adaptive plasticity, and restore synaptic function. Cognitive training, and neuromodulation techniques are examples of processes that may use neuroplasticity to delay the progression of disease and help in healing. Therefore, focusing on neuroplastic processes is an important and developing strategy in the creation of successful, disease-modifying treatments.

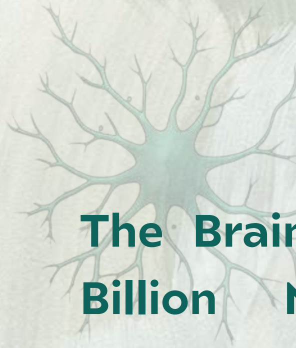
"Inside the skull lives a universe that interprets another universe"



BRAIN TRIVIA

-DHARMENDER GUPTA

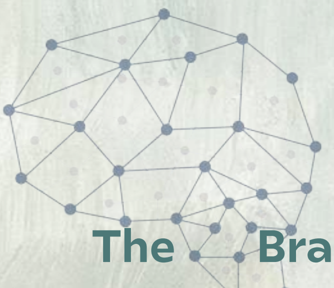
Our Brain Runs on about 20 Watts. Enough energy to power a dim light bulb.



The Brain Contains ~86 Billion Neurons. Each neuron can connect to thousands of others.

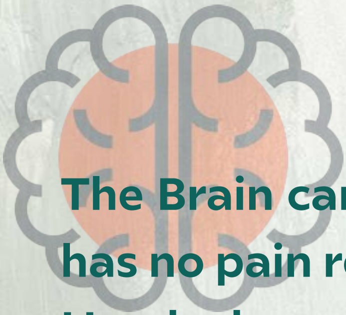
Sleep is active Brain Time. During sleep, the brain consolidates memory and clears metabolic waste.

The Brain is about 75% Water. Even mild dehydration affects cognition.

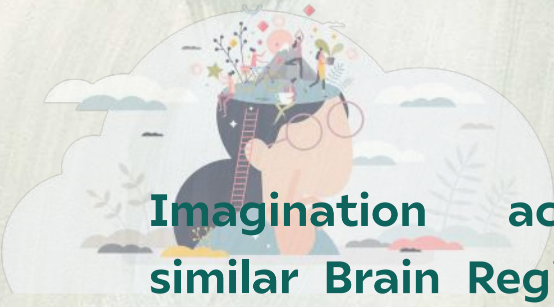


The Brain physically changes when we learn. New synaptic connections form learning literally reshapes structure.

The Gut influences the Brain. The gut-brain axis links microbiome activity to mood and cognition.



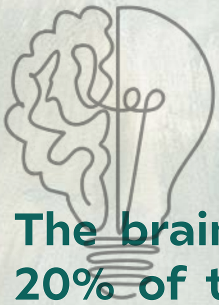
The Brain can feel Pain but has no pain receptors. Headaches come from surrounding tissues, not the brain itself.



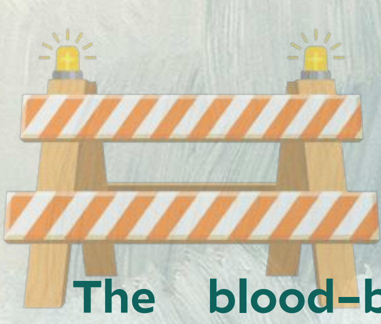
Imagination activates similar Brain Regions as Real Experience. Visualization can enhance performance (used in sports psychology).

Meditation Changes Brain Structure. Regular practice can increase gray matter density in areas linked to attention and emotion regulation.

The Brain processes information in milliseconds. Neural signals travel up to ~120 m/s.



The brain consumes about 20% of the body's oxygen and glucose, despite accounting for only ~2% of total body mass.



The blood–brain barrier (BBB) selectively regulates molecular exchange, protecting neural tissue from toxins and pathogens.

SLEEP AND DREAMS

-MANASWINI

A sleep cycle is about 90 minutes, and on average, a person requires 4-6 sleep cycles to feel well-rested. Each cycle is further divided into 4 stages – 3 Non REM Stages (N1, N2 and N3) and a REM stage. REM (Rapid Eye Movement stage) is the stage in which we experience vivid dreaming. Since most of us encounter visual imagery during our dreams, our eyes move just like tracking an object when awake. These stages transition from relaxing the body and mind, progressing into deep sleep (occurs during Non-REM) and finally to dreaming. The quality and architecture of a sleep (how long a cycle lasts, duration of REM, etc.) is analysed by Polysomnography (PSG). The important parameters measured include the activities of the brain (Electroencephalogram, EEG), the eye (Electrooculogram, EOG), the muscle (Electromyogram, EMG), the heart (Electrocardiogram, ECG) and respiration characteristics. Sleep evaluation can rule out any sleep disorders and abnormalities in the brain, improving the quality of life by helping us experience a good night's sleep while dreaming. This also gives a relative measure to study dreams externally, based on the physiological parameters such as eye movement, cortical activation, muscle atonia (relaxed muscles), etc, which are further backed by the subject's content of their dream upon waking.

It's fascinating to note that we live two different lives all at once, one when we are up and about and the other when we sleep. We live this alternate existence through dreams. Dreams are collective mental, emotional or sensory processes experienced when asleep. Although there is not a single explanation on why we dream, they commonly reflect our personality, fears or daily thoughts and experiences in our waking life or might appear as random as a fairytale that no one would believe. We could say that dreams are projections of our subconscious thoughts.

Certain regions of the brain "light up" during dreams. Starting with the limbic system, which includes the hippocampus, amygdala and the hypothalamus, mainly involved in memory consolidation and emotions, due to which we feel the dreams as if we are living it, retrieving the memories, present or past. The visual cortex, located in the occipital lobe of the brain show high activity during dreams, enabling the formation of vivid imagery suited to the storyline. In contrast, the prefrontal cortex is relatively inactive since this is the region that correlates to logic and being in the present, as opposed to the state of dreaming. In addition to brain regions, hormones and neurotransmitters play a huge role in our perception of dreams with respect to their intensity, logic, and emotion. Sleep is mainly induced by Melatonin. It (sleep hormone) rises in the dark, giving a rest and digest signal to the body. After the sleep onset, levels of other hormones such as cortisol and adrenaline decrease as the body prepares itself for the sleep cycle. These are among the hormones that tie us to reality. This can be traced to the reason why we remember bits and pieces of the dreams before we are about to wake up, rather than the midnight dreams, as the hormones increase our alertness, therefore the memory related to the dreams. It is interesting to note that males and females experience dreams differently due to different hormones. Neurotransmitters (the chemical messengers of the brain), have their fair share of functions that let us experience dreams the way they are. Noted examples would include acetyl choline (formation of vivid dreams), dopamine (joy/reward) and serotonin (mood regulation and better sleep quality).

How cool it would be if we could control our dreams – the storyline, the characters and even the minutest details of it? This is called Lucid dreaming, and one could actually make it happen. There are several ways to go about it, most of them rely on manifesting and telling yourself that you will remember your dreams – “I will remember my dreams today/I will realise that I am dreaming” and writing down key elements of your dream in a journal, once awake. Upon consistent practice, we will be able to notice a pattern of familiarity in our dreams, and our recollection of the storyline would be getting better by each day. This will not only help us achieve our motive of remembering dreams but may be even decode what they are trying to say to us. The scientific terms for these techniques are M.I.L.D.T (Mnemonic Induction of Lucid Dreaming Technique). S.I.L.D.T (Sensory Induction of Lucid Dreaming Technique), uses sensory inputs to realise the transition from wakefulness to sleep and is better suited for individuals who practice mindfulness/meditation. There have been many theories about dreaming that have been proposed over time, and let's look at them closely. Sigmund Freud, a 20th centrury pschyoanalyst, published a book titled “The Interpretation of Dreams” and was one of the most important books to state the purpose of dreams. He described dreams as a form of wish fulfilment and a means to explore one's hidden desires. But this theory was largely hypothesised, lacking any experimental evidence at the time. Modern science has come up with various theories relating to dreams such as the Activation-synthesis theory, Memory consolidation theory, dream for emotional regulation and problem solving etc. They all plot back to the working of the subconcious which no one has been able to completely understand till date. Dreams do come with exceptions such as nightmares, bizzare or frequently recurring dreams which has to be tackled at a very different angle. This might be due to brain abnormalities which might further result in sleep disorders. Dreams remain one of the most intriguing aspects of human consciousness. They represent a complex interaction between brain activity, emotions, and experiences, offering a glimpse into the inner workings of the mind and what they mean is ultimately left to our interpretation.

In sleep, the body rests; in dreams, the mind explores.

