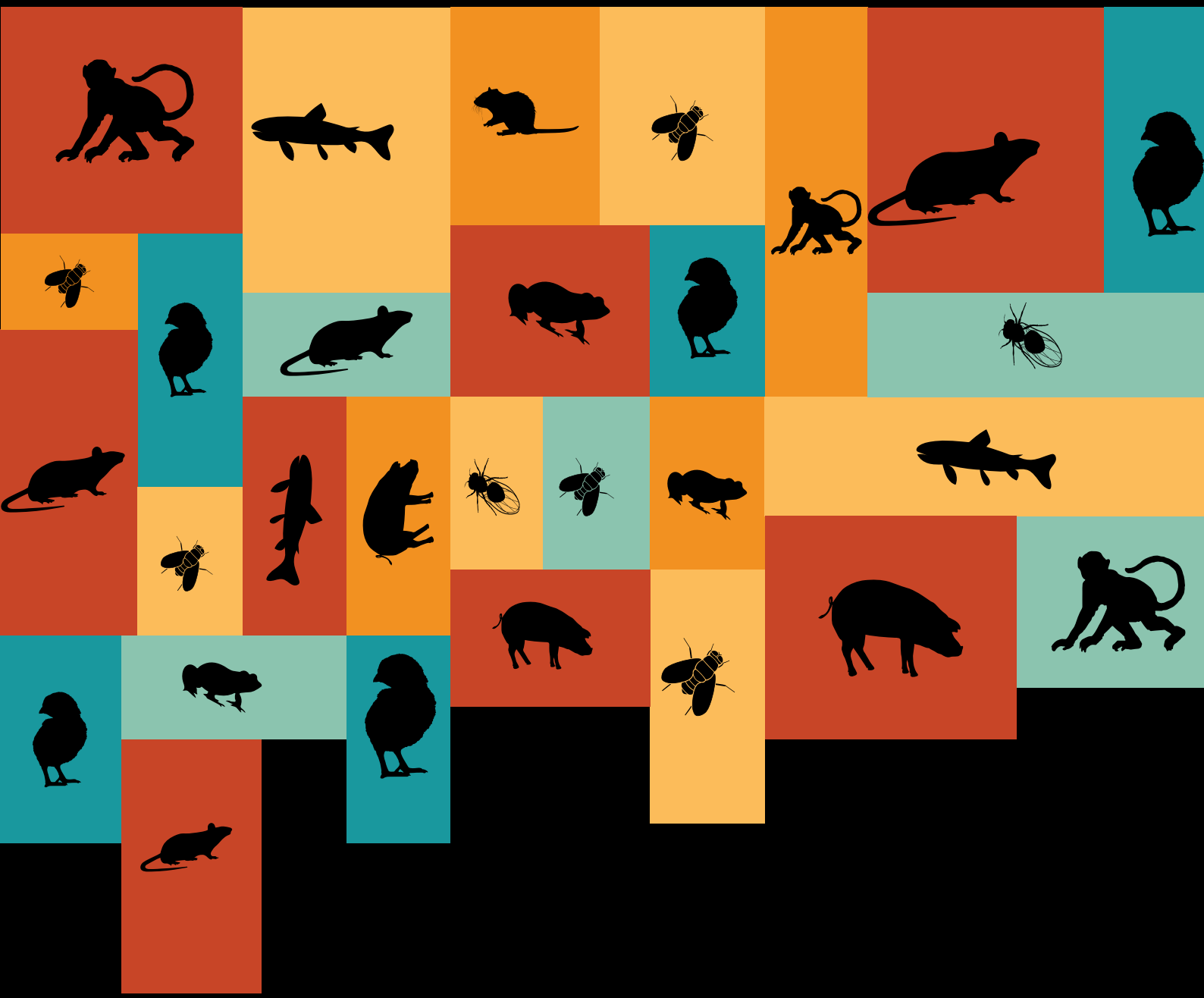
Neuroletter

The official newsletter of Project Encephalon



January 2022

Volume 1 Issue 5

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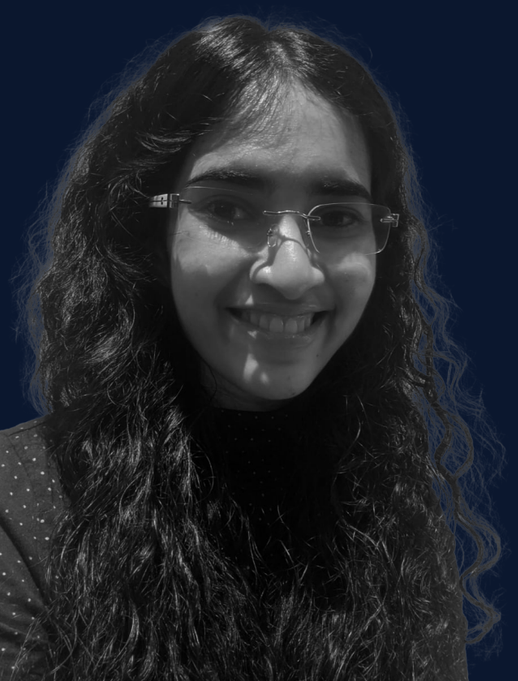
A note from the Editor

Madhuri Srinivasan

Associate Editor

Welcome to our first quart-yearly edition of Neuroletter for 2022! This edition is a thought experiment that is grounded on our shared value of appreciating the diversity arounds us- in science and our scientific community. It is special for many reasons but mainly for bringing to fore the diversity in model systems and scientific approaches in Neuroscience as we draw parallels to the diverse spectrum of people in our PE community. We try to reflect and represent this spectrum spanning across Clinical to Theoretical Neuroscience. We wager that a round- up of recent advancements beyond living model systems completes this edition as it reinstates the idea that a futuristic vision has been possible because it gravitates from the interdisciplinary nature of research.



