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Visionary:

Dr. T. D. Singh
Founder Director,
Bhaktivedanta Institute

Handbook

Summer School – 2023

Unfolding the Mystery of MEMORY

3 – 7 July 2023

BIOM, Nabadwip, W.B.

The world is a construct of our sensations, perceptions, memories. It is convenient to regard it as existing objectively on its own. But it certainly does not become manifest by its mere existence..

– Erwin Schrödinger
Nobel Laureate in Physics

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Dedicated to

Dr. T. D. Singh

(His Holiness Bhaktisvarupa Damodara Swami)

(1937-2006)

Scientist & Saint

Founder Director, Bhaktivedanta Institute

&

Founder President, Vedanta and Science Educational Research Foundation

Acknowledgements

We are thankful that by the mercy of the Supreme Lord and blessings of the school visionary Dr. T. D. Singh and all the dedicated team members, the 8th Summer School, "Unfolding the Mystery of Memory", is finally being organized at Nabadwip, West Bengal, India. We express our deep gratitude to the distinguished guests - Sri. B. D. Mundra, Emeritus Chairman, Simplex Infrastructure Limited; Dr. Ramji Singh, Executive Director, AIIMS Kalyani; Dr. Bhaskar Nath Bhattacharyya, Director (Acting), School of Vedic Studies, Rabindra Bharati University, Kolkata; Dr. Partha Sarkar, Principal, JIS College of Engineering, Kalyani; Dr. Swapan Kumar Roy, Principal, Vidyasagar college, Nabadip; Swakshar Chakraborty, Principal, Techno School, Nabadwip for kindly accepting our invitation to grace the event and share their profound words of wisdom. We would also deeply acknowledge all the esteemed speakers for kindly accepting our invitation to share their profound wisdom.

We would like to specially thank the Director of AIIMS Kalyani - Dr. Ramji Singh for organizing a special seminar of the school at AIIMS Kalyani and encouraging students to take part in this school. We as well express gratitude to Dr. Partha Sarkar, Principal, JIS College of Engineering, Kalyani for encouraging us to organize preschool seminar in their institute. Our heartfelt thanks go to all the organizing team members of the school - Sanjib Saha, Acarya Charan Das, Jitun Dhal, Avinash Kumar,Sravan Kumar, Jagadishwar Dasari, Manas,Vedanand, Yogesh, Katta Sai Vineeth, Roshan Tiwari, Ruthvik Galem and Nikhil Yenugu who have put immense time, heart, energy and above all, their pure loving service for the conference.

We also humbly acknowledge and thank our institute members and volunteers of various services - Sri Krishnananda Das, Rakesh, Bidesh, Laddu Gopal and Balachandra

for lovingly helping and assisting at various ends related to website design, venue management, registration, accommodation, hospitality, outreach, management on online platform (zoom), tour arrangements, serving food, fund raising, etc... We would also like to thank the incharge and staff of BIOM for helping us in logistics for accommodation.

The assistance rendered by the members coming from different parts of the country and all the members of the Bhaktivedanta Institute are beyond imagination. Without their dedication, and full support, this school would not have been possible. Our sincere thanks to all of you for your wonderful dedication. We gratefully acknowledge the good wishes and prayers from friends, well-wishers, and the community of Dr. T. D. Singh's family without whose blessings, we could not have thought about this school.

We are obliged to the financial help rendered by Balaji, Chaitanya Madhav, Narendra, Vamanabali, Premarupini, Sirigiri Ramesh, Prof. Sandeep Kumar, IIT(BHU) Varanasi; and many other generous supporters for this school. Thank you!

Sincere thanks are for special sponsors - Sushanth Sarma and school partners for their generous support and encouragement.

We are indebted to Dr. T. D. Singh (H. H. Bhaktisvarupa Damodara Swami), a pioneer of science and spirituality dialogue, Founder Director of the Bhaktivedanta Institute, who has guided us immensely for organizing the school for the benefit of humanity. Our deep gratitude to Srila A. C. Bhaktivedanta Swami Prabhupada, a visionary saint for the modern age and the Founder Acarya of the Bhaktivedanta Institute - for giving us this wonderful platform and vision.

Words are limited but feelings of heart are beyond what our minds and hands can grasp.

We sincerely thank each and every individual, whether your name is mentioned or not, from the unlimited depth of our hearts. May good thoughts come from all directions. May everyone be happy.

Sarve jana sukhino bhavantu!

In the service of the Supreme Lord and your good self,

Organizing Committee
Summer School – 2023
Bhaktivedanta Institute, Kolkata

Contents

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Welcome

Understanding memory necessitates a study and exploring haven dedicated to discovering its infinite secrets. The current school is a haven of study dedicated to unravelling the infinite secrets of memory. The modern scientific approach has been extremely successful in revealing the secrets of memory, particularly some that are not readily apparent to ordinary understanding. Yet, how do fleeting moments become etched into the tapestry of our consciousness? How do forgotten fragments resurface with vivid clarity? Exploring the depths of memory unveils a labyrinth of neural connections, cognitive processes, and emotional imprints. As we embark on this captivating quest, we unravel the enigmatic mechanisms that underlie our recollections, unlocking the secrets that make us who we are.

Beyond the realm of neuroscience, memory reveals its multidimensional nature, intertwining with our emotions, shaping our perceptions, and shaping the narrative of our lives. The study of memory encompasses a tapestry of disciplines, from psychology and neuroscience to philosophy and sociology. Each thread woven into this intricate fabric unravels new insights, posing thought-provoking questions that challenge our assumptions and expand our understanding. How do memories transform over time, subject to the whims of perception and the vagaries of human fallibility? What role does memory play in shaping culture, heritage, and shared narratives? As we navigate the labyrinth of memory's mysteries, we unlock profound insights into the workings of the human mind and beyond.

Yet, even as we make remarkable strides in unravelling the secrets of memory, its

full complexity eludes us. It remains an ever-evolving frontier, enticing us to delve deeper into its recesses, to explore the delicate balance between forgetting and remembering, and to seek meaning in the tapestry of our personal histories.

In this ongoing exploration, we invite you to join us on an intellectual adventure, where the mysteries of memory unfold before our eyes. Together, let us embrace the wonder, challenge the boundaries of our knowledge, and strive to unravel the intricate mechanisms that shape our recollections. In the pursuit of understanding memory's mysteries, we embark on a journey that not only illuminates the essence of human experience but also holds the potential to transform our perception of the world.

Within the labyrinthine corridors of our institution, you will find a vibrant community of passionate learners and esteemed scholars, all united by a shared fascination for the enigmatic workings of memory. Together, we strive to peel back the layers of this intricate tapestry, seeking to comprehend the mechanisms that govern our recollections, shape our identities, and influence our perception of the world.

Led by a distinguished faculty of experts, who possess unrivalled expertise in the realms of psychology, neuroscience, computer science, cognitive science and ancient Vedanic wisdom, you will be guided through an intellectual odyssey like no other. Their wisdom and insights will illuminate the intricate pathways of memory, revealing the interplay between neurobiology, cognitive processes, and the formation of lasting impressions.

Immersive and experiential learning lie at the heart of our pedagogical approach. Hands-on experiments, cutting-edge research, and thought-provoking case

studies will transport you to the forefront of memory exploration. You will dissect the mechanisms of encoding and retrieval, untangle the web of associations, and examine the intricate interplay between memory and emotions. Through this multidimensional approach, you will gain a profound understanding of memory's impact on our perceptions, decisions, and experiences. Together, you will unravel the mysteries of memory, drawing on the collective wisdom and diverse perspectives of your peers. These interactions will foster an environment of intellectual growth, where lively discourse nurtures innovation, empathy, and personal development.

Moreover, our school embraces the profound significance of memory beyond the confines of academic pursuit. As you embark on this extraordinary journey of discovery, we encourage you to embrace the awe and wonder that accompanies each revelation. Unlock the depths of your own recollections, tap into the reservoir of your personal stories, and reflect upon the profound ways in which memory weaves the tapestry of your own existence.

I would like to welcome you all to immerse in the exciting deliberations in this five day summer school on 'Unfolding the Mystery of Memory' being held from July 3-7, 2023 in Nabadwip, West Bengal, India.

We wish you pleasant stay.

With gratitude,
K Vasudeva Rao (Bhaktisvarupa Vrajapati Swami)
(Alumnus, IIT Kanpur)
President, Bhaktivedanta Institute

Introduction

Every learning relies on memory since it allows one to store and recall the knowledge when required. Since past several decades, serious researchers from different disciplines make memory study innately cross-disciplinary. Despite extensive scientific research on memory and its several aspects, many of the memory-related issues/outcomes still have no agreed-upon explanation. It still remains a mystery. Recent developments in science and technology indicates the need to unify, and extend the definition of memory. Visualizing memory as some physical entity held inside the physical spatial machinery of the brain organ has been one of the major obstacles to present knowledge of memory. Today, there are many theories which propose that memory may be stored elsewhere other than the brain. And of course, major enigma besides the mystery of storage and retrieval of our experiences, are the 'conscious experiences' themselves – what they are and who actually experiences them? Are we hitting the age-old concepts back again of mind and soul? Scientific community thus, through the current exciting research in the field of memory, seems to once again be gradually pushed towards pondering over majorly interchangeably used terms namely mind, brain and conscious particle called as soul.