AI VS THE HUMAN BRAIN

BY NEHA ELDOSE

Artificial Intelligence, or AI as we commonly call it, has become an everyday term in all of our lives. What is AI? Why has it gained so much momentum in recent years? AI is a brainchild of humankind; designed to assist and support us. So, can it ever be compared to the human brain? Can it ever surpass the human brain? For which tasks, and under what circumstances, is it safe to leave decision-making to AI, and when is human judgement required?

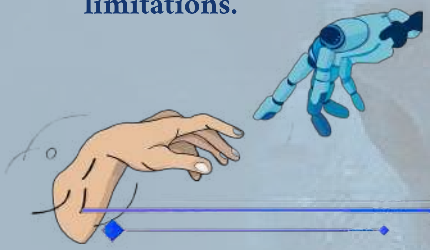
The human brain is the seat of intelligence, interpreter of the senses, initiator of body movement, and controller of behavior. The brain is the source of all the qualities that define our humanity. It weighs about 2% of the body weight and yet consumes almost 20% of the total energy generated. With about 86 billion neurons forming roughly 1 quadrillion synaptic connections, it functions like a super-network of switches, constantly communicating, adapting, and creating new pathways, shaping both our mind and body.

The birth of artificial intelligence was in the 1950s when Alan Turing, a mathematician and computer scientist, asked the iconic question, "Can machines think?". The term 'Artificial Intelligence' was coined at the Dartmouth Conference in 1956. A lot of progress has been made since then, especially with the surge of computational data in the 2010s which marked the entry of AI into a new era. AI today is not a single technology, rather it consists of multiple branches namely machine learning, deep learning, NLP, computer vision and many more. It can now recognize speech, analyze images, generate text, and even assist in discoveries, from self-driving cars to predicting the three dimensional structures of biomolecules.

If we were to draw a comparison between the human brain and AI, it becomes evident that AI is capable of performing only a narrow subset of the extensive cognitive repertoire of the human brain. The human brain has exceptional cognitive abilities which are made possible by the interaction of multiple neural networks. The frontal lobes and prefrontal cortex play key roles in these processes, although their activities are correlated with other brain regions. In contrast, AI derives its strength from computational speed and the ability to process vast amounts of data efficiently. While AI excels in rapid data processing, and task optimization, it lacks inherent awareness, emotional intuition and the ability to interpret context in the way the human brain does.

Decision-making and adaptation is one of the many domains in which the mechanism of action and adaptability of AI and brain differ significantly. The brain functions as a network that coordinates actions and reactions. Learning in the brain is continuous, adaptive, and deeply influenced by experience, emotions, and interactions with the environment, whereas AI systems require training, correction, and retraining when errors occur. For instance, when confronted with a difficult decision, the limbic system evaluates emotional relevance while the prefrontal cortex takes rational thinking into account. Effective decision-making and adaptive behavior are ensured by this cooperation between different brain areas.

The brain's capacity to change its structure by creating new neural connections is known as neuroplasticity. Learning, memory formation and injury healing are all aided by this flexibility. In contrast, decision-making by AI is largely driven by pattern recognition and statistical inferences. The ability to detect patterns and regularities from large datasets is essential for decision making processes, automation, and developing intelligent systems. These fundamental differences highlight that the human brain and artificial intelligence are not equivalent systems; rather, they represent distinct forms of intelligence, each with unique strengths and limitations.



One of the ways in which AI intersects with human cognition is through a new technology called the Brain Computer Interface (BCI), which seeks to provide a direct line of command from the brain to the output devices, which then receive, analyze and translate the signals from the brain into commands. Using brain activity to control external devices or to interact with virtual worlds is one of the main objectives of BCI. BCI has the potential to improve human computer interaction, to restore movement in paralyzed individuals, and to create new opportunities in a variety of fields, including communication, gaming, and medicine.

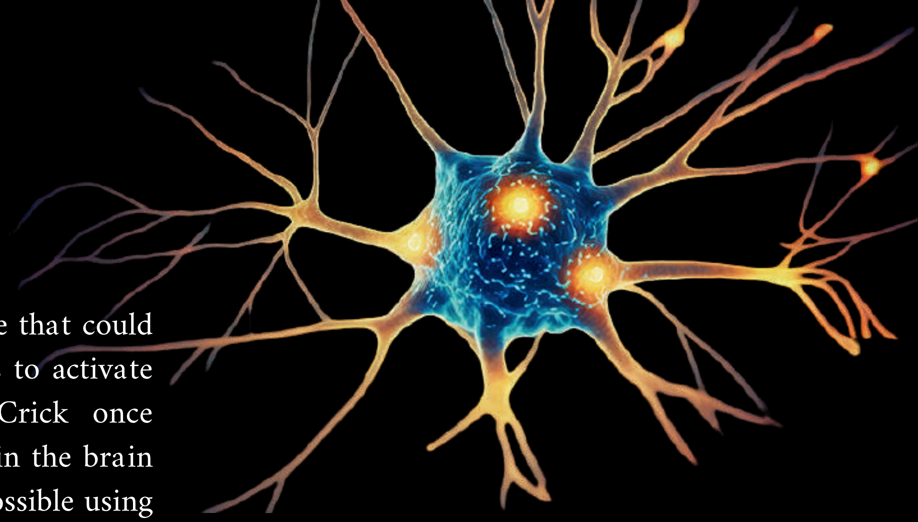
Very recently, Dr Ganguly et al. at UC San Francisco planted small sensors on the surface of the brain of an individual who had been paralysed for many years. Although he could not actually move, his brain produced signals when he imagined himself moving and these signals were used to train the AI over the course of a few weeks. Eventually, the individual was able to make a robotic arm pick up blocks, turn them and move them to new locations. He was even able to open a cabinet, take out a cup and hold it up to a water dispenser, emphasizing the advancements made in the field of BCI since its invention.

A future in which human and AI develop simultaneously, influencing and enhancing one another's skill, envisions the co-development of human competences and AI functionality. This co-evolutionary process includes both AI's assistance to humans and requires humans to learn how to interact with and use AI as a co-operative partner. So, to answer the questions asked in the beginning of the article, AI is not a competitor to the brain, rather it is a complementary tool that enhances human capabilities instead of replacing them. By integrating human adaptability with the efficiency of AI, we can develop systems that are not only intelligent but also ethical, paving the way for a future where human-AI collaboration brings new innovations for society.

better tomorrow

Optogenetics

-Het Modi



The Origin: Why Optogenetics?

Scientists have long searched for a technique that could provide specific control over which neurons to activate while leaving others unaltered. Francis Crick once speculated that controlling one type of cell in the brain while leaving the rest untouched might be possible using light.

In 1995, Georg Nagel, Ernst Bamberg, and their colleagues successfully used heterologous expression of bacteriorhodopsin in Xenopus oocytes to demonstrate a light-induced current for the first time. Later, in 2002, Boris Zemelman and Gero Miesenböck modified neuronal cells with rhodopsin, making them light-sensitive. The technique was subsequently expanded with the use of channelrhodopsin and halorhodopsin. The true watershed moment arrived in 2005 at Stanford University. A team led by Karl Deisseroth, Edward Boyden, and Feng Zhang took Channelrhodopsin-2 (ChR2) and successfully expressed it in mammalian neurons. Unlike previous attempts that required multiple complex components, this single-protein system responded to blue light in mere milliseconds. This elegant simplicity marked the official birth of optogenetics, finally granting scientists the precise, real-time control over neural circuits that Crick had dreamed of decades earlier.

The Basic Mechanism

Using different opsins, neuronal cells can be modulated in diverse ways. For example, a neuron can be excited using blue light to activate channelrhodopsin-2, or inhibited using yellow light to activate halorhodopsin, which hyperpolarizes the neuron.

Implementation begins with the precise delivery of opsin transgenes using recombinant viral vectors, most commonly Adeno-Associated Viruses (rAAVs) or lentiviruses. To achieve cell-type specificity, researchers rarely rely on promoters alone due to the size constraints of the AAV packaging limit. Instead, they use intersectional genetic strategies:

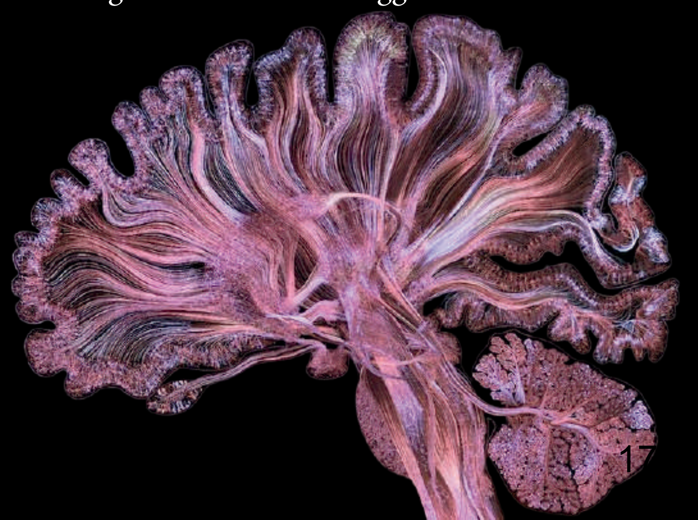
- The Cre-LoxP System: Used to restrict opsin expression to genetically defined cell populations.
- Vector Tropism: Utilizing different AAV serotypes (e.g., AAV5 or AAV9) to optimize retrograde or anterograde transport along axons.