Diversity in Neuroscience

Diversity in the current world of innovation and technological advancement is a key aspect in considering a holistic approach to Neuroscience research. The different sub fields in Neuroscience are connected in a delicate network and the connections between each other ensure that collaboration is essential to progress. While collaborative efforts between different labs and institutions are slowly becoming important, such efforts with other fields like mathematics, computer science, physics and chemistry also ensure that the horizons are broadening.

Molecular and Cellular Neurosciences are of considerable interest to understand the chemical and biological basis of any conditions, and Behavioral studies are quintessential in determining the understanding of perception and consciousness. Neural Engineering and mechanistic perspectives on how the human brain functions have contributed considerable discoveries to the field in recent times. Psychological perspectives and the research on mental health have become a point of growing awareness and the steps taken to understand it, has evolved.

While the pandemic brought the world to a monumental stop, it also brought to light new avenues for inclusivity through virtual engagement. This ensured that scientific communication was not hindered even if the actual research may have been, during the initial stages.

The measures to find Translational and Clinical implications in Theoretical studies ensure that academic research is becoming more relevant to the general population. Due to the pandemic, the growing interest in biological research has galvanized and the need for communicative science rose, especially in the face of increasing misinformation.

-Maalavika Govindarajan

Diversity in

While Neuroscience is a vast and increasingly growing sector in scientific research, it still has a long way to go. Inclusivity is one of the aspects that needs to be addressed and minority and underrepresented groups must be given more opportunities to not only enter but also thrive in the field. Eric Nestler, Director of the Friedman Brain Institute and president of SfN said that "Over the last 20 years or so, I've seen a large increase in the number of women who have entered neuroscience, but at the same time, the number of senior women faculty and the number of women in leadership positions continue to lag. The situation is even more dire for underrepresented minority groups." Vidita Vaidya, Professor at the Tata Institute of Fundamental Research, Mumbai feels "Many young women in India don't even have the access to an equal education, an equal nutrition, and equal access to many opportunities. We need diversity in science with representation from people who have had experiences from all walks of life."

But science communication has opened channels in today's world like never before. More people across all levels of Neuroscience and STEM are creating content, sharing their experiences as part of academia, including useful resources for people curious about and/or interested in pursuing science. Researchers are now being more mindful regarding their philosophy on diversity by sharing their statement on diversity and inclusion. Other practices like associating an individual with their preferred choice of pronoun(s) has helped create awareness of the conscious need to create a supportive environment for a diverse and inclusive community. These are great steps in the right direction to make Neuroscience research inclusive and welcome more folks for a better tomorrow!

The Mind

Gala

THAKUR LAB

IndiaBioscience

-Anushree Krishnamurthy

Many times, over a fresh cup of coffee in the morning, we find ourselves desperately trying to grab onto the fading memory of a dream the previous night. Meanwhile, as we read the newspaper the dream lies forgotten, only to be replaced by a burning curiosity to know what is going on in the world around us, followed by an anticipation of solving the daily Sudoku and crossword puzzles. Have you ever wondered how we accomplish these seemingly mundane tasks of brewing up a hot cuppa, trying to remember dreams, reading newspapers, solving puzzles, seeing the world and everything else that you seem to do every single day, as if you were on auto-pilot? What is this mysterious organ that allows you to go about your day the same way in a routine, yet at the same time pulls off extraordinary feats like building vehicles that can fly, machines that can work like humans, and even put together ships that shoot off to outer space (and come back!)?
As you would have guessed by now, all of this is achieved by one ~3 pound organ sitting on top of your shoulders— the brain.

The brain is a uniquely fascinating organ. It determines the responses, choices, and actions required for us to navigate through our surroundings. Neuroscience is a field that studies a multitude of aspects that make the brain the mysterious organ that it is, and aims to solve these mysteries in order to understand the organ better. Neuroscience gives you information about the brain, but where do you find information about neuroscience itself? Well, in today's world, the major sources for students and the general public to gain information on neuroscience are through movies, science fiction, and the news.

The Mind

Gala

THAKUR LAB

IndiaBioscience

"A Celebration of All Things Neuroscience"

However, these sources often depict a very distorted picture of neuroscience and sometimes even propagate misinformation. Furthermore, neuroscience is rarely taught in undergraduate courses, thus depriving students of the opportunity to learn more about it. While there are plenty of good and reliable sources to access neuroscience-related information, people perceive neuroscience as a difficult topic. This is not untrue, since these scientific resources are full of technical jargon and are difficult for beginners and enthusiasts alike.