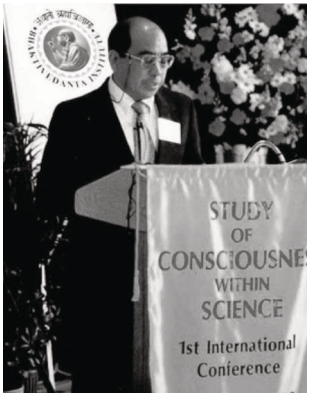
This Summer School 2023 on "Unfolding the Mystery of Memory" will focus on thought-provoking lectures for extended period of time from leading neuroscientists, experts on computer science and artificial intelligence, reputed mathematicians, medical doctors. prominent leaders from ancient-spiritual traditions, etc., on various issues related to memory and will attempt to explore the following questions: What is memory? What is a thought? What are the current cutting-edge theories existing to understand the intricacies of memory? How does memory work? What are the differences between chip memory and human

memory? How are our conscious experiences stored? What role does mind play in memory storage? What is mind really? Does mind have some sort of storage system like our physical organ brain? Why do we forget? How to increase memory? Is there a relation between memory and consciousness? Does soul also have a memory? Can memory exploration help becoming a better human being and have positive thinking? What about past life memories-are they reality? Like our brain and mind, does universe also have some sort of a memory? Is there any relation between memory and God? Does memory research have a potential to bring science and religion together on a common platform? Can our ancient Vedantic wisdom help to understand the far-reaching goal of memory research including the purpose of human civilization? The school thus aims to thoroughly introduce serious students and scholars to unfold the mystery of memory from a scientific, medical, philosophical and spiritual perspectives. The school is as well intended to present future visions with an opportunity to learn from and interact with the leaders of both science and spirituality in a stimulating setting. Thus, the lectures to be delivered will cover a broad range of perspectives and will enthuse the participants with thought-provoking questions, ideas and an undoubting hankering for the answers to the fundamental questions on memory.

We hope the school will enable the participants to appreciate multidisciplinary approaches highlighting the ongoing studies on memory and will lay the ground for the holistic approach in the quest for unfolding the mystery of memory. Best wishes for your life's journey to uncover the hidden truth of memory.

— Convener
Summer School - 2023

Visionary



Dr. T. D. Singh (His Holiness Bhaktisvarupa Damodara Swami) received his Ph.D. in Physical Organic Chemistry from the University of California at Irvine in 1974. Then, he was a Postdoctoral Research Fellow in the Chemistry Department of Emory University, Atlanta, Georgia, U.S.A., from 1974-76. He has contributed papers in the prestigious journals, such as, Journal of American Chemical Society and the Journal of Organic Chemistry in the field of fast proton transfer kinetics in model biological systems using stopped-flow technique and NMR spectroscopy. He also worked on gas phase reaction mechanisms using Ion Cyclotron Resonance (ICR) spectroscopy. He was a scientist and spiritualist known for his pioneering efforts in the synthesis of science and religion for a deeper understanding of life and the universe. He was trained in Vaishnava Vedanta studies from 1970 to 1977 under His Divine Grace A. C. Bhaktivedanta Swami Prabhupada and was appointed Director of the Bhaktivedanta Institute in 1974. He organized four major International Conferences on Science and Religion - First and Second World Congress for the Synthesis of Science and Religion (Mumbai, 1986 & Kolkata, 1997), First International Conference on the Study of Consciousness within Science (San Francisco, 1990), and Second International Congress on Life and Its Origin (Rome, 2004). Collectively, thousands of prominent scientists and religious leaders including several Nobel Laureates participated. He has authored and edited more than dozen books including What is Matter and What is Life? (1977), Theobiology (1979), Synthesis of Science and Religion: Critical Essays and Dialogues (1987) and Thoughts on Synthesis of

Science and Religion (2001). He was also the founder Editor-in-Chief for both the prestigious journal, "Savijnanam - Scientific Exploration for a Spiritual Paradigm," as well as students magazine, "Tattvajinasa - Scientific and Spiritual Quest for Ultimate Reality," of the Bhaktivedanta Institute.

Dr. Singh was very concerned for the student community with regard to their holistic development. He felt our younger generations were exposed to the latest scientific and technological developments in various disciplines at numerous colleges and universities around the world, but lacked a spiritual foundation to make proper use of them. He therefore laid down the mandate of Bhaktivedanta Institute to educate each and every student on essential foundations of science and spirituality through numerous educational programs. He emphasized educating the young generations to spiritual foundations of life in addition to scientific and technological development to construct a society of balanced growth of scientific temper and spiritual wisdom. Hence, he felt the need to organize student conferences on the interface of Science and Spirituality for their holistic growth and development. With this vision, Dr. Singh conceptualized the series of conferences, summer schools and workshops for the benefit of students. Since 2015, Bhaktivedanta Institute has organized over five summer schools on various foundationally stimulating themes like "Mathematics & Spirituality", "Computation & Mind", "Space & Time - in science & spiritual traditions", "Mathematics, Logic & Spirituality" and "Origin of Life Research - History, State-of-art, New Ideas, Future Visions." Today, inspired by his vision, his students, friends and well-wishers throughout the world are making a humble attempt to carry out his grand vision of harmonizing modern civilization through the synthesis of science and spirituality.

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Schedule

Day 1: July 3, 2023 (Monday)

08:00 am – 09:00 am	Breakfast
09:00 am – 09:25 am	Registration
09:30 am – 10:45 am	**Opening Ceremony & Welcome Address**
10:45 am – 11:00 am	Break
Session 1	
11:00 am – 11:45 am	**Uncertainties in Older Memory Creates Rapidly Consolidating Memories of Unreal Events** *Prof. Balaji Jayprakash, IISc Bangalore, India*
11:45 am – 12:00 pm	Q & A
12:00 pm – 12:45 pm	**Neural Mechanisms of Spatial and Episodic Memory** *Prof. Neil Burgess, University College London, UK*
12:45 pm – 01:00 pm	Q & A
01:00 pm – 03:00 pm	Lunch and Break
Session 2	
03:00 pm – 03:50 pm	**Activity 01**
04:00 pm – 04:45 pm	**Does Light affect Memories?** *Dr. Roshan Tiwari, IISER Kolkata, India*
04:45 pm – 05:00 pm	Q & A
05:00 pm – 05:45 pm	**Beyond Neurons: Memory, Mind and Consciousness** *Shri Varun Agarwal, Director, Bhaktivedanta Institute Kolkata, India*

05:45 pm – 06:00 pm	Q & A
06:00 pm – 06:45 pm	**From Clockwork to Emergence: A New View of the Brain** *Prof. Earl K Miller, Massachusetts Institute of Technology, USA*
06:45 pm – 07:00 pm	Q & A
07:00 pm – 08:00 pm	**Activity 02**
08:00 pm – 09:00 pm	Dinner

Day 2: July 4, 2023 (Tuesday)

06:30 am – 06:45 am	**Yoga**
08:00 am – 09:00 am	Breakfast
Session 1	
09:30 am – 10:15 am	**Neurophysics of Space, Time and Imagination** *Prof. Mayank Mehta, University of California, Los Angeles, USA*
10:15 am – 10:30 am	Q & A
10:30 am – 11:15 am	**Unfolding the Mystery of Memory: Types, Processes, and Impact of Neurodegenerative Disorders** *Prof. Jayasri Das Sarma, IISER Kolkata, India*
11:15 am – 11:30 am	Q & A
11:30 am – 11:45 am	Break
11:45 am – 12:30 pm	**What is a Thought?** *Dr. Srikanth Chandragiri, Max Planck Institute of Biology of Ageing, Cologne, Germany*
12:30 pm – 12:45 pm	Q & A

12:45 pm – 01:10 pm	**How to Increase Memory?** *Bhaktisvarupa Brihaspati Svami, Bhaktivedanta Institute Kolkata, India*
01:10 pm – 01:15 pm	Q & A
01:15 pm – 03:00 pm	Lunch and Break
Session 2	
03:00 pm – 04:00 pm	**Activity 03**
04:00 pm – 08:00 pm	**Spiritual Retreat 01: Knowing the Cultural Heritage of Mayapur**
8:00 pm – 9:00 pm	Dinner

Day 3: July 5, 2023 (Wednesday)

06:30 am – 06:45 am	**Yoga**
08:00 am – 09:00 am	Breakfast
Session 1	
09:30 am - 10:15 am	**Memory and Mind: A Vedantic Perspective** *Shri K Vasudev Rao, President, Bhaktivedanta Institute Kolkata, India*
10:15 am - 10:30 am	Q & A
10:30 am - 11:15 am	**Mysteries of Memory** *Dr. Ramjee Repaka, IIT Ropar, India*
11:15 am - 11:30 am	Q & A
11:30 am – 11:45 am	Break
11:45 am – 12:30 pm	**Memories in the Brain - Real and Imagined** *Prof. Neeraj Jain, IIT Jodhpur, India (Former Director, National Brain Research Center, India).*

12:30 pm – 12:45 pm	Q & A
12:45 pm – 01:05 pm	**Dynamics of Memory – Insights from Vedanta** *Er. Ruthvik Galem, Odisha Bridge and Building Constructions Ltd, Odisha*
01:05 pm – 01:15 pm	Q & A
01:15 pm – 03:30 pm	Lunch and Break
Session 2	
03:30 pm – 03:50 pm	**Effect of Listening to Indian Raga Bhimpalasi on EEG Power Spectrum in Adult Healthy Volunteers** *Mr. Ritesh, AIIMS Kalyani, India*
03:50 pm – 04:00 pm	Q & A
04:00 pm – 04:20 pm	**Unlocking Your Learning Potential: Strategies for Improving Memory Retention** *Mr. Yogesh Tambe, B. Tech. (Mech. Engg.)* *IIT Bhubaneshwar, India*
04:20 pm – 04:30 pm	Q & A
04:30 pm – 04:45 pm	Break
04:45 pm – 05:30 pm	**Natural Cooperation** *Prof. Martin Nowak, Harvard University, USA*
05:30 pm – 05:45 pm	Q & A
05:45 pm – 06:00 pm	Transition Time
06:00 pm – 08:00 pm	**Cultural Night**
08:00 pm – 09:00 pm	Dinner

Day 4: July 6, 2023 (Thursday)

06:30 am – 06:45 am	**Yoga**
08:00 am – 09:00 am	Breakfast

Session 1	
09:30 am – 10:15 am	**Modelling Transmigrating Smriti using Spectral Tensor** *Prof. Sandeep Kumar, IIT (BHU) Varanasi, India*
10:30 am – 11:15 am	**Memory – An Unresolved problem in AI** *Shri Sushant Sharma, Bhaktivedanta Institute Kolkata, India*
11:15 am – 11:30 am	Q & A
11:30 am – 11:45 am	Break
11:45 am – 12:05 pm	**Journey of Understanding Memory in Living Systems – Developments, History and Issues** *Mr. Nikhil Yenugu, Ph. D. Scholar, IISER Kolkata, India*
12:05 pm – 12:15 pm	Q & A
12:15 pm – 12:35 pm	**Use of AI Technology in Mimicing the Human Brain** *Mr. Rajesh Pandit, IISER Kolkata, India*
12:35 pm – 12:45 pm	Q & A
12:45 pm – 01:05 pm	**Mind and Machine: AI's Role in Memory** *Er. Sai Vineeth, Apollo Health and Lifestyle Limited, Hyderabad INDIA*
01:05 pm – 01:15 pm	Q & A
01:15 pm – 03:30 pm	Lunch and Break
Session 2	
03:30 pm – 03:50 pm	**Chip Memory vs Human Memory** *Er. Dasari Jagadishwar, M. Tech. (Civil Engg) IIT Gandhinagar*
03:50 pm – 04:00 pm	Q & A