Two to three weeks post-infection, stereotaxic surgery is performed to insert fiber-optic implants. However, new technologies have evolved that remove the need for invasive tethering:

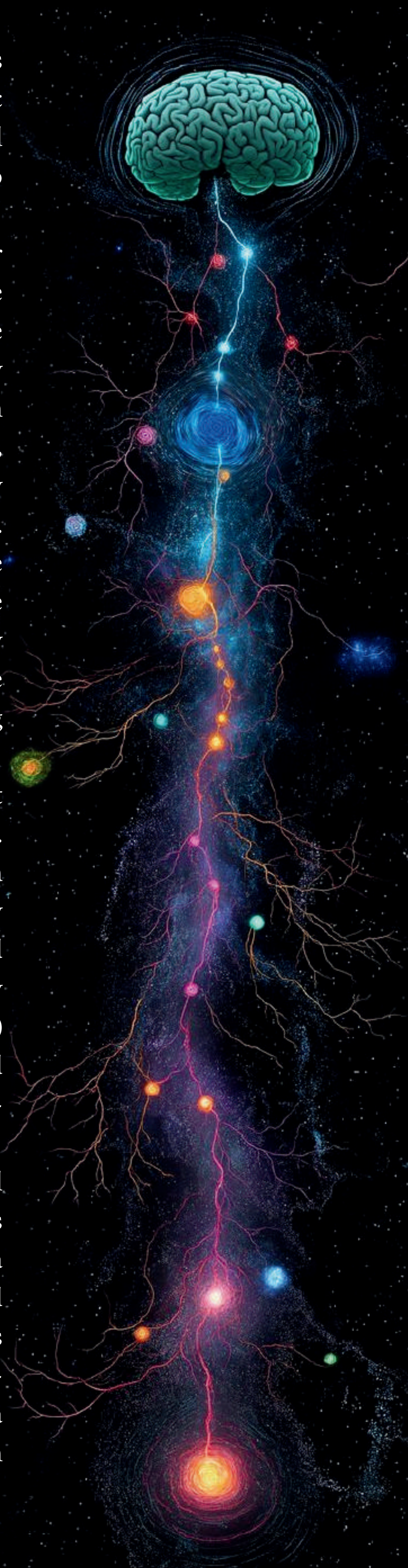
- μ-ILEDs: Ultrathin, flexible micro-inorganic light-emitting diodes injected directly into the brain, powered via subcutaneous antennas using inductive magnetic coupling.
- Upconversion Nanoparticles (UCNPs): Injected nanoparticles that absorb highly penetrative near-infrared (NIR) light applied outside the skull and locally emit blue light in the brain to trigger ChR2.

Current Breakthroughs

Optogenetic methods have enabled the acquisition of insights into a broad range of questions in behavior, physiology, and pathology, spanning the domains of sensation, cognition, and action. Although many studies have been conducted in mammals (typically rats and mice), optogenetics has also become a standard resource for scientific communities studying the neural circuit foundations of behavior in invertebrates.



Broadly speaking, optogenetics has illuminated the causal role of defined cell types and projections in natural and disease-related physiology, ranging from basic homeostasis to advanced cognitive functions. To illustrate this impact, several recent breakthroughs have moved the field beyond fundamental mapping and into the realm of translational therapeutics:



- **Rewiring Addiction**-Optogenetics has fundamentally reshaped our understanding of addiction, reframing it from a systemic chemical imbalance to a reversible circuit dysfunction. Chronic cocaine abuse is known to induce hypoactivity in the prefrontal cortex (PFC), eroding its top-down inhibitory control over the nucleus accumbens (NAc). By transducing PFC projection neurons with ChR2 and optically stimulating their terminals within the NAc, researchers were able to artificially restore this executive control, instantly suppressing compulsive drug-seeking behaviors in rodent models. Complementing this macro-circuit approach, researchers also targeted the micro-circuitry of the reward center. By selectively silencing a sparse population (~1%) of NAc cholinergic interneurons with halorhodopsin, they successfully blocked acute cocaine conditioning. Together, these breakthroughs demonstrate that addiction behaves like a neurological routing error that can be corrected in real-time.
- **First Human Ex Vivo Seizure Suppression**- Historically limited to rodent models, optogenetics crossed a major clinical threshold in late 2024. Researchers demonstrated the first optogenetic control of seizure activity in living human brain tissue. Using neocortical and hippocampal tissue surgically resected from patients with drug-resistant epilepsy, researchers transduced neurons with inhibitory opsins. By monitoring the tissue on high density microelectrode arrays, they successfully disrupted synchronized ictal (seizure) discharges in real-time using yellow light, without causing rebound hyperexcitability. This provides the first proof-of concept for human closed-loop optical neuro-prosthetics.
- **Ambient-Light Activation for Blindness**- The most advanced clinical application today is in sensory restoration. In 2024, Phase 2b clinical trials utilized MCO-010, a proprietary multi-characteristic opsin delivered via AAV2 vectors to surviving retinal bipolar cells in patients with advanced Retinitis Pigmentosa. Engineered for extreme highsensitivity, MCO-010 allows patients to see using ambient visible light, eliminating the need for bulky laser-goggles. Results showed that 40% of legally blind patients experienced a statistically significant improvement of logMAR (equivalent to 3 lines on an eye chart) sustained up to 76 weeks postinjection.

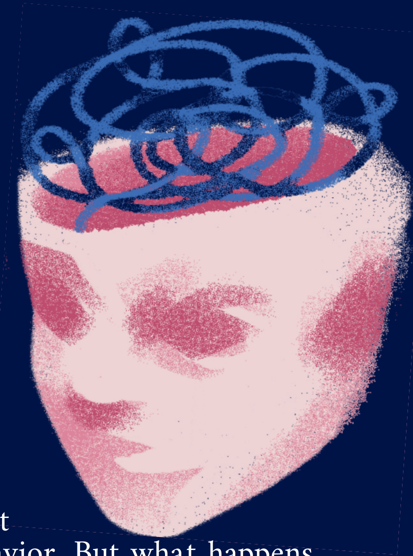
Future Outlook and Conclusion

Until recently, optogenetics was mostly "open-loop", researchers flashed a light to trigger a behavior, regardless of what the brain was doing at that moment. The future is closed-loop optogenetics. By combining light stimulation with real-time brain imaging, researchers can now listen to the brain's natural waves and only trigger the laser when specific physiological states occur. Advanced tools like two-photon microscopes and holographic light-shapers now allow scientists to target single, specific neurons in a living brain, rather than flooding a whole region with light. Ultimately, the story of optogenetics is an amazing one where it started from studying light-sensitive protein of a pond algae and somehow ended up being a potential treatment for blindness or addiction and uncovering the inner workings of the brain.

Fading Tapestry

The Labyrinth of the Mind: Unmasking the Molecular Shadows of Alzheimer’s and Depression

- Debayan Ghosh
(MS-PhD 1st year)



The human brain is often described as a biological orchestra. It’s like a complex, self-regulating masterpiece of billions of neurons and glial cells performing a silent Symphony of consciousness. It stores memory, profiles identity and pilots behavior. But what happens when this synchronization begins to fail? – it leads to an utter trouble inside our brain.

Brain disorders are not just the "glitches"; they are profound structural and molecular transformations that reshape the very essence of who we are. In this exploration, we dive into the depths of two of the most daunting clinically distinct but biologically entangled challenges of modern neuroscience: Alzheimer’s Disease (AD) and Major Depressive Disorder (MDD).