In order to find an answer to all your questions on basic neuroscience, bust myths about the brain, and to encourage students to explore the field, Project Encephalon and the Thakur Neurodegeneration Lab have collaborated to organize a year-long neuroscience outreach initiative, The Mind Gala, funded by the second IndiaBioScience Outreach Grant.

As the name suggests, this will be a year long celebration addressing basic aspects of the mind, brain and Neuroscience! The Mind Gala stands among the first science communication initiative that aims to convey the Neuroscience underlying complex yer fundamental neuroscientific concepts such as dreams, sleep, mood, emotions, memory, sensory perceptions, AI etc., in a simple and an easily comprehensible manner.. In an attempt to spark curiosity among students as well as the general public, The Mind Gala hopes to cater to a generation of Neuroscience enthusiasts whose curious minds can appreciate the beauty of brain sciences. It plans to share useful resources to support this process of learning, exploration and steer a journey to discover more about the brain in the future.

Itinerary for 2022

THAKUR LAB

IndiaBioscience

Bheja Fry:
A monthly webinar series designed to ignite your curiosity about the world of brain sciences!
Tailor-made for newbies in neuroscience.
Elementary topics, electrifying talks, exceptional speakers, a year long cerebral extravaganza!

Virtual Neuroscience Lab Tours all over the country:
Sneak-peek into some of the top neuroscience laboratories in India!
Offer a basic idea about the status quo of Neuroscience research, and a virtual journey through the work being done in the field across India.
Designed to give a practical idea about hands-on Neuroscience research in real time, outside of books and theoretical knowledge.

Panel discussions on important topics in neuroscience:
Panelists with diverse backgrounds shall be invited as dignitaries for an interactive panel discussion which will provide the attendees with exposure to Neuroscience and related topics

Science Communication workshop culminating in a pop-Neurosci book!:
Two-day science communication workshop conducted by leading science communicators in the country for undergraduate students interested in learning the art of communicating science.
An exclusive opportunity to undergo one-to-one mentorship on a merit basis. No prior knowledge or experience in science communication required.
Designed to provide participants with a platform to pen down their very own popular science article, which will be compiled into a popular science book and translated into a few popular Indian regional languages.

Bheja Fry

Series

THAKUR LAB

IndiaBioscience

SP Arun

Topic: If we can make computers play chess, why can't we make them see?

Speaker Bio- SP Arun is an electrical engineer turned neuroscientist at the centre for Neuroscience at IISc and is intwerested how sensation becomes perception. He is an Associate Professor at Centre for Neuroscience, Indian Institute of Bangalore.

Shruti Muralidhar

Topic: BrainBasics- A peek into the brain

Speaker Bio- Shruti Muralidhar is a neuroscientist and a science communicator. She is a research scientist at Deep Genomics. She is also the founding member of IndSciComm and BiasWatchIndia.

Head over to www.themindgala.com to register for upcoming webinars.

Neuronotes

Changing the Brain's Real Estate

Aarushi Chitkara

The human brain evolves tremendously, simply put, is plastic, and prone to changes when exposed to new stimuli. Until the mid-1960s, the adult brain was thought to be "hard-wired," which could not be mutated to reorganize its structure and function. However, this fundamental notion underwent a paradigm shift when studies on rhesus monkeys proved that the mammalian brain could be conditioned to respond to a particular stimulus naturally. When a new map develops in the cerebral cortex out of an existing map, which leads to cortical remapping, the cognitive process of cortical remapping can be interpreted efficiently by studying phantom limbs which is a phenomenon experienced in patients who have lost a limb. Interestingly, these patients can feel a limb that no longer exists! How is a map changing? How is it not rigid like the conventional ones?

The Neuroscience of Domestication

Bharati Venkatachalam

From being hunter-gatherers, humans switched to agriculture about 12,000 years ago. This new age saw an increase in plant and animal breeding catering to diverse human needs. Different animals were domesticated for different purposes. However, Darwin noticed that all domesticated animals had similar features. So how are all these animals belonging to unrelated species showing the same traits? Is their motivation to approach and interact with humans influenced by specific genes? This article highlights recent studies that aim to answer these questions.

Neuroscience & Technology-Optogenetics

Shreya Rao

This article talks about how technology and neuroscience can be connected and can make a huge impact in the field of medicine and therapy. It also emphasises on the role of engineering and how useful engineering can be when coupled with biology, although they are two contrasting fields.

NEW RO

Connecting the Brain with Computers

People who have lost the ability to move or speak can now communicate using brain-computer interfaces (BCIs). The focus of BCI research so far has been on restoring gross motor skills, such as reaching and grasping and using a computer cursor. A team of researchers developed an intracortical BCI that decodes handwriting movements using neural activity in the motor cortex and translates them into text in real time, using recurrent neural networks (RNN). RNNs are able to accurately predict events by 'memorizing' parts of the input data. Speech recognition, translation, and more are based on these networks. With a general-purpose autocorrect, a participant whose hand was paralyzed by spinal cord injury achieved typing speeds of 90 characters per minute with 94.1% raw accuracy online and greater than 99% accuracy offline. They found these typing speeds to be higher than any other BCI, and comparable to typical smartphone typing speeds for our participant's age group (115 characters per minute). Studies like these demonstrate how cutting-edge neuroscience and computational innovation can be used to improve people's lives.