04:00 pm – 08:00 pm	**Spiritual Retreat 02: Knowing the Cultural Heritage of Nabadwip**
08:00 pm – 09:00 pm	Dinner

Day 5: July 7, 2023 (Friday)

06:30 am – 06:45 am	**Yoga**
08:00 am – 09:00 am	Breakfast
Session 1	
09:30 am – 10:15 am	**The Mysteries of Memory: Taxonomy, Distribution and the Purpose; Memory in AI** *Dr. A. K. Mukhopadhyay, Former Professor of AIIMS, New Delhi, India*
10:15 am – 10:30 am	Q & A
10:30 am – 11:15 am	**Physiology of Memory: Before we Forget** *Dr. Sanjay Kumar Patel, AIIMS, Kalyani, India*
11:15 am – 11:30 am	Q & A
11:30 am – 11:45 am	Break
11:45 am – 12:05 pm	**Memory: Past Life & Reincarnation: Scientific Study and Vedic Concepts** *Er. Niket Kumar Jha, B. Tech. (EEE), CMRIT, Bangalore*
12:05 am – 12:15 pm	Q & A
12:15 pm – 01:00 pm	**Memory and Karmic Patterns - A Vedantic Perspective** *Dr. Hare Krishna Mohanta, BITS Pilani, Rajasthan, India*
01:00 pm – 01:15 pm	Q & A

01:15 pm – 03:30 pm	Lunch and Break
Session 2	
03:30 pm – 04:15 pm	TBA *Prof. Ramgopal V. S. Uppaluri, IIT Guwahati, India*
04:15 pm – 04:30 pm	Q & A
04:30 pm – 05:30 pm	**Panel Discussion**
05:30 pm – 06:30 pm	**Valedictory Session**
08:00 pm – 09:00 pm	Dinner

Abstracts & Bio-datas

Day 1
Session 1

1.1. Uncertainties in Older Memory Creates Rapidly Consolidating Memories of Unreal Events

Prof. Balaji Jayprakash, *IISc Bangalore, India*

Our brain encodes novel information in the form of new memories. However, most often the brain integrates new information such as those resulting from everyday experiences with related, existing memories. Remarkably, the neurobiology of such related learning is fundamentally different as they are typically acquired in absence of direct reinforcement and are based on previous memories of reward or punishment. Core to this process is our brain's ability to compare the current sensory perception to past experiences and establish a plausible relationship. Little is known about how the current ongoing experience dictated by sensory perception interacts with events perceived through memory retrieval ("memory perception"). With recent advent of targeted activation and inactivation through opto/chemo genetic approaches we now could create mixed perception where perceived memory is different from the ongoing experience. I would be discussing the experiments performed in our laboratory to probe such perceptions specifically when the sensory experience a) is congruent to a related memory and b) conflicts with a related memory. Our results indicate that such interactions between related memories result in creation of new memories for events hitherto unexperienced by the organism (unreal events) and unlike memories of realistic events such memories are rapidly consolidated.

Prof. Balaji Jayaprakash is currently an associate professor at center of

neuroscience, IISc Bangalore. He obtained his Ph.D. in Chemistry from Tata Institute of Fundamental Research in 2004. Then he pursued his postdoctoral research at Weill Medical College of Cornell University in Biochemistry with Prof. Ryan and subsequently another postdoc at UCLA, Los Angeles in Neurobiology with Prof. Silva. Later on he joined IISc Bangalore. His research interests lie in investigating neural correlates of different forms of learning and memory with use of techniques such as optogenetics, CLARITY, Virtual Reality and in-vivo imaging along with various behavioral paradigms in mice. He has numerous publications in journals of international repute and a patent on "Fluorescence correlation microscopy with real-time alignment readout." He was a Ramanjuan Fellow.

1.2. Neural Mechanisms of Spatial and Episodic Memory

Prof. Neil Burgess, *University College London, UK*

I will introduce the neural representations underlying spatial memory, including place, head-direction and boundary- and object-vector cells in the rodent hippocampus. I will then outline a computational model of how these cell types could work together to enable the spatial and episodic memory, e.g. reconstruction of the scene of an event. Predictions of this computational model will be compared with results from behavioral and functional neuroimaging experiments on human memory and imagery. I will discuss how environmental information needs to combine with information from self-motion for spatial localisation and planning, and how this might be achieved by the interaction of place cells and grid cells.

I will conclude by considering how this knowledge about the neural mechanisms of spatial memory can be generalised to other aspects of learning, memory and cognition. For example, whether place and grid cells can be seen as representing states and transitions in a way that is optimal for prediction within model-based reinforcement learning, and how memory

(re)construction and consolidation can be seen as student-teacher training by the hippocampus of deep generative networks in the neocortex.

References:

1. Andrej Bicanski, Neil Burgess, A neural-level model of spatial memory and imagery, eLife 7:e33752, 2018. https://doi.org/10.7554/eLife.33752
2. Neil Burgess et.al, The Tolman-Eichenbaum Machine: Unifying Space and Relational Memory through Generalization in the Hippocampal Formation, Cell, Volume 183, Issue 5, 2020, pp. 1249-1263. https://doi.org/10.1016/j.cell.2020.10.024.

Prof. Neil Burgess is currently Professor of Cognitive and Computational Neuroscience at University College London and Wellcome Trust Principal Research Fellow. He was awarded a Ph.D. in Theoretical Physics by University of Manchester in 1991. In Manchester, he began modeling working memory with Graham Hitch. He returned to UCL to work with John O'Keefe, working on models and experiments concerning how neurons represent space and support memory. His behavioral, neuroimaging and electrophysiology experiments with both humans and rodents bridge the gap between brain science and observed behavior, shining a light on the neural representations and computations supporting spatial cognition.

With colleagues Tom Hartley and Colin Lever he predicted and discovered neurons representing environmental boundaries. With Sue Becker in 2001 he proposed the first model explaining how neurons in the hippocampal system support coherent spatial imagery. This model has developed to explain aspects of episodic memory, imagery and planning in terms of the activity of populations of neurons. He has a rich research experience of more than four decades with over 200 publications in journals of international repute and well cited (h-index 96). He also held many responsible positions in academia. For

his work he has been recognized with many awards to name a few - 'William James Fellow' award (for lifetime contribution to psychology) by Association for Psychological Science, Elected Fellow of the Royal Society and Elected member of the International Neuropsychological Congress.

Session 2

2.1. Does Light affect Memories?

Dr. Roshan Tiwari, *IISER Kolkata, India*

In the past few decades, light has become an important tool for many biomedical and clinical uses. Their properties like wavelength, polarization, phase, intensity, coherence, etc. have given numerous biomedical techniques with higher sensitivity and specificity at cellular and molecular levels. However, the idea that light could find applications to manipulate memory doesn't seem likely. But recently, researchers have manipulated the memories of mice's brains using light. A defined population of neurons corresponds to a specific memory trace. They targeted the population of the dentate gyrus (DG) cells in the hippocampus of a mouse to express the fear memory when stimulated by light. They also showed that light-induced fear memory recall is context-specific. The work indicated that activating a sparse but specific ensemble of hippocampus neurons that contribute to a memory engram is sufficient for the recall of that memory.

Roshan Tiwari has obtained his Ph.D. in Physics recently from the Indian Institute of Science Education and Research (IISER) Kolkata. He completed his B.Sc. in Physics from Banaras Hindu University (BHU), Varanasi, in 2014. His research interests include spectroscopy, bioinspired-waveguides, microscopy, sensing, optical trapping and statistical analysis.He is also interested in the connections of unexplored aspects of reality with age-old wisdom.

2.2. Beyond Neurons: Memory, Mind and Consciousness

Shri Varun Agarwal, *Director, Bhaktivedanta Institute Kolkata, India*

Memory is a great puzzle today. Though we cannot live without memory even for a day, it is a great mystery in every discipline today, from artificial intelligence to neuroscience and philosophy to psychology. How memories are stored in the human brain? How memories are retrieved? Are their storage confined to the brain only, the neurons and synapses? How memories are formed and forgotten? What guides some memories to be short-lived and others to be long-lived? These and many such intriguing questions are at the forefront of memory research which puzzle scientists, philosophers, medical practitioners, psychologists and scholars every day. The studies and developments in memory research have indicated that there are foundational problems in our very conception that memory is confined to the brain only. Recent research and investigations point out good hints that memory may not be related to the brain only, but also to mind and consciousness. How then memories are stored in mind and consciousness or self? If memories are stored in mind in consciousness too, will it revolutionize our modern scientific investigations and our basic view about reality? Will it also then pay way for the past life memories as valid possibilities? The author in this presentation would take us for a smooth Journey of memory from brain to mind to consciousness, taking insights from modern scientific developments as well as ancient scriptural wisdom.

Varun Agarwal is an alumnus of IIT Kanpur (Aerospace Engg - 1999) and is currently the Director of the Bhaktivedanta Institute, Kolkata. His research interests include the foundations of science and its possible connections with spirituality. His search for a deeper meaning of life culminated in meeting and taking personal guidance from Dr. T. D. Singh, which completely changed his life, after which he dedicated himself to the cause of selflessly helping humanity. He is the Editor of

many publications on science and spirituality, including Bhaktivedanta Institute's reputed annual science-spirituality journal, Savijnanam – Scientific Exploration for a Spiritual Paradigm. His deep interest in the foundations of mathematics and the nature of consciousness and its relation to the nature of reality as well as ancient Indian texts has led him to interact and meet with renowned scholars at Harvard, Princeton, ETH, Stanford and MIT. He has given numerous talks worldwide on the foundations of science, as well as the foundations of life, mathematics and spirituality.