Alzheimer’s is much more than simple forgetfulness; it is a progressive biological heist. The chemical make-up of Alzheimer's disease (AD) is often referred to as the 'Amyloid Cascade' where that act like molecular sludge, clogging the spaces between neurons. While these plaques are the hallmark, the real "villain" is often the Tau protein which has a major role in how AD progresses through the body. Under pathological conditions, Tau undergoes hyperphosphorylation, detaching from microtubules and forming neurofibrillary tangles (NFTs) that collapse the neuron’s internal transport system, ultimately leading to cell death. Neurologically, this results as severe damage to the cholinergic system, leading to a catastrophic drop in acetylcholine - the primary neurotransmitter for learning and memory. Neuroinflammation now plays a central role, as overactivated microglia and astrocytes release inflammatory signals that worsen brain damage.

Clinically, the molecular changes associate with progression of memory impairment caused by Alzheimer Disease initially appear to be progressive loss of memory resulting in the loss of language, visuospatial skills and behavioural impairments, and ultimately progress to a complete cognitive collapse. The current research on possible anti-amyloid treatment (i.e. Aβ directed antibodies) has generated numerous renewed interests in early diagnosis and intervention, but long-term benefits and safety remain active questions.

Major Depressive Disorder: The Stormy Silence

While Alzheimer’s is a disease of memory loss, MDD is often considered as a disease of miscommunication and systemic imbalance. The traditional "monoamine hypothesis" of mood disorders suggests a functional deficiency in key neurotransmitters like serotonin (5- HT), norepinephrine (NE), and dopamine (DA). However, at the molecular level, the situation can be much more complicated than what was discussed earlier, as it also requires consideration of the Hypothalamic-Pituitary-Adrenal Axis (HPA Axis). Chronic stress leads to elevated glucocorticoids which can potentially be neurotoxic, and will produce a change in structure in both the PFC and the hippocampus.

Neurologically, MDD is characterized by a "thinning" of the brain’s support network. Postmortem studies reveal reduced densities of glial cells (particularly astrocytes) in the PFC and amygdala. This loss of glia disrupts the "tripartite synapse," leading to an imbalance between excitatory glutamate and inhibitory GABA signalling. Furthermore, a reduction in Brain-Derived Neurotrophic Factor (BDNF) prevents the brain from repairing, leaving it stuck in a state of "neurological winter".

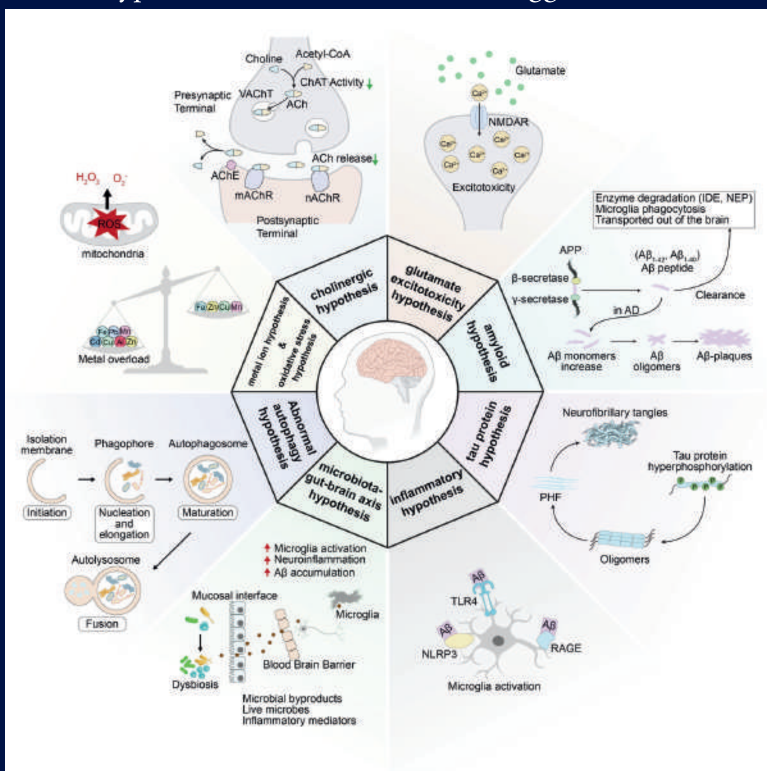


Fig: An outline map of the hypotheses to explain MDD

The New Regulators: The Dark Matter of the Genome

In our quest to understand these disorders, we have moved beyond simple protein-coding genes and entered the world of non-coding RNAs (ncRNAs) - the biological "dark matter" that regulates gene expression without ever becoming a protein.

- In Alzheimer's: A recently identified microRNA, miR-25802, has been found overexpressed in AD affected brains. It appears to regulate microglial polarization by pushing these cells toward a pro-inflammatory state that accelerates Aβ deposition and memory loss.
- In MDD: Sex-specific regulators have come to light in recent studies. In the locus coeruleus, miR-1179 is found at higher levels in females who struggled with depression, targeting genes like MAOA that are critical for neurotransmitter metabolism.

Beyond RNA, the Microbiota-Gut-Brain Axis has emerged as a powerhouse regulator. An imbalanced gut can increase inflammation in the body, allowing harmful signals to cross the blood-brain barrier and activate the brain's immune cells that can directly disturb mood and cognitive thinking.

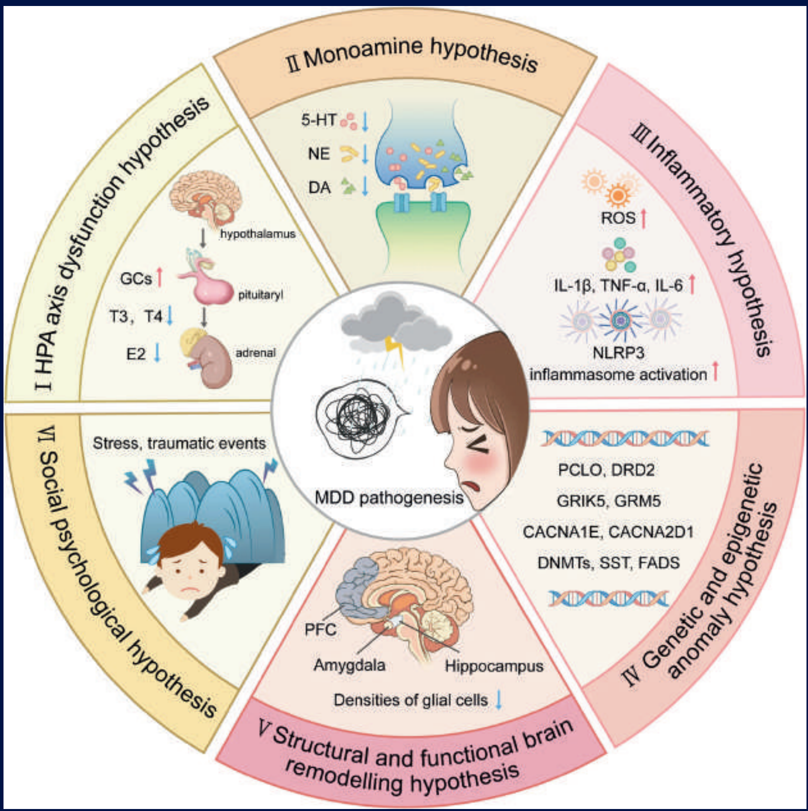
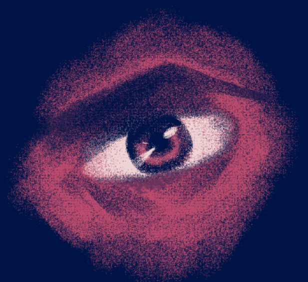


Fig: An outline map of the hypotheses to explain MDD

A New Horizon: The Finish

We are moving beyond just managing symptoms and into an era where treatments can actually slow or change disease progression, from monoclonal antibodies like lecanemab that clear amyloid plaques to rapidly acting antidepressants like ketamine that rebuild synapses within hours rather than weeks. The brain is like the universe, has no limits, its mysteries are endless, and our journey to understand it will never truly end. But by targeting these deep molecular regulators like the ncRNAs, the gut-brain signals, and the glial-neuron integrity we aren't just slowing the silence; we are learning to tune the orchestra once more. The labyrinth may be deep, but for the first time, we have the molecular map to find our way back.



"You might not remember what I said 5 minutes ago or even who I am but you'll remember how I made you feel." — Lisa Genova

Anxiety, Depression and Brain

ANXIETY: A friend you don't want for long

Apprehension, tension, anticipation of impending catastrophe, danger or misfortune accompanied by tensing of muscles, rapid heartbeat and faster breathing - ANXIETY, an emotion we all are familiar with in varying intensity and frequency. To reach the place where we are, it is safe to say that none of us have escaped the loving embrace of anxiety and some of us became such darlings of it that it has denied leaving us from its adrenaline-felt hug.