Reference: Willett, F. R., Avansino, D. T., Hochberg, L. R., Henderson, J. M., & Shenoy, K. V. (2021). High-performance brain-to-text communication via handwriting. Nature, 593(7858), 249-254.

-Rohan Nath

Can you solve problems in your dream?

The short answer is yes! Many people experience their dreams as a hallucinatory world that feels as real as waking life. Dreams are yet to be adequately understood, yet they are emblematic of human sleep. When people recall dreams they can be distorted and forgotten, which poses a fundamental challenge to neuroscientific studies of dreaming. Researchers found that individuals who are asleep and in the midst of a lucid dream can perceive and provide answers to questions posed by an experimenter using electrophysiological signals. Sounds like it's straight out of the movie Inception?! The researchers presented simple math problems and yes/no questions to study participants using Morse code and verbal communication, and several of them correctly answered using previously established eye signals. Participants were also capable of performing veridical perceptual analysis of novel information, storing information in working memory, computing simple answers, and expressing volitional responses during REM sleep. Direct perception of stimuli in their original form is called veridical perception. For example, through the various sense organs, individuals receive information that allows them to perceive their "reality" and orient themselves accordingly. Dreams can be explored empirically using this relatively unexplored communication channel.

Reference: Konkoly, K. R., Appel, K., Chabani, E., Mangiaruga, A., Gott, J., Mallett, R., ... & Paller, K. A. (2021). Real-time dialogue between experimenters and dreamers during REM sleep. Current Biology, 31(7), 1417-1427.

This Quarter in Neuroscience

The brain can multitask while walking

A new mobile brain/body imaging system was used to provide insights into how the brain can handle cognitive tasks while carrying out a simple motor activity- walking! This commentary on the multitasker's brain has the potential to be a biomarker useful for identifying the individuals that could potentially develop neurodegenerative disorders

Visual percepts evoked in human occipital cortex

In true science-fiction fashion, researchers attempted to develop 'visual prosthetics'. By implanting a microelectrode array in the visual cortex, a biology teacher who had lost her vision, was able to distinguish shapes and letters.

Forgetting as a form of adaptive engram cell plasticity

When an experience is stored as a potentially retrievable memory in the brain, it becomes an engram. The engram theory of memory storage offers insight into what "forgetting" really means. Researchers suggest that it might just be a form of neuronal plasticity that alters engram cell accessibility in a manner that is sensitive to mismatches between expectations and the environment.

Scientists Use Photosynthesis to Power an Animal's Brain

In what can be termed as an attempt to unite fundamental biological differences, researchers found a way to utilise the process of photosynthesis in animals, to supply neuronal cells with oxygen, that rescued neural activity after hypoxia (oxygen deprived condition) .

Regional synapse gain and loss and memory formation in zebrafish

In an attempt to elucidate the robust nature of memory formation due to classical conditioning, zebrafish model maps were used to demonstrate "synapse gain and loss", as a potential mechanism. This could possibly open the doors to a new world of synaptic surgery to distinguish "bad memories"

-Sumedha Sengupta

Translational Neuroscience

In this age of neuroscience, as we keep marching forwards, there is an unmet need to directly impact the day-to-day lives of people, given the burden of neurological diseases. This is where translational science comes in, to apply strides made in basic sciences to the clinical needs of the populace, which is widely referred to as the 'bench-to-bedside model'. NIH National Center for Advancing Translational Sciences (NCATS) defines translation as "the process of turning observations in the laboratory, clinic and community into interventions that improve the health of individuals and the public — from diagnostics and therapeutics to medical procedures and behavioural changes." The existing healthcare is in dire need of newer tools (diagnostic and therapeutic), a paradigm shift towards efficient clinical approaches. Modern medicine has come a long way, yet there are many diseases where the existing treatment isn't satisfactory, while some diseases have no cure. This requires translational research in both wet labs and dry labs. We would also require significant input from industry partners, policymakers, and the public. Davies C et al. (2020) have beautifully illustrated this as a neuronal flowchart (Figure 1).

-Harsh Srivastava

The translational research pipeline, also known as the translational science spectrum, as depicted by Davies C et al. (2020), is a multi-phase process consisting of five phases, T0 to T4.

T0 refers to basic biomedical research to discover fundamental mechanisms in biology, diseases, or the behaviour of organisms.

T1 is the translation of the findings from basic biomedical research to humans, i.e., pre-clinical research. This includes proof of concept studies (small-scale studies that are designed to detect if a drug is active on a pathophysiologically relevant mechanism), phase 1 clinical trials, and the focus is to develop new or more effective methods of diagnosis, treatment, and prevention in highly-controlled settings. Experiments are carried out in cell or animal models; or through computer-assisted simulations of the drug or devices within living systems.

T2 stage is the translation of the findings in T1 stage to patients. This includes Phase 2 and 3 clinical trials, and controlled studies leading to clinical application and evidence-based guidelines. The goal is to test the safety and efficacy of interventions based on the findings in the T1 stage.

T3 stage is the translation to clinical practice. This involves adopting interventions into routine clinical care for the general population. This includes comparative effectiveness research, post-marketing studies, and clinical outcomes research. T3 stage is essentially the core of clinical research. While this is the first stage where discoveries from the lab reach the public, it also helps identify gaps in the existing clinical care which can guide the research at T0 stage.