2.3. From Clockwork to Emergence: A New View of the Brain

Prof. Earl K Miller, *Massachusetts Institute of Technology, USA*

For a long time, the brain was thought to function like clockwork, with specialized parts working together due to physical connections. However, in recent decades, our understanding has undergone a major shift. While the individual parts and anatomical connections are still important, many cognitive functions are driven by emergent properties - higher-level properties that arise from the interactions between the parts. A key aspect of these emergent properties are brain waves, oscillating rhythms of electrical activity that allow millions of neurons to self-organize and control our thoughts, much like a crowd doing 'the wave'.

Earl K. Miller is the Picower Professor of Neuroscience in The Picower Institute for Learning and Memory at the Massachusetts Institute of Technology. He received an M.A. degree (in 1987) and Ph.D. (in 1990) in Psychology and Neuroscience from Princeton University. He was awarded an honorary doctorate (Doctor of Science, honoris causa) from Kent State University in 2020. He studies the neural basis of executive brain functions, the ability to carry out goal-directed behavior using complex mental processes. His research topics include working

memory, attention, decision-making and learning. The Miller Lab has shown how categories and concepts are learned, how multifunctional "mixed selectivity" neurons endow the cortex with computational horsepower and flexibility, and how neural oscillations regulate neural communication and consciousness. This work has established a foundation upon which to construct more detailed, mechanistic accounts of cognition and its dysfunction in diseases such as autism, schizophrenia, and attention deficit disorder.

Professor Miller is the recipient of a variety of awards and serves as editor, and on the editorial boards of major journals in neuroscience, and on international advisory boards. His paper with Jonathan Cohen, (Miller and Cohen, 2001), which presented a new framework for understanding the prefrontal cortex, ranks fifth all-time in citations in neuroscience.

Day 2

Session 1

1.1. Neurophysics of Space, Time and Imagination

Prof. Mayank Mehta, *University of California, Los Angeles, USA*

The mind is thought to be the emergent property of the activities of ensembles of neurons. The nature of these emergent properties and how they arise are unknown. This is the focus of our research. In this presentation, I would discuss some of our results and insights in understanding the crucial aspects related to the fundamental questions in Neurophysics : How is information about the physical world represented by ensembles of neurons? In particular, what are the neural mechanisms of perceiving space-time? How do these neural representations evolve with learning? What is the role of brain rhythms in learning and memory? How does sleep influence learning?

Further reading: https://www.physics.ucla.edu/~mayank/index.html

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Prof. Mayank Mehta is Professor at University of California, Los Angeles. He is affiliated to the department of Physics and Astronomy, Neurology, Neurobiology. He obtained his Ph.D. from IISc Bangalore in Theoretical physics. And subsequently he did his postdoctoral research in neurophysics in MIT, UC Irvine and University of Arizona. His current research includes neurophysics of mind, memory and information. One of the areas in which his team works to learn more is the method by which ensembles of neurons encode information about the physical world. Understanding how the brain perceives space-time and how these neural representations change as we learn is necessary for this. His group investigates how sleep affects learning using cutting-edge methods. He focuses on creating the next generation of artificial intelligence (AI) that is based on the human brain and non-invasive, reversible ways to turn on/off specific brain regions. In addition, he studies how individual neurons respond to virtual reality and how information is processed by neurons as they sleep to generate long-lasting memories. His findings would not only offer a fundamental knowledge of the dynamics of neuronal ensembles, but they would also suggest brand-new approaches to treating learning and memory problems. In order to comprehend how animals perceive space, he employs virtual reality. The theories put forth by Prof. Mayank Mehta demonstrate how virtual reality might enhance healthy brain rhythms by changing neuronal dynamics, circuitry, and plasticity. His outstanding list of academic publications includes numerous publications in Nature and Science.

1.2. Unfolding the Mystery of Memory: Types, Processes, and Impact of Neurodegenerative Disorders

Prof. Jayasri Das Sarma, *IISER Kolkata, India*

Memory is a complex phenomenon that allows us to store and retrieve information about past experiences. It is a fundamental element of human thought that empowers us to learn, conform, and carry out our tasks in the surrounding environment. Despite the fact that scientists have made great strides in comprehending memory, there is still much that remains a mystery. Over the past few decades, studies have revealed various types of learning and memory, each with unique cognitive and computational characteristics and relying on different brain mechanisms. The memory generally entails the processes of encoding, storing, retrieving, and consolidating information. Furthermore, mistakes or failures in recalling information can give insights into the nature and purpose of learning and memory and how they shape our behavior and future planning. These discoveries suggest that memory can be categorized based on how long information is stored and the type of stored information. Various neurological/neurodegenerative disorders, like Alzheimer's disease, Parkinson's disease, Multiple sclerosis (MS), can affect memory. Alzheimer's disease is characterized by the buildup of amyloid plaques and tau tangles in the brain, which can cause neurons to die and lead to cognitive decline, including memory loss. Parkinson's disease, on the other hand, can result in memory impairment due to the loss of dopamine-producing neurons in the brain. In contrast, Multiple Sclerosis (MS) leads to the formation of lesions in the central nervous system when the myelin and nerves are damaged, which can result in both physical and cognitive symptoms. If these lesions form on the brain regions responsible for memory processing, it can result in memory loss. Strategies such as memory aids, cognitive rehabilitation, and lifestyle changes may help manage memory problems in individuals with neurodegenerative disorders.

Dr. Jayasri Das Sarma is a professor in the Department of Biological Sciences at IISER Kolkata, India. She received her Ph.D. in 1995 from Indian Statistical Institute (Jadavpur) in collaboration with the Indian Institute of Chemical Biology. After her brief stay at IISc Bangalore as

a Research Associate, she moved to the University of Pennsylvania, Philadelphia, USA in 1997 for her post-doctoral studies and continued her work till 2003. She was then appointed as an Assistant Professor (in 2004) at the Department of Neurology, Thomas Jefferson University, Philadelphia, and in 2008 she returned to India and became an associate professor at IISER Kolkata, India. Between 2012 to 2018, she held adjunct faculty positions at the Department of Pathology, Anatomy and Cell Biology and the Department of Ophthalmology at the University of Pennsylvania. Her research work lies in Neurovirology, Neuroimmunology, and Neurobiology of disease mainly focused on murine coronavirus-induced neuroinflammation and chronic progressive myelin loss which are the pathological hallmarks of human neurological disorders like Multiple Sclerosis. Her other research interests include cervical cancer and ovarian cancer.

Prof. Jayasri has been the Elected Fellow of the Indian Academy of Neuroscience (IAN), Indian Academy of Science (IAS), and National Academy of Science, India (NASI) in 2021. She received the ASMCUE Leadership Award for International Educators from the American Society for Microbiology (ASM) in 2017 and in 2016. She received ASM-IUSSTF Indo-US International Professorship Award to develop a bilateral research relationship between India and the US in 2013.

1.3. What is a thought?

Dr. Srikanth Chandragiri, *Max Planck Institute, Germany*

We all have thoughts, but have you ever take a time to consider what a thought actually is? According to wikipedia, a thought is a conscious cognitive process that can happen even in the absence of sensory stimulation. Computers are much faster than people at performing complex tasks, but they are unable to think or come up with original ideas. Although intelligent, even supercomputers are unable to produce original ideas or thoughts. So, what is thought ?

What is the source of thought? Many neuroscientists believe that the brain is the source of thought. According to Charles Jennings, director of neurotechnology at MIT's McGovern Institute for Brain Research, "The human brain is made up of approximately 100 billion nerve cells (neurons) connected by billions of connections called synapses." On average, each connection transmits approximately one signal. per second. Some specialized connections send up to 1000 signals per second. "Somehow...this produces thoughts." Recently, The Human Brain Project released a 3D map of the human brain with micrometer resolution, which is considered Google Earth of the Brain. Despite the availability of a micrometer-resolution brain map, we are still a long way from understanding how thoughts are formed and what their source is. At this moment we don't have any convincing evidence to show neurons forming a thought. When we talk about thought, it touches on fundamental issues in neuroscience such as Consciousness, Mind, storage and retrieval of memory, etc. We often come across statements like "You are what you think". Of course, the focus here is on the mind and its ability to think, as it shapes our personality by influencing our emotions, behavior and habits. But the question is - what are thoughts and how do they affect our character? In this summer school we will discuss recent advances in neuroscience in understanding thought. We also discuss how to cultivate noble thoughts and enable us to build a better society.

Srikanth Chandragiri, currently working as a postdoctoral scientist at Max Planck Institute of Biology of Aging, Cologne, Germany. He obtained his doctorate degree in Biology from Max Planck Institute for Biology of Aging in Cologne, Germany. His research mainly focused on mitochondrial proteostasis in understanding Spinocerebellar ataxia (SCA) and Cardiomyopathy diseases. He obtained a Master's in Genetics from Osmania University. After completing his master's degree, he carried out brief research in the Notch signaling of T cell development and survival at National Centre for Biological Sciences

(NCBS) Bangalore. He also worked at University of Fribourg (UNIFR) Switzerland on the molecular mechanism of membrane contact sites (MCS) formation and its role in facilitating the transport of biomolecules between the organelles. He has been a recipient of CSIR, ICMR and DBT fellowships in India and Swiss National Science Foundation (SNSF) fellowship in Switzerland.

1.4. How to Increase Memory?

Bhaktisvarupa Brihaspati Swami, *Bhaktivedanta Institute Kolkata, India*

H. H. Bhaktisvarupa Brihaspati Swami has been the President of the Association of Ayurvedic Medicine in Europe, since 1980; presided over the Parapsy Institute in France for over 10 years. He is a Vedanta teacher at Vedanta Science Educational Research Foundation, Kolkata and taught in gurukul for 12 years. He delivered hundreds of lectures regarding health sciences and spirituality on congresses, radio, TV and authored 64 books in French about Yoga, Ayurveda, Vastu, Vedic Numerology and Sanskrit. He received training in spiritual wisdom under Dr. T. D. Singh since 1986 and he actively participated in the humanitarian welfare field in India since 1992.