When arising for a short span of time and on occasions where something big is expected from us it is normal to experience anxiety. But when subjected to a stressful situation for a very long period of time the person may start showing symptoms of severe anxiety resulting in anxiety attacks and other cognitive malfunctions (as if having attacks alone was not sufficient). Without proper knowledge and awareness the one suffering may start blaming themselves for being overly sensitive, over reacting or just not being strong enough when this is clearly not the case. And to top it all, having anxiety issues is not even considered an 'issue' but just an excuse for being lazy or irritated.

Now because, and it's a huge *because*….! We are budding scientists, we need to know the chemical and biological cause underlying it (maybe then we can prove that it is REAL and not some made up term) and not just psychological [though this one's the most relevant]. Anxiety manifests as measurable alterations in brain structure, function, and neurochemistry, particularly involving the amygdala, prefrontal cortex (PFC), hippocampus, and associated neuromodulatory pathways. These systems collectively form an integrated threat-processing network that becomes dysregulated in clinical anxiety disorders.

Amygdala is the main unit which detects potential threats and the ventromedial PFC acts as brake on amygdala's function. The dysfunction of this connectivity is the hallmark of anxiety disorders. The prolonged state of anxiety is linked to the bed nucleus of stria terminalis(BNST).

In psychology, an anxiety disorder involves excessive, persistent fear and worry that's disproportionate to the actual threat, interfering with daily life, unlike normal anxiety. They can cause people to try to avoid situations that trigger or worsen their symptoms. The associated problems can be anxiety attacks, phobias, social anxiety disorder, agoraphobia, separation anxiety disorder and selective mutism in children. The symptoms include feeling panic, fear, dread and uneasiness, feeling on edge or irritable, uncontrollable, obsessive thoughts, and difficulty concentrating. It also includes physical symptoms like insomnia, restlessness, heart palpitation, etc. It can be caused by chemical imbalance, brain changes, genetics and environmental factors like severe and long-lasting stress.

An anxiety disorder is like any other health condition that requires treatment. You can't "will" it away. It's not a matter of self-discipline or attitude. It can be effectively treated with cognitive behavioral therapy, breathing exercises and meditation, and in severe cases medication.

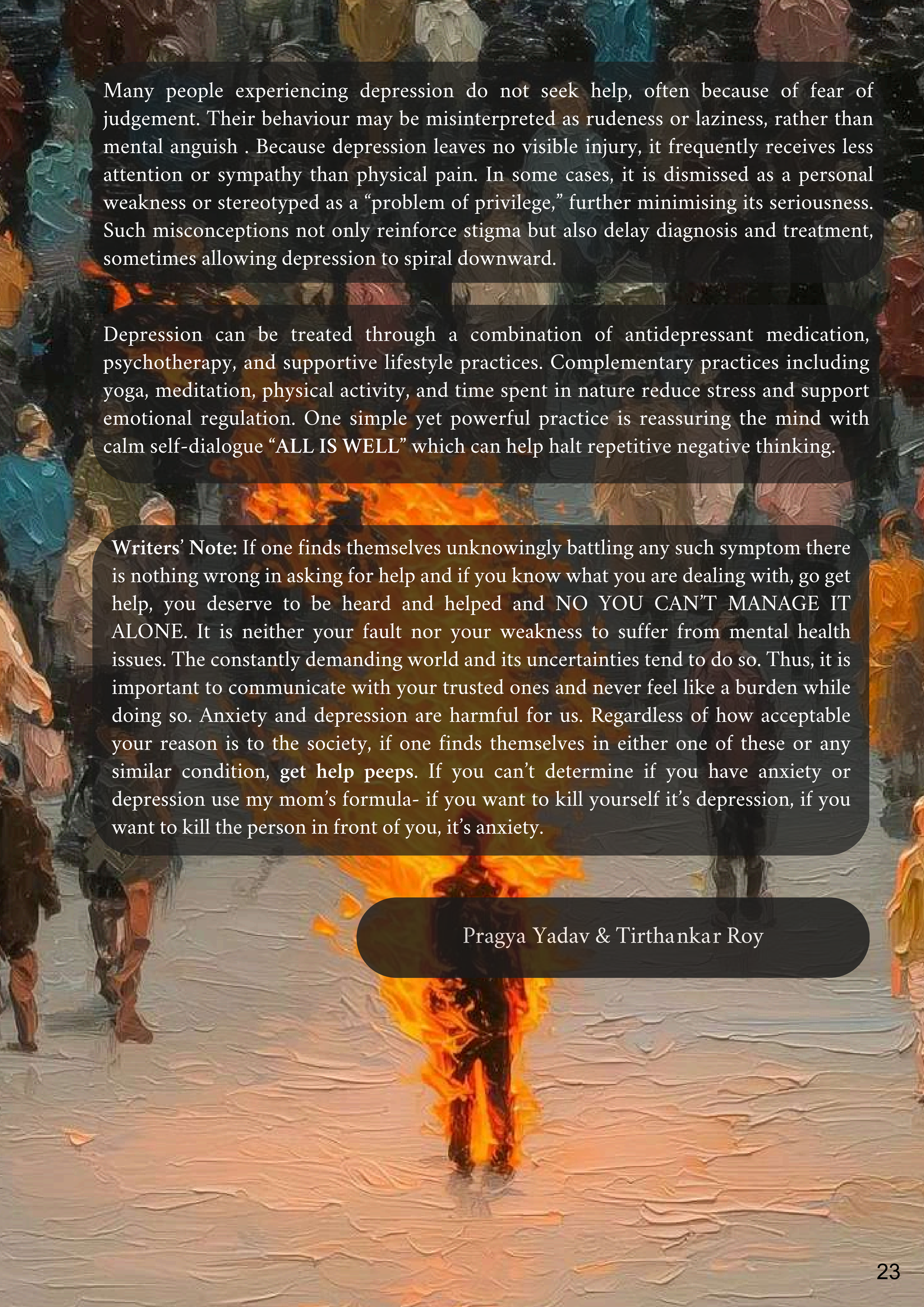
Depression: The Invisible Bruise on the Mind

Everyone can see the physical injuries on the outside but depression is an invisible battle within the brain, altering mood, thoughts and behaviour without outward signs. Modern neuroscience can explain this invisibility, showing that there are measurable changes within the brain.

Depression is a serious mood disorder marked by persistent and intense sadness lasting weeks or months, enveloping the mind like a fog that slowly thickens. It interferes with daily activities, emotions, and functioning. Unlike ordinary sadness, which is temporary, depression is clinically distinct and must persist for at least two weeks to be diagnosed.

At the brain level, depression is associated with both structural and functional changes. Brain imaging studies show that the hippocampus, a region involved in memory and emotional regulation, can shrink after prolonged exposure to stress hormones such as cortisol. At the same time, the amygdala (the brain's emotion processing and stress response centre) often becomes overactive, heightening feelings of sadness and threat. In contrast, the prefrontal cortex, responsible for rational thinking, decision-making, and concentration, tends to become less active and less well connected. Chronic stress further contributes to inflammation, reduced neuroplasticity, and the loss of neural connections, disrupting communication between mood-regulating brain circuits and perpetuating the symptoms of depression.

For a person experiencing depression, activities that were once enjoyable can begin to feel like heavy burdens. Individuals may feel persistently low or hopeless, often accompanied by excessive guilt or a painful fixation on past failures. Social withdrawal is common, as people isolate themselves from friends, family, and colleagues. Alongside these emotional changes, depression frequently brings physical and cognitive symptoms, including fatigue, insomnia or excessive sleeping, slowed behaviour, and difficulty concentrating, remembering information, or making decisions.



Many people experiencing depression do not seek help, often because of fear of judgement. Their behaviour may be misinterpreted as rudeness or laziness, rather than mental anguish . Because depression leaves no visible injury, it frequently receives less attention or sympathy than physical pain. In some cases, it is dismissed as a personal weakness or stereotyped as a “problem of privilege,” further minimising its seriousness. Such misconceptions not only reinforce stigma but also delay diagnosis and treatment, sometimes allowing depression to spiral downward.

Depression can be treated through a combination of antidepressant medication, psychotherapy, and supportive lifestyle practices. Complementary practices including yoga, meditation, physical activity, and time spent in nature reduce stress and support emotional regulation. One simple yet powerful practice is reassuring the mind with calm self-dialogue “**ALL IS WELL**” which can help halt repetitive negative thinking.