T4 stage or, the final stage is, the translation to the target communities. Here, the benefit of extensive research reaches the whole community as compared to a limited group of people in T3, which is the goal of biomedical research, helping the society. This stage includes population-level outcomes research, monitoring of morbidity, mortality, benefits and risks, and health policy changes.

Movement along the scale between T0 and T4 is not one-way. Results from a T4 population outcome study might inform a future T1 pilot study, for instance, or a T3 trial might reveal the need for more studies at the T2 level. Results at any point on the spectrum might indicate new pathways for research at the T0 stage. This can be well visualized through this infographic by NCATS depicting translational spectrum as an iterative cycle (Figure 2).

We have shortlisted a few resources where you can check out the opportunities in Translational Research.

1. Programs offered by NINDS Division of Translational Research
https://www.ninds.nih.gov/Current-Research/Research-Funded-NINDS/Translational-Research

2. Programs offered by UAMS Translational Research Institute
https://tri.uams.edu/funding-opportunities/

3. Four Year PhD Programme in Translational Neuroscience by the University of Edinburgh
https://www.ed.ac.uk/studying/postgraduate/degrees/index.php

4. MSc Translational Neuroscience one year course by Imperial College, London
https://www.imperial.ac.uk/study/pg/medicine/translational-neuroscience/

5. Wu Tsai Neurosciences Institute, Stanford University: Translate grant program
https://neuroscience.stanford.edu/research/programs/neuroscience-translate

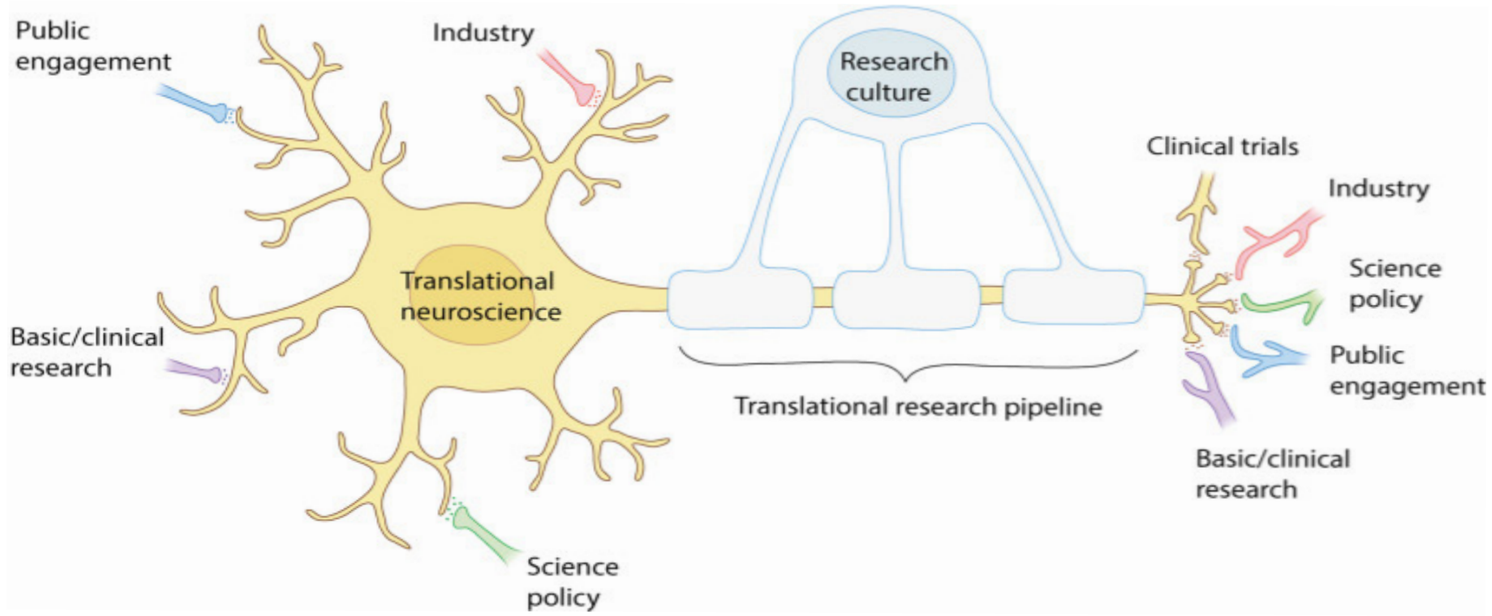


Figure 1: Davies C, Hamilton OKL, Hooley M, Ritakari TE, Stevenson AJ, Wheater ENW. Translational neuroscience: the state of the nation (a PhD student perspective). Brain Commun. 2020;2(1):fcaa038. doi: 10.1093/braincomms/fcaa038. Epub 2020 Apr 6. PMID: 32671338; PMCID: PMC7331125.