Day 3

Session 1

1.1. Memory and Mind: A Vedantic Perspective

Shri K. Vasudeva Rao, *President, Bhaktivedanta Institute Kolkata, India*

Memory forms an integral part of our life, from our everyday actions to remote corners and events of our life. We rely on memory to think, feel and will. Memories of our actions, from day to day actions, to actions

performed in the distant past in this life, and to actions performed in previous lives, they all form the content of our mind and thereby shape our life and consciousness. Vedic Scriptures mention a great deal about memory and its possible relation with our human mind. The other would hear by attempting to present the importance and relationship between memory and mind in the light of ancient wisdom that has been deleted in our vedic Scriptures and some modern developments.

Vasudeva Rao is an alumnus of the prestigious IIT Kanpur (Computer Science, 1998), and is currently the President of the Bhaktivedanta Institute. He is one of the major contributors to Bhaktivedanta Institute's publications, and also the Editor of Bhaktivedanta Institute's reputed annual journal, Savijnanam – Scientific Exploration for a Spiritual Paradigm. He travels widely across India and abroad creating awareness regarding the interface of Science and Spirituality among academic and professional circles. His deep interest in the foundations of mathematics, the fundamentals of computer science and logic, and its relation to the nature of consciousness, nature of reality as well as ancient Indian texts has led him to meet and interact with renowned scholars at Harvard, Princeton, Stanford and MIT. He has delivered numerous talks on computer science and spirituality. Under his able guidance and supervision, more than 10 national conferences, two International conferences, and over 100 seminars and workshops on science and spirituality have been organized by the Institute in the past decade, which includes contributions from more than 20 Nobel Laureates and world-renowned scholars; in addition, over 200 papers have been published by the Bhaktivedanta Institute. He was a former Global Council Trustee of the United Religions Initiative.

1.2. Mysteries of Memory

Dr. Ramjee Repaka, *IIT Ropar, India*

Dr. Ramjee Repaka is an Associate Professor in the Department of

Mechanical Engineering and Center for Biomedical Engineering at IIT Ropar. He received his Bachelors degree in Mechanical Engineering from Andhra University, Masters degree in Mechanical Engineering from Jadavpur University, Kolkata and Ph.D. in Mechanical Engineering from IIT Kharagpur. He worked as Assistant Professor in the Department of Mechanical Engineering at NIT Rourkela before joining IIT Ropar. Dr Ramjee Repaka is also an Associate Editor for ASME Journal of Engineering and Science in Medical Diagnostics and Therapy, Guest Editor for a special issue on Minimally Invasive Thermal Therapies of ASME Journal of Engineering and Science in Medical Diagnostics and Therapy, Editorial Board Member of Electromagnetic Biology and Medicine and Guest Associate Editor, Diagnostic and Therapeutic Devices, Frontiers in Medical Technology. His research areas include Heat Transfer, Applied Thermal Engineering, Bioheat Transfer, Cancer Diagnosis and Therapy (RFA and MWA), Biofluid Mechanics, Refrigeration and Air Conditioning and Thermal Management of Electric Vehicles. With inspiration from Dr. T. D. Singh, he has been associated with Bhaktivedanta institute and selflessly contributed in activities on science and spirituality and their synthesis. Presently he is serving as a senior faculty member in the department of distance education at Bhaktivedanta Institute, Kolkata.

1.3. Memories in the Brain - Real and Imagined

Prof. Neeraj Jain, *IIT Jodhpur, India (former Director, National Brain Research Center, Manesar, India)*

This talk will focus on the biological underpinnings of perception and memories. I will discuss how our brain and experiences help our survival in this world; memories being an integral and essential component of the survival kit. However, our genes and experiences create an information processing system in the brain that does not always reflect the 'reality'.

Prof Neeraj Jain is Head of the School of Artificial Intelligence and

Data Science, and Professor in the Department of Bioscience and Bioengineering at IIT Jodhpur. Before joining IIT Jodhpur he was the Director of National Brain Research Centre, Manesar. He received his Post-Doctoral training in neuroscience at Vanderbilt University, Nashville, USA. While at Vanderbilt he was awarded Young Scientist Award by John F Kennedy Center for his work on the effects of spinal cord injuries on the brain. He received the prestigious International Senior Research Fellowship from the Wellcome Trust, UK to move to India and establish his laboratory at National Brain Research Centre.

His work has led to identification of many novel features of the organization of the mammalian somatosensory and motor areas, and unravelled mechanisms of adult brain plasticity following spinal cord injuries, which has implications for improving recoveries from spinal cord injuries. He has led many large multi-institutional projects on neurodegenerative diseases and common mental illnesses. Prof. Jain is a Fellow of the Indian National Science Academy (INSA) and National Academy of Sciences India (NASI). Recently he received the Haryana Vigyan Ratna Award from the Govt. of Haryana.

1.4. Dynamics of Memory – Insights from Vedanta

Er. Ruthvik Galem, *M.Tech. (Civil Engg.), IIT Bhubaneswar, India*

From a student preparing for his final exams to an engineer designing sophisticated equipment, memory plays a crucial role in our day-to-day life. What makes one remember and makes one forget things? Why are we able to recall specific things in our life and forget a few? What parameters are involved in increasing one's memory? Top universities around the world are curious to understand memory and trying to develop methods and techniques to improve our memory. In an attempt to understand the mystery of memory, Vedanta gives insights for dwelling deep into the subject matter. In this talk, I would like to present a few texts from Vedanta that deal with memory and open our thought process in deciphering the mystery of memory.

Ruthvik Galem is a civil engineer at Odisha Bridge and Construction Corporation LTD (OBCC). He received his Integrated Dual Degree with B.Tech. in Civil Engineering and M.Tech. in Environmental Engineering at IIT Bhubaneswar in 2023. His research interests include Air Pollution Assessment and Forecasting. He also received the Best B.Tech. Project Award-2022 for his excellent project on "Assessment of Level of Air Pollution in Metro Cities in India." In addition, he has a keen interest in the synthesis of science and spirituality.

Session 2

2.1. Effect of Listening to Indian Raga Bhimpalasi on EEG Power Spectrum in Adult Healthy Volunteers

Mr. Ritesh, *AIIMS Kalyani, India*

To understand the physiological effects of ragas or any music, we can study the EEG pattern and its synchronization. A synchronized EEG pattern will have higher lower frequency spectrum viz. increased power of alpha, theta and delta. Literatures point out that enhancing alpha and alpha-theta spectrum in EEG is beneficial in the management of anxiety disorders. Bhimpalasi is a raga in Hindustani music which relaxes and soothe the mind of the listener.

Ritesh Pandey is currently pursuing second year of MBBS degree from AIIMS kalyani. He is interested in exploring about human body and mind. His research interests include implementation of ragas in medical field as non pharmacological pills for treating various disorders.

2.2. Unlocking Your Learning Potential: Strategies for Improving Memory Retention

Mr. Yogesh Tambe, *B. Tech. (Mech. Engg.) IIT Bhubaneswar, India*

Learning and memorization are two of the most vital cognitive processes that shape our daily experiences. Whether it's learning a new skill or retaining important information, our ability to learn and remember plays a significant role in both our personal and professional lives. In this talk, we will delve into effective ways to enhance learning abilities and improve memory retention. We will explore various methods to boost learning, such as active learning strategies and mnemonic techniques, as well as ways to minimize distractions during the learning process. These topics are particularly crucial for students, as they can significantly impact academic success and future career prospects. By providing practical tips and insights, it is my hope that this talk will be immensely beneficial for students in both their academic and personal lives.

Mr. Yogesh Tambe is currently a Dual Degree student of Mechanical Engineering, IIT Bhubaneswar. He finished his schooling in Modern Education Society, Nasik, Maharashtra. He completed his XI & XII from Matoshree College, Nasik, Maharashtra. His research interests include, learning patterns, Dynamics of Mind, Concentration Enhancement & Consciousness.

2.3. Natural Cooperation

Prof. Martin Nowak, *Harvard University, USA*

Cooperation means that one individual pays a cost for another to receive a benefit. Cooperation can be at variance with natural selection. Why should you help competitors? Yet cooperation is abundant in nature and is an important component of evolutionary innovation. Cooperation can

be seen as the master architect of evolution and as the third fundamental principle of evolution beside mutation and selection. I will present five mechanisms for the evolution of cooperation: direct reciprocity, indirect reciprocity, spatial selection, group selection and kin selection. Global cooperation and cooperation with future generations is necessary to ensure the survival of our species.

References:

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Prof. Martin Nowak is currently a Professor of Mathematical Biology at Harvard University and Director of Harvard's Program for Evolutionary Dynamics. He is one of the leading researchers in the field that studies the role of cooperation in evolution. In 1989, he earned his doctorate in Biochemistry and Mathematics from the University of Vienna. From 1989-1998, he was Erwin Schrodinger Postdoctoral Scholar at University of Oxford. He held professorships at University of Oxford and IAS, Princeton, before moving to Harvard in 2003.

Prof. Nowak's research interests include evolution of cooperation, evolution of language, evolutionary game theory and graph theory, somatic evolution of cancer, the dynamics of viruses and infectious diseases, pre-life and origins of life. He is famous for his proposal and works in showing evolution requires a third component called "cooperation", in addition to the classical components of mutation and natural selection. Among his major discoveries are the mechanism of HIV disease progression, the first mathematical approach for studying the evolution of human language, the first quantification of the 'In

vivo kinetics' of human cancer and the five rules for the evolution of cooperation. He has published over 300 papers in the world's leading scientific journals, including several in Nature and Science. He is a highly-cited researcher with an h-index of 159. He authored many well-received books, including Virus Dynamics (2000); Evolutionary Dynamics (2006); Super Cooperators (2011) and Evolution, Games & God (2013). Prof. Nowak is a corresponding member of the Austrian Academy of Sciences. For his outstanding works, he has received enormous international recognition, including Oxford's Weldon Memorial Prize; the Albert Wander Prize of the University of Bern; the Akira Okabo Prize of the Society for Mathematical Biology; the David Starr Jordan Prize jointly awarded by Oxford, Cornell and Indiana Universities; and the Henry Dale Prize of the Royal Institution of London.