Writers’ Note: If one finds themselves unknowingly battling any such symptom there is nothing wrong in asking for help and if you know what you are dealing with, go get help, you deserve to be heard and helped and NO YOU CAN’T MANAGE IT ALONE. It is neither your fault nor your weakness to suffer from mental health issues. The constantly demanding world and its uncertainties tend to do so. Thus, it is important to communicate with your trusted ones and never feel like a burden while doing so. Anxiety and depression are harmful for us. Regardless of how acceptable your reason is to the society, if one finds themselves in either one of these or any similar condition, **get help peeps**. If you can’t determine if you have anxiety or depression use my mom’s formula- if you want to kill yourself it’s depression, if you want to kill the person in front of you, it’s anxiety.

Pragya Yadav & Tirthankar Roy

Rewiring the Mind: Science of Meditation and Mindfulness

By Divanshu Dogra

"But my mind is a tempest, a storm of anxieties, swirling and crashing, each wave a relentless assault of 'what ifs' and 'should haves. Anxiety, stress and depression all inside me , is there any way to remove that burden from me ?"'

And the answer is yes there is a way through meditation and mindfulness, once ancient practices, now captivate neuroscientists for their power to reshape the brain. But do these things really make any significant effects and are useful ? Let us try to find the answers of these questions. **Meditation** can be defined in many ways, but a simple way to think of it is training your attention to achieve a mental state of calm concentration and positive emotions. Mindfulness is one of the most popular meditation techniques. It involves two components : attention and acceptance.The attention piece is about tuning into your experiences to focus on what's happening in the present moment. It typically involves directing your awareness to your breath, your thoughts, the physical sensations in your body and the feelings you are experiencing.The acceptance piece involves observing those feelings and sensations without judgment. Instead of responding or reacting to those thoughts or feelings, you aim to note them and let them go.

How could simply tuning into your thoughts and feelings lead to so many positive outcomes throughout the body? Stress , anxiety and depression are now common terms that we listen. Especially the young generation is suffering from these things. Chronic stress can impair the body's immune system and make many other health problems worse. By lowering the stress response, mindfulness may have downstream effects throughout the body. Mindfulness influences stress pathways in the brain, changing brain structures and activity in regions associated with attention and emotion regulation. Mindfulness-based therapy is especially effective for reducing stress, anxiety, and depression. Mindfulness can also help treat people with specific problems including depression, pain, and addiction.

- **Mindfulness-based stress reduction** (MBSR) is a therapeutic intervention that involves weekly group classes and daily mindfulness exercises to practice at home, over an 8-week period. MBSR teaches people how to increase mindfulness through yoga and meditation.
- **Mindfulness-based cognitive therapy** (MBCT) is a therapeutic intervention that combines elements of MBSR and cognitive behavioral therapy (CBT) to treat people with depression.

Neuroimaging reveals meditation thickens gray matter in the prefrontal cortex for better attention, hippocampus for memory, and insula for body awareness. The amygdala shrinks, curbing fear responses.The brain's plasticity—its ability to reorganize via synaptic strengthening , dendritic growth, and myelination — underpins meditation's magic. Meditation hacks epigenetics and inflammation. Chronic stress shortens telomeres (chromosome caps) via oxidative damage, accelerating senescence. Yet, a 2011 UC Davis study of 30 retreat participants (3-month intensive meditation) showed telomerase upregulation—the telomere-repair enzyme—outpacing controls, mediated by mindfulness, purpose in life, and reduced rumination.

Ready to give it a try? Learning mindfulness is easier than ever. Start with just 15 minutes yoga session followed by sitting in silence without phone or anything and acknowledging your thoughts and breathing patterns for 10 to 15 minutes. This half an hour routine seems simple but yet it makes a huge difference over a period of time. It can take a little while for mindfulness meditation to feel natural and to become a part of your regular routine. But with practice, you may discover a powerful tool for relieving stress and improving well-being.

BRAIN MYTHS DEBUNKED!

-HIBA HARIS

MYTH 1

We only use 10% of our brain.

In reality, scientists across the globe agree that the entire brain is active throughout the day. The brain is constantly engaged and requires an extraordinary amount of energy. Although it accounts for only about two percent of body weight, it consumes nearly 20 percent of the body's calories. This level of energy use remains relatively stable across different activities from playing football to conducting experiments. Even during sleep, the brain continues to operate at a high level of activity. Together, these findings clearly dispel the long-standing myth that humans use only 10percent of their brains, showing instead that the brain functions as a fully active and highly efficient organ at virtually all times.

MYTH 2

Humans have the attention span of about 8 seconds.

The widely cited claim that humans have an attention span of only eight seconds—shorter than that of a goldfish—stems from a misinterpretation of a 2015 Microsoft report and does not accurately reflect human cognition. The report itself relied on surveys and neuroimaging data to examine how people engagewith digital media, not to measure inherent attention capacity. The findings speak more to changes in how attention is distributed in technology-rich environments than to anyfundamental reduction in human attention span. Moreover, comparisons between humans and goldfish are scientifically misleading. The two species have vastly different neurological structures and process information in entirely different ways.

The "eight-second attention span" myth is also part of a broader misunderstanding of attention. Similar claims suggest that focus drops sharply after 10 to 15 minutes, leading to the belief that lectures or presentations must be kept extremely short to be effective. Human attention is not fixed or uniformly limited; it fluctuates depending oninterest, motivation, and cognitive demand.

MYTH 3

Human memory is highly accurate, especially when participants are confident in their responses.

The ability to mentally revisit a specific personal experience is known as episodic memory.

But how accurate are these recollections? How much of what we remember reflects what actually happened, and is there any reliable way to tell?These questions have motivated extensive research on the reliability of episodic memory, identifying several factors that contribute to distortion. Highly emotional events, for example, can produce memories that feel vivid and detailed yet contain significant inaccuracies. Other influences—such as misleading information, interference from similar experiences, or leading questions—can further alter recall. As a result, memory research has increasingly emphasized the fallibility of human memory rather than its precision. However, much of this evidence comes from laboratory-based studies that rely on artificial tasks, such as memorizing word lists, images, or short video clips and recalling them shortly afterward under conditions designed to elicit errors. Consequently, far less is known about the accuracy of memories formed in real-world, first-person experiences—the kinds of events that shape everyday life. While it is clear that memory errors do occur, an important question remains unresolved: how frequently do these distortions arise in natural settings, outside of experimental manipulation?

MYTH 4

Your brain works better under pressure.

The idea that pressure improves performance is often summarized with clichés about diamonds and heat, but such generalizations are misleading. Even claims that moderate pressure is beneficial raise important questions: for whom, in what context, and for what kind of work? People vary widely in how they respond to pressure, making it unlikely that any single level of stress is universally helpful. This belief is frequently linked to the Yerkes–Dodson Law, which suggests that moderate arousal can enhance performance on certain tasks. However, arousal or challenge is not the same as stress. Stress typically involves feelings of threat and loss of control, which are far more likely to impair performance—particularly on complex, creative, or cognitively demanding tasks. Pressure is more likely to be motivating when challenges are self-chosen rather than externally imposed. Moreover, what counts as "productivity" matters: while pressure may increase short-term output on simple tasks, it often undermines creativity, deep thinking, and sustained effectiveness. Chronic pressure also carries clear biological costs. Prolonged stress triggers sustained cortisol release, which over time impairs memory, disrupts sleep, weakens immune function, and increases the risk of anxiety, depression, and cardiovascular disease. In short, pressure may reduce the risk of immediate failure, but it rarely supports meaningful or sustainable success.

MYTH 5

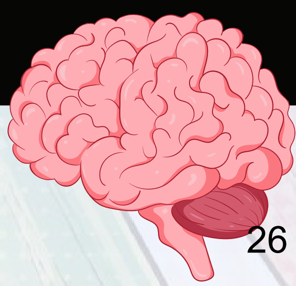
Age reduces brain plasticity.

Scientists once believed that brain development ended after adolescence, but research now shows that the brain continues to change throughout life. Each time we learn a new skill or refine an existing one, the brain reorganizes itself through ongoing physical changes within its neural circuits. This capacity for change, known as brain plasticity, refers to the brain's ability to form and strengthen connections between nerve cells. As these connections grow stronger, tasks that once required conscious effort gradually become automatic. Conversely, when skills are no longer practiced, the underlying neural connections weaken, which helps explain why distant memories—such as the names of former co workers—fade more easily than information we use regularly.

Although the brain retains its ability to adapt with age, it can appear less flexible when it is no longer challenged. Merzenich describes this as a tendency toward complacency after reaching a certain level of competence. Continued learning and deliberate practice are therefore essential for maintaining and reinforcing neural pathways. Elite athletes and musicians illustrate this principle well. Even at the peak of their performance, they continue to practice consistently. As violinist Jascha Heifetz famously observed, missing a single day of practice is noticeable first to the performer, then toothers—underscoring the importance of sustained engagement in keeping skills sharp.