Translational Neuroscience

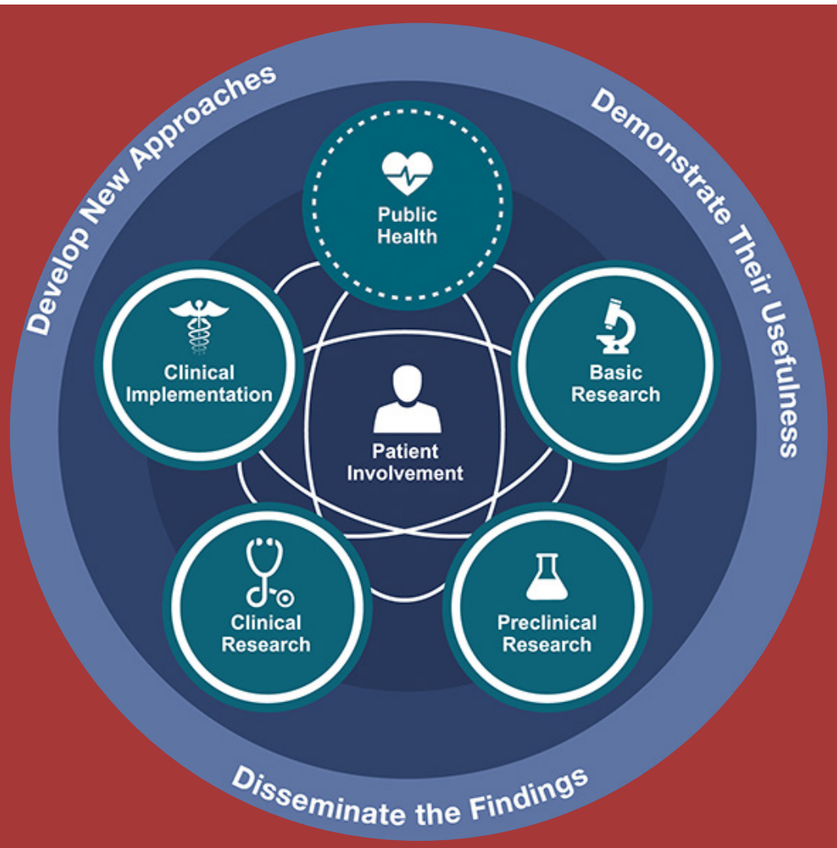


Figure 2: https://ncats.nih.gov/translation/spectrum

Sapiens in Neuroscience

I feel forever indebted to my mentors and support system, and looking back, I feel it is my responsibility to pay that forward and encourage young students to never give up and keep learning because the potential to do so truly has no bounds."

- Karina Bistrong

Read the full article

https://www.projectencephalon.org/post/karina-bistrong

"Everyone comes into science with a different background and different training, and that is the beauty of it.

-Gregory Youdan

Read the full article

https://www.projectencephalon.org/post/gregory-youdan

Neuro crossword

Click here to solve the crossword digitally

-Susan Ajith

ACROSS

3. the neuroimaging technique that works on the principle that higher blood flow indicates synaptic activity
5. the neural basis of social decision making is often based on this economic theory
6. increases the speed of action potential conduction along an axon
8. a neuronal protein that regulates synaptic vesicle trafficking and subsequent neurotransmitter release. It is mainly found in neural tissues.
11. the nitrogen base that is unique to RNA
12. most commonly used animal in neuroscience research
13. Pioneered by Rosalind Picard, this is the study and development of systems that are capable of detection, processing, interpretation, and simulation of human affective states.
15. the perspective that the human brain works on principles of statistics. This approach investigates the capacity of the nervous system to work under uncertainty
16. method to record the electrical activity on the scalp

DOWN

1. the interdisciplinary scientific study of how the mind works, functions and behaves
2. provides biochemical support for endothelial cells that forms the blood-brain barrier
4. the extracellular accumulation of amyloid plaques and tau proteins is believed to cause this disease
7. the neuroscience to explain and understand the aesthetics at the neurological level
9. the mathematical symbol that corresponds to the feedback between and interdependence of different parts of a system that define consciousness
10. chromosomes that are found mainly in the salivary glands of insects. The hereditary nature of these chromosomes was first identified in the fruit fly Drosophila melanogaster.
14. These are a type of pyramidal neurons within the hippocampus that respond specifically to places.

Answers to the previous crossword

ACROSS

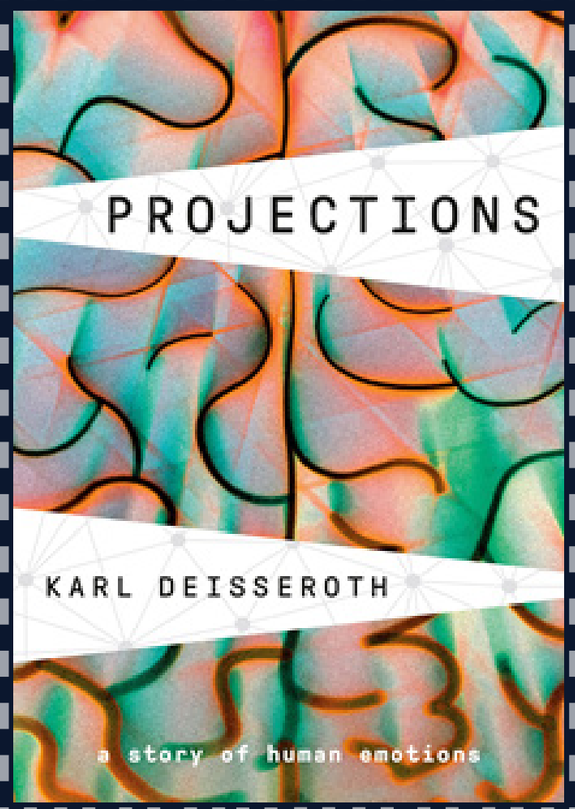
3. Capsaicin
5. Krause end bulbs
9. David Julius
10. Free nerve endings
11. TRPV1
12. A delta fibres
13. Thermoreceptors
14. Ruffini endings