Day 4

Session 1

1.1. Modeling Transmigrating Smriti using Spectral Tensor

Prof. Sandeep Kumar, *IIT (BHU) Varanasi, India*

This talk will compare the functioning of the brain with the rules and facts based expert system software. In this presentation, we will propose a spectral tensor based model for smriti. Smriti is not merely a memory of rules and facts but it is a memory which a soul transmigrates from one body to another. It will be shown that the spectral tensor memory (smriti) is the source of genetic coding.

Dr. Sandeep Kumar is a Professor, Department of Mechanical Engineering, IIT (BHU), Varanasi. He graduated from MNREC Allahabad and completed post-graduation from BHU, Varanasi. His field of interest

is Computational Mechanics. After completing Ph.D. from IIT Delhi in the field of composite plates and shells, he has worked in various fields of research such as meshless methods, chaos theory, and wavelets etc. Before joining IIT (BHU), he worked in REC Kurukshetra, BITS Pilani and AIMST, Malaysia. He has completed several research projects for DST and BARC. He has numerous publications in international journals of repute. He has authored a popular book, "Mathematical Theory of Subdivisions - Finite Elements and Wavelet Methods", which is published by CRC press.

1.2. Memory – An Unresolved problem in AI

Mr. Sushant Sharma, *Bhaktivedanta Institute Kolkata, India*

While the recent surge in AI breakthroughs can be exhilarating, it is important to maintain a balanced perspective and acknowledge the numerous unsolved problems that persist in the field. Among these challenges, the intricacies of memory remain a significant area yet to be fully addressed.

To enable the retrieval of appropriate memories, any system, including our brains, must address a minimum of four key challenges.

1. To identify similar situations/events: This task involves recognizing patterns or cues in the current situation and comparing them to stored memories. In AI, techniques such as pattern recognition, machine learning, and deep learning have been developed to address this challenge. Cognitive science explores how the brain identifies similarities and forms associations between different events.
2. To select and recall the relevant memories in such situations: Once similar situations are identified, the next step is to retrieve relevant memories. This process involves accessing and activating specific memory traces. In AI, various memory models and retrieval mechanisms have been proposed, such as content-addressable memory and attention mechanisms. In cognitive science, research

focuses on understanding how the brain retrieves and organizes memories.

3. To apply the relevant memories to the identified similar situations: After recalling the relevant memories, the system needs to apply them appropriately to the current situation. This step involves integrating retrieved knowledge, past experiences, and relevant information to guide decision-making or action. In AI, techniques such as reinforcement learning and knowledge-based systems are used to apply retrieved memories in different contexts. Cognitive science investigates how the brain uses retrieved memories to inform behavior and cognition.
4. To time the recall and use of memory retrieval correctly: The timing of memory recall is crucial, as memories need to be accessed at the right moment to be useful. This task involves coordinating memory retrieval with ongoing cognitive processes or external events. In AI, timing and synchronization mechanisms are implemented to optimize memory recall. In cognitive science, research explores how the brain processes timing and synchronizes memory retrieval with other cognitive processes.

While significant progress has been made in AI and cognitive sciences, it is important to acknowledge that each of the tasks mentioned is highly intricate and remains largely unresolved at its core.

Sushant Sharma is a B.Tech graduate in Computer Science and Engineering from IIT Guwahati. He has a rich experience of over 15 years as an IT Professional, working with well known organizations such as CATS-pvt Ltd, TCS, Techmahindra and Roamware. After his meeting with Dr. T. D. Singh in 2000, he developed a keen interest in the domain of synthesis of science and spirituality. Under the mentorship of Dr. Singh and his students, Sushant has been exploring the studies at the interface of foundations of computer science, mathematics and consciousness, and consequently has been delivering many

talks in various conferences, seminars and workshops organized by Bhaktivedanta Institute. His study interests include foundations of set theory and computer science, Godel's incompleteness theorems and Vedanta. In 2016, he joined Bhaktivedanta Institute as full time scholar and dedicated member, and served in many crucial roles in various events and publications of Bhaktivedanta Institute. Currently, he is serving as Director of Cognitive Studies and Fine arts of Bhaktivedanta Institute and also the Director of Bhaktivedanta Institute Study center, Kalyani.

1.3. Journey of Understanding Memory in Living Systems – Developments, History and Issues

Mr. Nikhil Yenugu, *Ph. D. Scholar, IISER Kolkata, India*

The landscape of memory research beginning from Aristotle to modern times has taken major breakthroughs in identification of responsible organs for memory in living systems and advanced techniques to map the brain components for many actions of the body. In addition, many theories have been born out to address the key issues of memory - how it is encoded, how it is stored, and how it is retrieved in living systems? Inspite of collection of huge data of brain and many case studies, our understanding about complexity of memory is still surrounded by paradoxes and key fundamental issues. In this short presentation, some of the major breakthroughs which shaped our perspectives of memory and key fundamental issues would be touched upon.

Yenugu Nikhil is a second year Research Scholar in the Department of Chemical Sciences at the Indian Institute of Science Education and Research (IISER) Kolkata. He obtained his Integrated BS-MS degree in Chemistry with Physics minor from IISER-Kolkata in 2020. His research interests include Quantum Chemistry, Electronic Structure Theory and Molecular Reaction Dynamics. Apart from his academic studies, he

has a keen interest in studies at the interface of foundations of science, science of mind, memory and consciousness.

1.4. Use of AI Technology in Mimicking the Human Brain

Mr. Rajesh Pandit, *IISER Kolkata, India*

Research in artificial intelligence is underway to develop an intelligent "super machine" that can learn, compute and adapt like the human brain, and the most prominent element to do so is memory. Typically memories are associated with the past phenomenon and these memories act as the basis of a new generation of devices through AI technologies. In this talk we'll explore the emerging properties of memory and its applications in Artificial Intelligence.

Rajesh Pandit received his integrated masters in mathematics from IISER Kolkata in 2019. He is being trained in data science by IIT Madras through distance education from 2021. He has been working as an associate subject matter expert of Mathematics in Hurix Digital. His research interests include in the field of data science and artificial intelligence.

1.5. Mind and Machine: AI's Role in Memory

Er. Sai Vineeth, *B.Tech. (Computer Science Engg.), IIT Bhubaneswar, INDIA*

Machines struggle with contextual understanding, emotional memory, and recalling specific episodes. They lack creativity, autobiographical memory, and the ability to store sensory details. Machines also do not forget or selectively prioritize information."AI Dungeon" experiment, Tay Experiment. AI's Challenges to Understand and Interact with Humans.

Katta Saivineeth is presently a Data Analyst at Apollo Health and Lifestyle Limited, Hyderabad. He received his B.Tech in Computer Science and Engineering from IIT Bhubaneswar in 2022. He secured AIR - 1686 in the prestigious JEE (Advanced) in 2018. His research interests include machine learning algorithms development, web development and business analytics.

Session 2

2.1. Chip Memory vs Human Memory

Er. Jagadishwar Dasari, *M.Tech. (Geotechnical Engg.), IIT Gandhinagar, INDIA*

In the realm of information storage and retrieval, the comparison between chip memory and human memory provides fascinating insights into the capabilities and limitations of these distinct systems. This abstract presents a comprehensive analysis of chip memory and human memory, shedding light on their fundamental differences, functionalities, and respective capacities for information processing. However, chip memory is constrained by its fixed architecture, limited capacity, and lack of adaptability. On the other hand, human memory is a complex cognitive system that includes a number of unique processes, including sensory memory, short-term memory, and long-term memory. It enables sophisticated cognitive functions like pattern recognition, logic, and creativity by being able to store enormous volumes of information in a densely interconnected network. This study examines the strengths and weaknesses of chip memory and human memory from different perspectives. It explores the limitations of chip memory in terms of capacity, processing speed, and adaptability. Additionally, the analysis delves into the remarkable capabilities of human memory, including its capacity for abstraction, emotional associations, and context-dependent retrieval.

Jagadishwar Dasari who completed his Bachelor of Technology (B.Tech) degree in Civil Engineering from the prestigious Indian Institute of Technology (IIT) Bhubaneswar in 2022. Building upon his strong foundation in civil engineering, he is currently pursuing a Master of Technology (M.Tech) degree at IIT Gandhinagar, specializing in Geotechnical Engineering. Jagadishwar's research objective is to explore innovative methods and approaches to enhance the lateral capacity of piles through ground improvement techniques.

Day 5
Session 1

1.1. The Mysteries of Memory: Taxonomy, Distribution and the Purpose; Memory in AI

Dr. A. K. Mukhopadhyay, *Former Professor (AIIMS, New Delhi, India)*

The entire phenomenon of acquisition and storing data and information, experience, events and happenings, recalling and retrieval of those is called Memory. The most important part of the definition is retrievable acquired data etc., not the programmed sequence of instructions, which when fails is called memory loss. In human situations this failure is called forgetfulness. In the absence of perception there is no acquisition of information from data, and therefore no memory formation and in this sense, the memory is always biological. It means "life" is essential for the genesis of memory.

The taxonomy of memory is usually devised as observed in human situations in the context of the brain. The subcellular, cellular or intercellular signal memory or pre-attentional memory is possible in live situations since the process is supported by life and consciousness. It is also called iconic/echoic memory. It lasts for less than a second. In the memory test of minimal mental state examination (MSME), if the

patient can retrieve instantaneously the name of three items told, his working memory, which lasts for a few seconds, is fine. If he can repeat those after 5-15 minutes, the patient's short term memory is alright! Long term memory, which requires synaptic potentiation, could be explicit or implicit. Explicit memory affects behavior with awareness. When it is of facts and concepts it is called semantic memory. When it is about happenings, events and experience, the memory is called episodic. Implicit memory affects behavior without awareness. This could be perceptual memory (perceptions stored in the subconscious) and procedural memory of task, skill, conditioned reflex etc. Besides these major categories, there are exceptional conditions such as photographic memory, highly superior autobiographical memory, a kind of rarest and strongest biological memory.