Many widely held beliefs about the brain—like the idea that we only use 10% of it, that it stops developing after adolescence, or that pressure always boosts productivity—are myths.

Research shows that the brain is highly active, adaptable, and capable of growth throughout life. Memory is reconstructive rather than perfect, attention spans vary with context, and stress can be both helpful and harmful depending on the situation. Understanding how the brain really works helps us separate fact from fiction and encourages more effective approaches to learning, health, and performance.



The Brain in Shadows and Light: Stigma, Science, and the Future of Neuroscience in India

-Pragya and Debayan

The Invisible Struggle: Stigma and Misunderstanding of Brain Diseases and Neurological Disorders : Whenever one gets sick, they go to the physiologist for checkup, doctor prescribes some medicine, friends and family come to check on the patient and usually they are given enormous support and care and told that they will get well soon and it is not their fault. The story goes like this when the problem is with the body, but what happens when the problem is with another organ of the human body, the brain.
Apparently, the people of our nation do not consider brain a part of the body. They expect it to work tirelessly without any malfunctioning (which it should do) but without taking any care of it.

We have been told to eat carrots for good eyesight, papaya for digestion, tomato and green leafy vegetables for the body to function well but when it comes to taking care of the brain, the society goes silent as if we talked about helping the enemy. When many things are taken care of by the brain why is it not taken care of.

And the brain might even get some attention and care because it is a physical entity but what about the mind, you can't see it, you don't know where it lies but it is true that it is there, that it is where one's character, behaviour and personality arise from. This is the part responsible for that aspect of human beings that make them unique and different from each other and with which we usually deal while interacting with other yet it is the one whose existence is still questioned. And so are its problems way out of consideration, often considered as show for seeking attention rather than a cry for help.

The major reason behind the stigma around neurological disorders in India is the misinterpretation of religious and cultural beliefs. All the diverse cultures we have emphasize compassion, care and harmony, but the misinterpretation of it can give rise to major superstition. At times these are so strong that the individuals do not question them as it clashes with what have been believing in for generations. The superstitions blind the people and drain the empathy they may have for the people suffering from neurological disorder. The way epilepsy is seen is a big example of this stigma. In India, around 12 million individuals are impacted by epilepsy and instead of giving them care and health care facilities, they are said to be captured by evil spirit or that it is due to their past sins and they deserve it . Other than religious and cultural misinterpretations, the fear of being outcasts from the society and to protect the family honour many families tend to hide it that someone is suffering from such issues and pretending everything is normal, delaying their treatment thus paradoxically reducing their chances of getting back to normal.

A general lack of awareness and prevalence of misinformation about the biological and psychological bases of neurological and mental disorders contribute significantly to stigma. All these reasons combined makes it even for difficult to treat the conditions and make the treatment more accessible, especially for the Indian society.

Neuroscience Research in India: Foundations and Future:

Neuroscience in India has grown from humble beginnings into a vibrant field. NIMHANS in Bangalore, India's premier mental-health and neuroscience institute traces its roots to an 1848 mental asylum and was officially formed as the All-India Institute of Mental Health in the1950s. Today NIMHANS is an autonomous institute of national importance, combining patient care, education and research in psychiatry and neurosciences. In northern India, the National Brain Research Centre (NBRC) in Manesar was founded in 1999, is funded by the Department of Biotechnology, and has been designated a DBT 'Institution of Excellence'.

Newer centers are appearing: for example, the privately endowed Centre for Brain Research at IISc Bangalore (launched in 2022) focuses on brain aging and dementia, and Bengaluru's Rohini Nilekani Centre for Brain and Mind (CBM, 2023) brings together NCBS and NIMHANS to apply genetics and stem-cell tech to mental illness. These institutes often linkbasic labs with clinics (for instance, NBRC's divisions span molecular to clinical work), and even private initiatives like the CHINTA center in Kolkata are mobilizing interdisciplinary teams to combat brain disorders. Neuroscience connects deeply with our everyday lives in India, whether it's caring for an aging parent with memory loss, supporting a friend with anxiety, or understanding the stress we all feel in a fast-paced world. An ageing population - projected at 19.1% of India's population by 2050 (about 316 million over age 60) means dementia and Alzheimer's will become a major public health challenge. At the same time, pressures like urban stress and connectivity mean psychiatric conditions (depression, anxiety, ADHD) are more recognized. Public awareness is growing - for example, India observes World Brain Day and Brain Awareness Week with community events and school activities because neurological conditions increasingly affect millions. Workshops and media campaigns are raising interest: one report notes that India's health system "faces a growing burden of neurological disorders" with aging, underlining "the need for wider awareness and public engagement" in brain science.

Neuroscience research is now producing real-world impact in mental health and aging care. Cutting-edge labs have been established: recently NBRC inaugurated a state-of-the-art 3T MRI machine (like those used by the U.S. BRAIN Initiative) to scan patients with disorders from Parkinson's and Alzheimer's to depression and PTSD. Universities are also investing for instance, IIT Bombay's Cognitive and Behavioural Neuroscience lab uses MRI, EEG and other tools to study attention, memory and their breakdown in conditions like ADHD and dementia. India also runs educational programs: NBRC now offers Ph.D. degrees in neuroscience, training students in multidisciplinary brain research. All these developments, new labs, courses and funding programs show neuroscience increasingly woven into healthcare, with the promise of better diagnosis and treatment of mental illness, stroke and neurodegeneration.

The Path Forward: Moving forward, India must strengthen links between the neuroscience lab and the clinic. Translational research programs already model this: for example, DBT's ADBS project (a collaboration of NIMHANS, NCBS and inStem) (now the Rohini Nilekani Centre for Brain and Mind at NIMHANS) explicitly connects basic science and clinical psychiatry, tracking families at risk for mental illness and generating patient-derived stem cells. Similarly, IISc's Centre for Brain Research is co-led by neurologists and engineers and partners with NIMHANS on dementia studies. Such cross-disciplinary teams should be expanded: establishing joint neurology/neurosurgery-neuroscience consortia in medical centres would help translate lab discoveries (e.g. biomarkers for epilepsy or Alzheimer's) into new surgical and therapy protocols.

Public education and stigma-reduction are equally crucial. Campaigns like World Brain Day have already shown impact in India - in 2022 hundreds of activities (seminars, school programs, walks) reached citizens from Nagpur to Chennai with the message of "Brain Health for All". These events often feature doctors and scientists explaining stroke prevention, dementia care, and mental wellness. But stigma remains strong. Experts stress that India needs more outreach on brain health - one project found there are ~23 million Indian children with neurodevelopmental disabilities, "calling for urgent… public awareness programs" on brain disorders. The government and NGOs should therefore fund school visits, media spots and brain-fair events to demystify neurology and promote early screening. For example, specialist societies like the Indian Academy of Neurology have used Brain Day to launch stroke-awareness apps and community clinics, showing how media and camps can change perceptions.

Finally, India must boost its infrastructure and funding. Brain research remains under- resourced, so planned investments are welcome. The 2026 budget announced a second NIMHANS in northern India modelled on Bengaluru's) to expand neuroscience training and care. It also upgraded regional institutes (Ranchi, Tezpur) into centres for mental health. On the research side, continued government support (DBT, DST, ICMR, etc.) and new science funds will be needed for high-end tools like MEG and 7T MRI. Philanthropy can help too: for example, Infosys co-founder Kris Gopalakrishnan donated ₹255 crore over 10 years to IISc's brain research center, and TCG-CREST funded a major lab in Kolkata. Building on those models, India should foster public-private grants and global partnerships to build labs and data banks. In summary, stronger bench-to-bedside networks, energized public campaigns and well-funded facilities will be key to improving brain health and neurological care nationwide.

<u>Writers' Perspective:</u> As biotechnology graduate students, we see first-hand how lab science and clinical care must go hand in hand. Only by teaming up with neurologists and neurosurgeons can our research translate into real treatments, for stroke, Alzheimer's or mental illness. India's labs are growing, but to truly improve outcomes we need a collaborative ecosystem. By working together, the scientists, doctors, and communities we can tackle stigma and deliver brain health advances to every patient who needs them.

