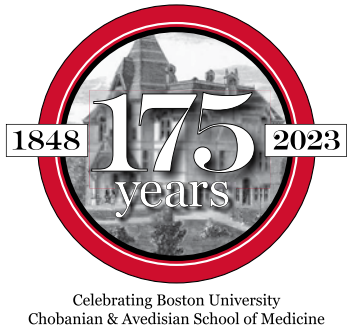

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Boston University
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School of Medicine

Department of Anatomy
& Neurobiology

Deepak N. Pandya, MD
Memorial Symposium
& Celebration

BOSTON UNIVERSITY

Thursday, June 15, 2023

Eichenbaum Room
Rajen Kilachand Center at Boston University
610 Commonwealth Avenue
Boston, Massachusetts

Symposium Program

9:00 am — Welcome and Introduction
Jennifer I. Luebke, PhD; Jeremy Schmahmann, MD; and Kathleen Rockland, PhD

9:15 — **M. Marsel Mesulam, MD**
Deepak Pandya and the Triumvirate of Neoconnectivism

9:45 — **Brent A. Vogt, PhD**
Dee and Me: The Early Years at Boston City Hospital

10:00 — **Elliott Mufson, PhD**
Dee and Me at the Bedford VA

10:15 — **Albert Galaburda, MD**
The Dual Origin Concept: Historical Notes

10:30 — Discussion and Break

11:00 — **Mark Hallett, MD**
Revisiting the Early Studies of Cortical Auditory Connections

11:15 — **Gene J. Blatt, PhD**
From India Ink to AI:
Mapping the Cellular Distribution in the Brain

11:30 — **Kathleen Rockland, PhD**
Cortical Feedback: A (very) Short Review and Open Questions

11:45 — **Maria (Maya) Medalla, PhD**
Comparative Features of Local Circuit Interneurons in Mouse and Monkey Primary Visual and Frontal Cortices

12:00 pm — **Ana Solodkin, PhD**
The Journey from Anatomy to Brain Dynamics

12:15 — Discussion and Lunch Break

2:00 — **Helen Barbas, PhD**
Amygdalar Pathways for Cognitive-emotional Interactions Through Thalamus and Prefrontal Cortex

2:15 — **Michael Petrides, PhD**
Fronto-temporal Interactions and the Semantic System

2:30 — **Jean Augustinack, PhD**
Characterizing Individual Variability of the Entorhinal Subfields in Health and Disease

2:45 — **Douglas Rosene, PhD**
Hippocampal Efferents to Cortex and the Creation of the Pandya Monkey Connectome Archive

3:00 — Discussion and Break

3:15 — **Catherine Stoodley, PhD**
Cerebellar Modulation of Cognition and Cognitive Networks

3:45 — **Xavier Guell Paradis, MD, PhD**
Diaschisis in the Human Brain Reveals Specificity of Cerebrocerebellar Connections

4:00 — **Nikos Makris, MD, PhD**
A Proposed Structural Connectivity Matrices Approach for Brain Fiber Tracts Following a Comparative Inferential Approach of Extrapolation

4:15 — **Jeremy Schmahmann, MD**
The Method Creates the Result:
An Exploration of the Fronto-occipital Fasciculus

4:30 — Discussion and Closing

5:00 — Reception

Symposium Speakers

Jean Augustinack, PhD, received her doctorate from the University of Iowa in 1999 and then completed her postdoctoral fellowship at Harvard Medical School and the Alzheimer's Unit at Massachusetts General Hospital. She is on the faculty in the Department of Radiology at Massachusetts General and director of the Quantitative Pathology (QPATH) lab at the Martinos Center for Biomedical Imaging. Her lab focuses on investigating the regional and neuronal vulnerability in aging and Alzheimer's disease. The lab also validates and creates anatomy- and pathology-based maps for neuroimaging biomarkers. She is an associate editor at the *Journal of Alzheimer's Disease*, a member of the Hippocampal Subfield Segmentation Group, and co-directs and teaches the Neuroanatomy and Neuropathology course at Harvard Medical School HST program.

Helen Barbas, PhD, is a professor in the Department of Health Sciences at BU's College of Health & Rehabilitation Sciences: Sargent College. She studied neuroscience at McGill University (PhD) and Harvard Medical School (postdoctoral). She established the Neural Systems Laboratory at Boston University, funded by grants from the National Institutes of Health (NIMH and NINDS), the National Science Foundation, and Autism Speaks. Her research focuses on the organization of the cerebral cortex, and specifically on the pattern and synaptology of prefrontal pathways with excitatory and inhibitory systems, as well as influences from the amygdala and hippocampus through the thalamus for the synthesis of signals associated with cognition, memory, and emotions. Her work has led to establishment of the predictive Structural Model, which links the laminar structure of the cortex to connections, development, the stability/plasticity continuum within the cortical mantle, and preferential vulnerability of some areas to neurodegenerative and psychiatric diseases.