Memory is distributed over biological systems and nature. Inside the brain it is said to be distributed over synapses. Human brain's memory storage capacity is estimated on the basis of the number of synaptic nodes, on the assumption that one synapse stores about one byte of information. 100 billion neurons, each making 1000 synapses. This results in 100 trillion data points, or about 100 terabytes of information. It is said that the human brain's memory storage capacity could be nearly 2.5 petabytes (a million gigabytes). This view is contested by many neuroscientists since mechanistic formulations are not applicable in biological systems. The alternate view is that the brain stores memory holographically evident from the fact that a good amount of memory still persists even after removal of hippocampus and amygdala. Also, a large amount of memory can be retrieved from a small piece of brain tissue. Within the biological system, beside the nervous system, every cell possesses its own and interactive memory. Some organs like heart store memory, and even DNAs store evolutionary memory. The example of cellular memory is vividly seen in memory B-, and T-lymphocytes of the immune system. Memories stored occasionally in a transplanted heart have been found to create disturbing situations in the recipient. In nature, memory is stored in classical holographic, quantum holographic

or information holographic ways. Computer memory, RAM, is not true memory but denotes the data storage capacity and is measured in units of bytes; megabyte, terabyte etc. However, the cache memory of computer is an example of one of the fastest retrieval of instructional memory (?)! Even some of the quantum particles have been said to have memory (?).

Why is this phenomenon of memory? What is its purpose? Memory brings dynamics of time in life. It divides time into past, present and future. Biological memory is perception-based. Memory is essential for thinking. Memory is essential for learning (not training). Without memory, there is no intelligent decision-making. If evolution is looked at as the process of error/mistake corrections, spiritual transformation is said to be a gradual process of regaining the original memory of the unity with the Source!

Considering all the above purposes critically, it could be told with confidence that even the latest model of a signal-driven, programmed artificial device of intelligence (ADI), such as chat GPT and LLM does not even have non-attentional signal memory. They are stateless! For the future of ADI, the genesis and distribution of memory in a biological cell shows the way (The Paper is in Press)!

The presentation concludes with the statement that the mystery of memory is intertwined with the mystery of "life".

Prof. A. K. Mukhopadhyay is presently Professor of Pathology, North DMC Medical College and Hindu Rao Hospital, Delhi. He was formerly Professor of Department of Laboratory Medicine at All India Institute of Medical Sciences (AIIMS), New Delhi (1985-2018). In India, he is honored as "The Father of Laboratory Medicine." He received his MBBS from University of Calcutta (1977), MD in Pathology from AIIMS, Delhi (1981). His areas of expertise are neurodegenerative disorders, like Parkinson's

disease, Alzheimer disease, vascular dementia; and neuropsychiatric disorders, like depression and stress. His works have been published in several internationally recognized publications. He is well-known for his works in the field of Consciousness. He coined the term and concept of "supracortical consciousness" in 1985 and further developed this idea integrating science, humanity and spirit. He received several international awards. Some of them are: Doctor in Science (Honoris Causa) by the Open International University for Complementary Medicine, Colombo, Sri Lanka in 1996, the 2000 'Millennium Medal' of American Biographical Institute (ABI), and the Lifetime Achievement Award by Systems Society of India (SSI) in 2018. He is a member of the International Academy of Pathology, New York Academy of Sciences, Indian Medical Association and Indian Science Congress Association. Prof. Mukhopadhyay has been long associated with the Bhaktivedanta Institute and he has delivered several stimulating lectures at the Bhaktivedanta Institute's annual conferences and seminars.

1.2. Physiology of Memory: Before we forget

Dr. Sanjay Kumar Patel, *AIIMS, Kalyani, India*

Memory is a complex and multifaceted cognitive process essential for learning, adapting, and functioning in the world. It encompasses the encoding, storage, and retrieval of information by the brain. Memory can be broadly categorized into two types: declarative and nondeclarative. Declarative memory involves conscious recollection of facts and events and can be further divided into semantic memory, which stores general knowledge, and episodic memory, which retains personal experiences tied to specific times and places. Non-declarative memory operates unconsciously and includes procedural memory, responsible for acquiring skills and habits like riding a bike or playing an instrument, and priming, where exposure to a stimulus influences subsequent perception or behavior.

Memory involves neural changes in the brain and the interaction of

different brain regions. The hippocampus and the medial temporal lobe play a crucial role in the formation and consolidation of declarative memory, particularly episodic memory. The hippocampus acts as a temporary storage site, with memories eventually transferred to other parts of the cerebral cortex for long-term storage. The medial temporal lobe interacts with the prefrontal cortex and the amygdala to integrate information and modulate memory based on relevance and emotional significance. Procedural memory relies on the basal ganglia and the cerebellum, which are involved in motor learning and coordination. The basal ganglia interact with the striatum and the thalamus to select and execute actions based on rewards and feedback. The cerebellum, in conjunction with the motor cortex and brainstem, fine-tunes motor commands and maintains balance and posture. Priming, another form of memory, involves various brain regions depending on the type of processing. Perceptual priming is influenced by sensory areas such as the occipital and temporal lobes, while semantic priming is mediated by language areas like the inferior frontal gyrus and the posterior temporal gyrus.

At the cellular level, synaptic plasticity serves as the foundation for memory formation. Long-term potentiation (LTP) and long-term depression (LTD) are recognized as cellular models of memory consolidation, highlighting the role of synaptic strengthening, and weakening in memory storage. These mechanisms involve the modulation of neurotransmitter receptors, particularly glutamate receptors such as NMDA and AMPA receptors.

Memory is a dynamic and adaptable process influenced by various factors. Attention plays a vital role in selecting and enhancing the encoding and retrieval of relevant information. Motivation assigns value to information, improving its encoding and retrieval. Emotion affects memory by assigning emotional significance to information, enhancing, or impairing its encoding and retrieval based on congruence with one's mood. Interference occurs when competing or conflicting

information hinders the encoding or retrieval of other information. Distortion arises when inaccurate or incomplete information alters the encoding or retrieval of other information. Sleep is being studied extensively in relation to memory by modern day researchers.

Memory research seeks to comprehend memory processes across behavioural, cognitive, and neural levels and explores interventions that can enhance or impair memory. It utilizes diverse methodologies including behavioural experiments, neuroimaging, genetics, and computational models. Research has practical applications in fields like education, cognitive aging, dementia, neurological and psychiatric disorders, artificial intelligence, and providing insights into human nature.

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Dr. Sanjay Kumar Patel is an associate professor Department of Physiology, All India Institute of Medical Sciences (AIIMS), Kalyani. He received his MBBS in 2009 from King George's Medical University, Lucknow. He obtained his MD in physiology from Dr. B.R. Ambedkar University, Agra (affiliated). He rendered clinical services at AIIMS, New Delhi and Paras Hospital, Gurugram, Haryana as Neurophysiology consultant before joining AIIMS Kalyani in 2019. His research area of interests include Neurophysiology, Intraoperative Neurophysiological Monitoring, Medical education, Nutrition and metabolism. He is a Life member of The Association of Physiologists and Pharmacologists of India and The Physiological Society of India.

1.3. Memory: Past Life & Reincarnation: Scientific study and Vedic Concepts

Er. Niket Kumar Jha, *B. Tech. (EEE), CMRIT, Bangalore*

Mind is the controlling element of memory but is the mind constrained to a body or is the dynamics beyond the body? In this presentation, I would cover the study carried out by University of Virginia researchers about the past life memories and reincarnation. The concepts and mysteries came across through these case studies pointing out the mystery of mind is beyond the body. I would also explore the science of mind and memory from a vedantic perspective as well.

Niket Kumar Jha has obtained his Bachelor's of Engineering in EEE from CMR Institute of Technology, Bangalore in 2017. He is undergoing training in Vidyut Sahayak in Gujarat Electrical Board. His interests include Power system studies, Electronic devices instrumentation, switchgear and protection designing and new renewable energies. He is also interested in the synthesis of science and spirituality.

1.4. Memory and Karmic Patterns - A Vedantic Perspective

Dr. Hare Krishna Mohanta, *BITS Pilani, Rajasthan, India*

According to Shrimad Bhagavad Gita, the crest jewel of the Vedanta Philosophy, smriti or memory is not a product of material or neuronal interaction in the brain, but is a function of the super soul residing in the heart. The super soul reserves the right to preserve or delete certain packets of information and then supply the same to the mind through the soul (self) which is also residing in the heart, near to the super soul. That past information is reflected as the memory of the living entity. It is the main function of the mind and forms the basis of our identity in life. The mind is rooted in memories and forgetfulness (vismriti)

that we have built up over time. When the memories are pushed down to a subconscious level, the detailed information is lost but only the impressions remain. These impressions are called karmic patterns or samskaras. In this article we will present a Vedantic model of smriti (memory) and samskaras (karmic patterns).

Dr. Hare Krishna Mohanta is an associate professor in the Department of Chemical Engineering in BITS Pilani Rajasthan. He obtained his B.E. (Chemical Engineering) in 1995 from NIT Rourkela, M.Tech (Chemical Engineering) in 1998 from IIT Kanpur, and Ph.D. in Chemical Engineering in 2006 from BITS Pilani. He has been teaching in BITS Pilani since 1998.He worked in Indian Rare Earths Ltd (a Govt. of India undertaking) from 1995 to 1996. He is a member of the Indian Institute of Chemical Engineers (IIChE). His research interests include advanced process control, process monitoring and control, sensors and microreactors, catalysis and pyrolysis, applied wavelet analysis, reactive distillation, modeling, simulation and consciousness studies. He has published numerous peer-reviewed papers in international journals of repute and many conference papers. He is keenly interested in Vedantic studies of consciousness.

Session 2

Prof. Ramgopal V. S. Uppaluri, IIT Guwahati, India

Prof. Ramagopal Uppaluri obtained B.Tech. (Chemical Engineering) from Andhra University, Visakhapatnam, M.Tech. (Chemical Engineering) from IIT Kanpur and Ph.D. (Process Integration) from University of Manchester, England. After a brief post-doctoral research at Robert Gordon University, Scotland, he joined IIT Guwahati and became the youngest Professor of IIT Guwahati in a very short span of time. He has diversified research profile in areas of chemical engineering, petroleum science and technology, computational mathematics and

food science and technology. He has published 115 international journal publications and has filed three Indian patents in the fields of surfactant enhanced oil recovery and palladium composite membranes. For about two decades, Prof. Uppaluri served in various capacities to assist and promote the activities of the Bhaktivedanta Institute, Kolkata. He received training and guidance from Dr. T. D. Singh to imbibe holistic aptitude towards the synthesis of science, philosophy and spirituality. He served the organization of the AISSQ conference series in several capacities as well as contributed several articles ranging from wider topics such as time dimension, origin of life, death, embryology and consciousness, consciousness studies etc. He has been instrumental in evolving Diploma and Certificate Courses in Science-Spirituality. Presently, he is serving as the Honorary Director of the Department of Education of the Bhaktivedanta Institute, Kolkata.