DOWN

1. C fibres
2. Cajal
4. Vanilloid receptors
6. Sensory receptors
7. Nociceptors
8. Charles Sherrington

Previous Edition Crossword

Book Recommendation

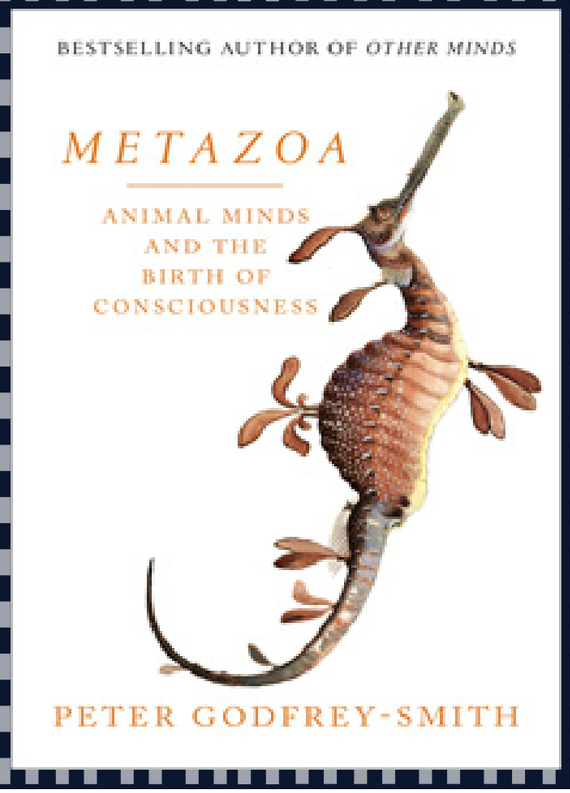


Lending a human touch to the science of emotions, Projections is a long-needed work by Karl Deisseroth, famous for his work on optogenetics (literally peering inside the brain). The book trudges along delicately between neuroscience, psychology, and literature— guiding us through the current understanding of emotions and his work, through emotionally touching anecdotes. Did you ever wonder whether psychiatry will ever form a part of pathology or neuroscience texts as we slowly begin to unravel biological connections to the mysterious psychological phenomenon? Can we finally bridge the mind-body dichotomy? If you think it's possible, this is where to begin!

Projections

Karl Deisseroth

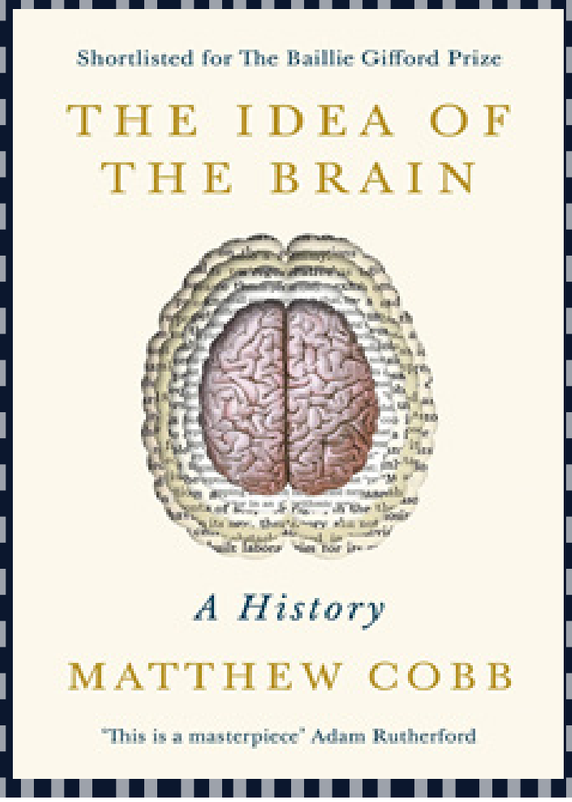
-Satwik Pasani



The author prefers to not unmix science and philosophy and so, his views are generously sprinkled with grains of philosophical salt, if you will? It makes us rethink our definition of 'intelligence' and 'consciousness' as he frames this evolutionarily through behaviour in shrimp to sharks. Consciousness may be simpler than it is considered or more complex than we can understand but should we be boxing consciousness with any labels at all? A wonderful companion to this book is the documentary 'My Octopus Teacher'- it's a much relatable bonus if you haven't watched it already.

Peter Godfrey-Smith

Metazoa: Animal life and the Birth of Consciousness



Matthew Cobb narrates the history of the study of the brain by way of compelling metaphors that allow for better insight into the discovery for the reader. This understanding through metaphors is not only memorable but also helps to see a new picture that reveals a looming gap in our understanding of the brain, mind, and consciousness. It binds what we know and what are we limited by with each discovery, with occasional cheeky humour.