"Where stigma thrives, potential dies"

The campus diaries

Debayan Ghosh

Shivam Kumar Tiwari

Shivam Kumar Tiwari

Shivam Kumar Tiwari

Kishan Gupta

Shivam Kumar Tiwari

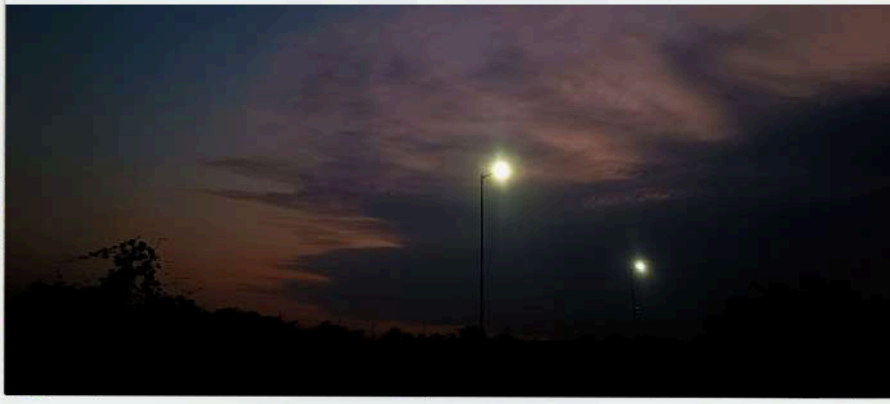
"MEMORIES STACKED, STORIES UNPACKED!"

Divanshu Dogra

Divanshu Dogra

Debayan Ghosh

Ishana

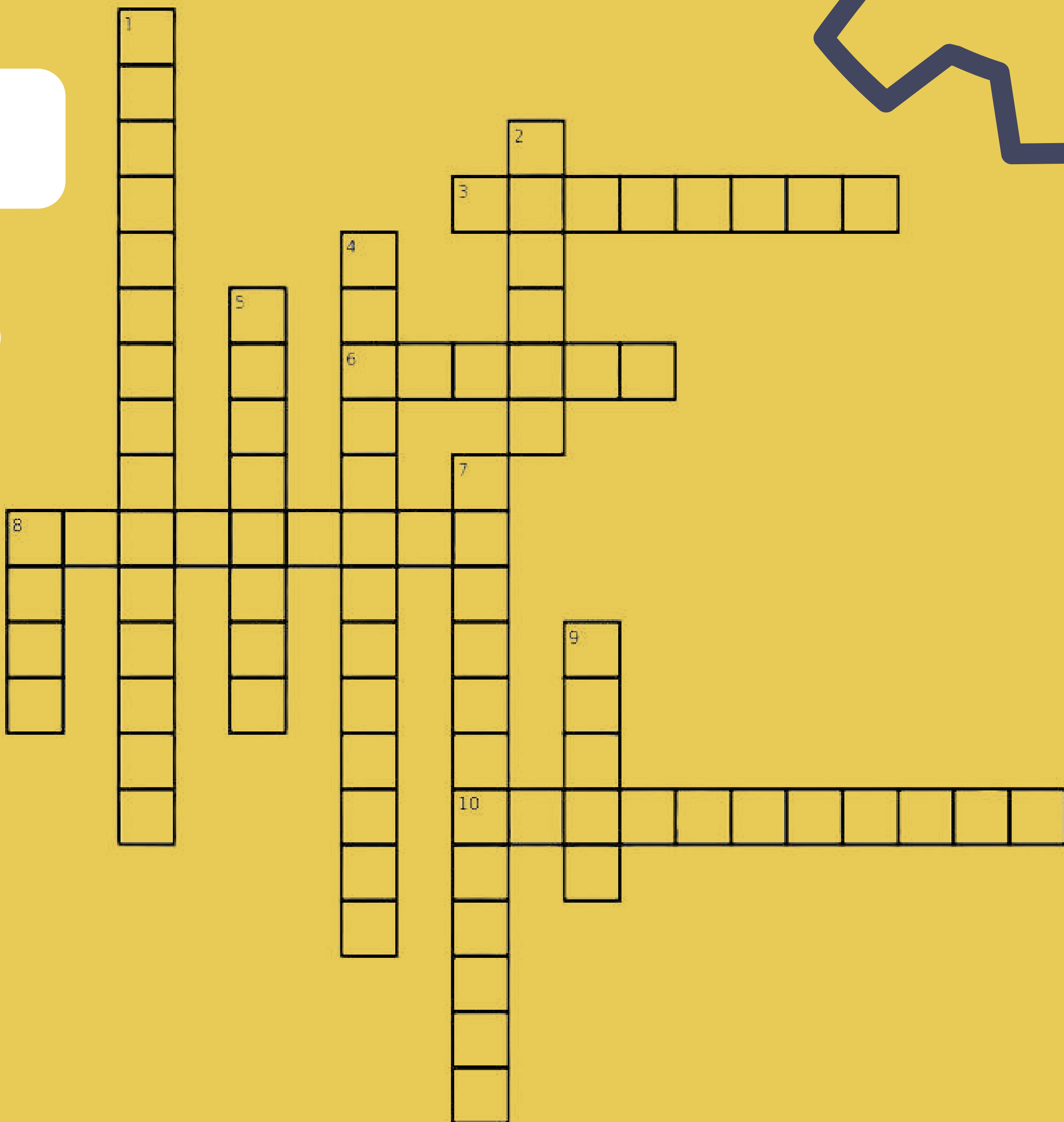


Shivam Kumar Tiwari

Shivam Kumar Tiwari

Shivam Kumar Tiwari

CROSSWORD



Down:

1. Brain's ability to adapt and reorganize.

2. The brain's storage system for past and voluntary actions. experiences.

4. Being aware of yourself and surroundings.

5. The process of gaining knowledge or skills.

7. Ability to think, understand, and solve problems.

8. The long fiber that carries messages away from a neuron.

9. Stories and images the mind creates during sleep

Across:

3. The largest part; responsible for thinking

6. Basic communication cell of the brain.

8. The ability to focus on a task.

10. Creating ideas or images beyond reality

1.Neuroplasticity; 2. Memory; 3. Cerebrum; 4. Consciousness; 5. Learning; 6. Neuron; 7. Intelligence; 8. (Across) Attention; 8. (Down) Axon; 9. Dream; 10. Imagination

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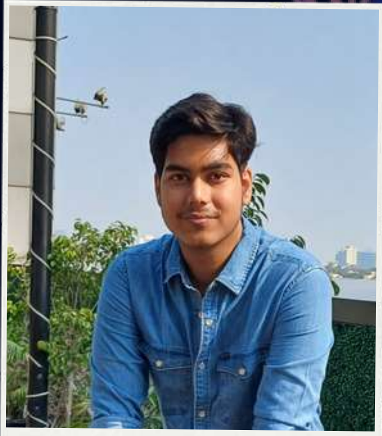

Tirthankar Roy

People behind the colourful pages

Hiba Haris

Apurva Singh

Davinder Kumar

Divanshu Dogra

Pragya Yadav

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"WE ARE NOT ONLY WHAT WE ARE, BUT WHAT WE REMEMBER."

"WE SPEAK NOT ONLY TO TELL OTHER PEOPLE WHAT WE THINK, BUT TO TELL OURSELVES WHAT WE THINK. SPEECH IS A PART OF THOUGHT."

"THERE IS NO SINGLE 'NORMAL' BRAIN."

-OLIVER SACKS

BACK COVER BY NEHA GULIYA


BRAIN
Assignment
Relationship
PAST
LOSS
TOUR
SLEEP
INSTAGRAM
SCHOOL
DREAMS
FRIENDS
Worries
Insult
FAITH
NEET
CARRER
Punishments
NO
MBA
Acts
Following
Depression
WORK
Perfect
Security
SERIOUS
MOTHER
Snapchat
COUNTRY
INDIA
Phobia
PEACE
Anger
MOVIES
OCD
Tears
Car
Home
Dead
Power
Connections
EXPECTATIONS
Face
LIES
PEER
PRESSURE
SENSES
Decisions
INEQUALITY
SOCIETY
Hairs
FEED UP
myths
Hobbies
Pressure
MOUNTAINS
FOOD
Teachers
FANTASY
POSSESSIVENESS
Childhood
Followers
OPPORTUNITIES
PHOTO
Dance
BOOKS
FREE
Regrets
UPSC
Win
Social
media
Happy
Religion
TRUTH
HOPE
Rewards
Values
BEAUTY
THOUGHTS
Appearance
Sports
OCCUPATION
LUCK
FEAR
College
FAMILY
Anxiety
Force
RICH
STRUGGLE
Mobile
SMILE
GOOD
LOVE
Emotions
Help
Affection
Freedom
Happiness
STUDY
Sea
memories
Friendship
Clothes
NEEDS
Facebook
FATHER
GOD
LIFE
EFFORTS
ADVENTURES
MBBS
Trauma
NOSTALGIA
HARDWORK
Govt.
Destiny
Jobs
Feelings
Ritual
OK
DRAMA
Story
Hatred
Patience
History
News
Success
Songs
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Jealousy
CONFUSION
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PROUD
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Money
Habits
Like
CARE