About Bhaktivedanta Institute

The Bhaktivedanta Institute was founded by His Divine Grace A. C. Bhaktivedānta Swami Prabhupāda in Vrindavan in August 1974. Śrīla Prabhupāda was one of the greatest exponents of Vedic culture in the 20th Century. He strongly felt that modern civilization is completely misdirected by scientific materialism and there is an urgent need to introduce the spiritual knowledge and wisdom of the *Bhagavad-gītā* and the *Śrīmad-bhāgavatam*, the essence of all the Vedic literatures, to the scientists, philosophers, scholars and students of the world. He noticed that all the prestigious academic institutions and universities of the world were teaching many different subjects but they had left out the most important branch of knowledge—the science of the soul. He envisioned that this spiritual knowledge of life would help restore an ethical culture for modern society. Thus, there would be hope for bringing lasting happiness and world peace. He felt that introducing this spiritual culture should be the contribution of India for the welfare of humanity. Śrīla Prabhupāda appointed his disciple Dr. T. D. Singh (Bhaktisvarūpa Dāmodara Swami) as the director of the Institute from its very inception and left several instructions to him to carry forward his vision.

The Bhaktivedanta Institute is a center for Advanced Studies in Science and Vedānta and focuses on a consciousness-based paradigm. This spiritual paradigm has a unique potential to resolve the mind-body problem, the question of evolution and life's origin and many

other philosophical and ethical concerns. Thus, this paradigm will have profound significance for science, religion, and their synthesis. One of the primary objectives of the Bhaktivedanta Institute is to present this paradigm for the critical attention of serious scholars and thinkers throughout the world. As such, the Institute supports a closer examination of existing scientific paradigms in cosmology, evolution, physics, biology, and other sciences. The Institute also promotes scientific, philosophical and religious dialogues among scientists, scholars and theologians of the world covering various common conceptual grounds of science and religion for the purpose of creating a better and harmonious understanding among all people. In order to achieve these goals, the Institute organizes international conferences regularly and publishes books and journals. Interested persons may contact the secretary of the Institute at:

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About Nabadwip

Nabadwip, also known as Nabadwip Dham or Nabadwip Mandala, is a historically significant town located in the Nadia district of the Indian state of West Bengal. Nabadwip has a rich tradition of attracting scholars and spiritual seekers from various disciplines. The town has been a center of learning and intellectual pursuits for centuries and inaddition it holds immense historical and cultural importance as it is considered the birthplace and center of the Vaishnava movement, particularly in the realm of Gaudiya Vaishnavism and the teachings of Sri Chaitanya Mahaprabhu. Here are some key points highlighting the historical importance of Nabadwip:

1. **Birthplace of Sri Chaitanya Mahaprabhu:** Nabadwip is renowned as the birthplace of Sri Chaitanya Mahaprabhu, who was born in 1486 CE. He is considered an incarnation of Lord Krishna by his followers and is revered as a great saint and religious reformer. Sri Chaitanya Mahaprabhu's teachings and his establishment of the congregational chanting of the Hare Krishna mantra had a profound impact on the religious and social fabric of India.
2. **Center of the Bhakti Movement:** Nabadwip served as the epicenter of the Bhakti Movement in medieval India. Sri Chaitanya Mahaprabhu's teachings emphasized the path of devotion (bhakti) as the means to attain spiritual enlightenment and connect with God. His teachings inspired a wave of devotional fervor and brought about a revival of Vaishnavism, influencing the religious landscape of the time.
3. **Pilgrimage Destination:** Nabadwip is a significant pilgrimage site for devotees of Gaudiya Vaishnavism. The town is divided into nine islands (or dweeps) that represent different aspects of

Krishna's activities. Devotees visit these sacred sites, known as navadwip dham parikrama, to seek spiritual blessings and immerse themselves in the devotional atmosphere.

4. **Associative Sites and Temples:** Nabadwip houses numerous temples and sites associated with Sri Chaitanya Mahaprabhu and his followers. The Sri Chaitanya Math, established by Bhaktisiddhanta Sarasvati Thakura, is an important institution dedicated to preserving and propagating the teachings of Sri Chaitanya Mahaprabhu. The town also features the renowned Radha-Madhava temple, which is considered a prominent Vaishnava shrine.
5. **Cultural Significance:** Nabadwip has been a melting pot of culture and spirituality for centuries. It has been a center of learning, where scholars and devotees have gathered to study scriptures and discuss religious philosophy. The town has also been a hub for arts and music, with various festivals and cultural events celebrating the life and teachings of Sri Chaitanya Mahaprabhu.

Nabadwip is a place where devotees and scholars immerse themselves in the teachings, practices, and devotional atmosphere of Gaudiya Vaishnavism. Its historical, religious, and cultural importance make it a significant destination for those seeking spiritual growth and a deeper understanding of the tradition.

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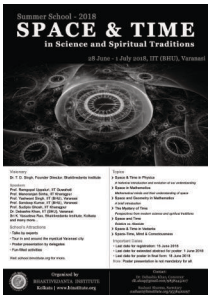

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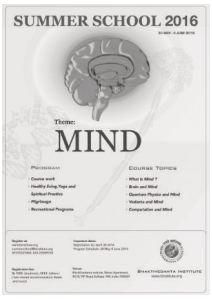

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Appreciations by past Summer School Participants

The way every lecture was presented, strong arguments were given to prove their points and they really widen my thinking.

– Prajwali Praveen Khirid

I liked how you connected spirituality to science and explained it very clearly and scientifically.

– Anitha Mandala

These kind of arrangement for delivering value education even at this pandemic influence where people are so much in depression and exhaustion being unable to be free to communicate properly outside. I am very much impressed with the beautiful arrangement made by BHAKTIVEDANTA INSTITUTE who worked so hard by themselves for the welfare of everyone. Thank you.

– Brajalika Devi

What was most amazing was that everyone, in their own way has to the best of their ability tried to expand, explain the existing facts and give a theory to what may be... And that's the first step to any research. This platform has been a yardstick to measure up against the best in the field, a way to glance at it through a window of safety (i.e. students life) and prepare for what's expected in the field to come up successful if we step into research.

– Akash Dilip Tejwani

I liked the in depth knowledge and dedication of each of the teachers for their research.

– Siddharth Panwar

I really loved the explanation of Vedic perspective and why Science can't explain origin of life. Especially the session by Prof. Wickramsinghe and Prof Tour.

– Ravi Garg

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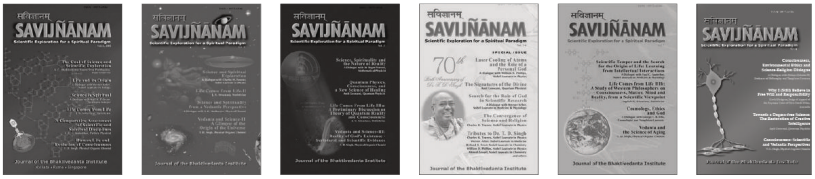

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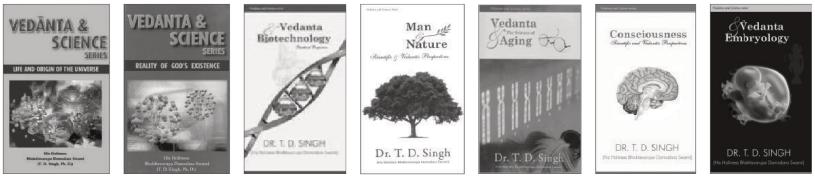

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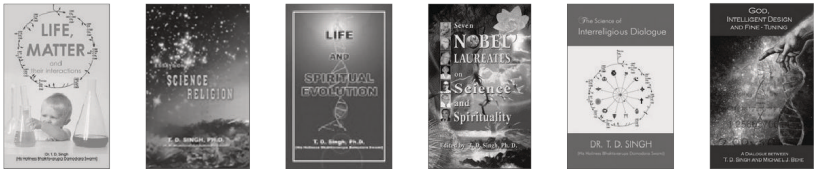

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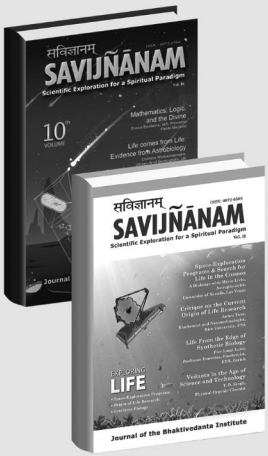

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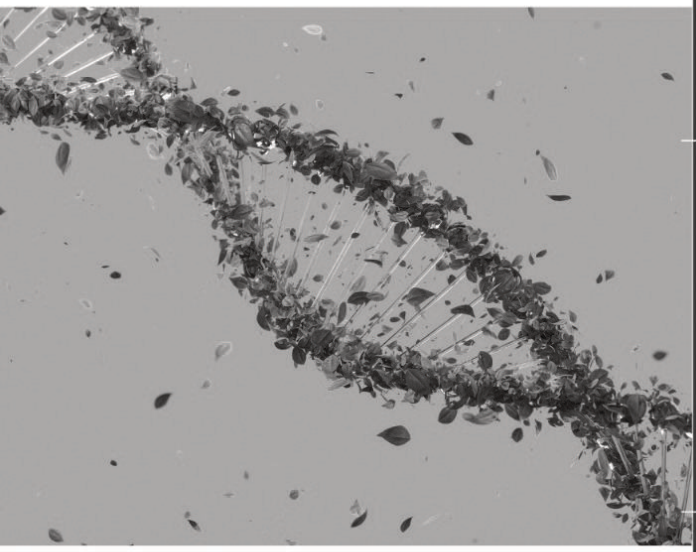

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