The Idea of the Brain

Matthew Cobb

-Madhuri Srinivasan

Volunteers of the Edition

Puja Kisku & Nosratullah Mohammadi

Puja and Nosratullah were the first couple of volunteers who joined Project Encephalon when it started more than a year ago. They have contributed considerably in the process of defining the style and design elements with their extraordinary capabilities to create signature designs that represent PE.

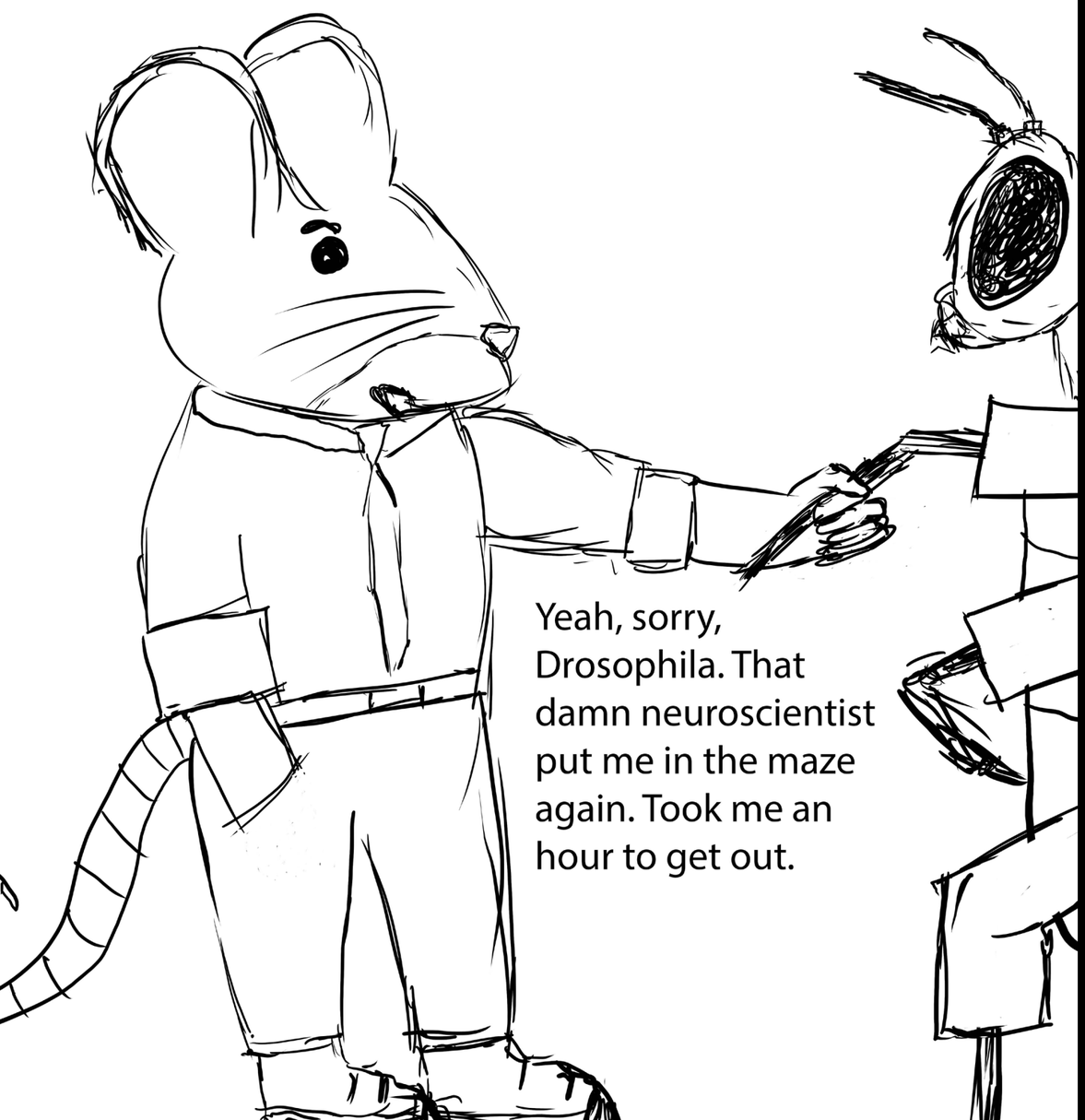
Their professionalism and a dedicated work ethic has been significant in propagating and generating the challenging art of presenting Neuroscience through innovative graphics. They have established and are leading a commendable design innings for PE.

Puja is currently a design intern in India and Nosratullah is a PhD student in Switzerland.

-Pranjal Garg

Neurocomic

-Harsh Srivastava



Feedback

Huge thanks to you for keeping us going! It's important that you, our readers, feel that you can have an open dialogue through this feedback, affecting change for our upcoming editions and other editorial activities. This interaction fosters a sense of accountability and community to generate and sustain our readership. Click here to give your feedback or headover to the Neuroletter section on our website www.projectencephalon.org/neuroletter.

To submit an article to Neuronotes, check out the guidelines at www.projectencephalon.org/neuronotes.

Want to have your Neuroscience image featured as Neuroletter's cover pic? Submit your entry at www.projectencephalon.org/neuropiction.

Do you make Neuroscience comics? Send it to editor@projectencephalon.org

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