Gene Blatt, PhD, received his doctorate in Neuroanatomy from Thomas Jefferson University School of Medicine Department of Anatomy (1985); Postdoc at Salk Institute (1985–1987) in Neurophysiology; 26 years at Boston University Chobanian & Avedisian School of Medicine (1987-2013) reaching Full Professor level; Director of Neuroscience at the Hussman Institute for Autism in Baltimore (2013–2020). Areas of research included the neuroanatomy and neurophysiology of the cerebellum, basal ganglia, and the limbic system. While at BU, he worked with Drs. Doug Rosene and Dee Pandya on the anatomy and physiology of the hippocampal formation and parahippocampal gyrus in the rhesus monkey mapping out afferent and efferent connectivity throughout the brain. Later in his career, Dr. Blatt's attention turned to the neurodevelopmental disorder autism, initially in his work with Drs. Margaret Bauman and Tom Kemper and later independently and collaboratively with Dr. Jean-Jacques Soghomonian. Over 20 years of ASD research led to a plethora of novel discoveries that have greatly impacted understanding of the disorder. Dr. Blatt is now retired and lives in Fort Collins, Colorado.

Albert Galaburda, MD, is the Emily Fisher Landau Professor of Neurology, Emeritus, at Harvard Medical School. His work spanned four decades and focused on cerebral lateralization, cortical architectonics and connectivity, and the neural basis of developmental dyslexia. His mentors included Norman Geschwind, Thomas Kemper, Deepak Pandya, Heiko Braak, and Friedrich Sanides.

Xavier Guell Paradis, MD, PhD, focuses his research on systems neuroscience of the cerebellum. His academic work described a triple representation of nonmotor function in the human cerebellum using functional MRI analyses, unmasked the functional gradients that define its macroscale organization, and used these novel neuroanatomy principles to better understand cerebellar abnormalities in multiple patient populations. In the domain of behavioral analyses, Dr. Guell Paradis' research described new patterns of language, social cognition, and other cognitive abnormalities in patients with cerebellar injury. He completed postdoctoral research training at MIT, neurology residency training at Harvard Medical School, and will join NYU as a Movement Disorders Fellow in July 2023.

Mark Hallett, MD, is a National Institutes of Health (NIH) Distinguished Investigator Emeritus, after leading the National Institute of Neurological Disorders and Stroke (NINDS) Human Motor Control Section from 1984 to 2022. He is currently the immediate Past-President of the Functional Neurological Disorder Society and was President of the International Parkinson and Movement Disorder Society, President of the International Federation of Clinical Neurophysiology, and Editor-in-Chief of *Clinical Neurophysiology*. His work mainly deals with principles of motor control and the pathophysiology of movement disorders. As a medical student, he spent the summer of 1967 working with Dr. Pandya.

Nikos Makris, MD, PhD, is an internationally known neuroanatomist, imager, and trained psychiatrist whose work is principally in human and nonhuman primate quantitative neuroanatomy and the development of imaging methodologies that translate basic brain science into the clinical domains of psychiatry, neurology and neurosurgery. He pioneered a structural connectivity framework for MRI based on classical human and comparative literature on white matter connections in the brain. Dr. Makris is a Professor of Psychiatry at Harvard Medical School and the Director of the Center of Morphometric Analysis at Massachusetts General Hospital.

Maria (Maya) Medalla, PhD, obtained her bachelor's degree in Biology at the University of the Philippines, and then went on to get her PhD at Boston University under the mentorship of Helen Barbas. She did her postdoc with Jennifer Luebke, holding a K99/R00 Pathway to Independence Award. She became faculty in the Department of Anatomy & Neurobiology at Boston University Chobanian & Avedisian School of Medicine, where her research program combines cellular in vitro electrophysiological methods with multi-scale anatomic techniques to understand the biophysical and synaptic properties of prefrontal cortical (PFC) circuits in nonhuman primate and rodent animal models. Her expertise includes patch-clamp recording, pathway tract-tracing, multiple immunohistochemical labeling techniques for light and electron microscopy (EM), 3D serial EM, and confocal microscopy. The major goal of her work is to understand how distinct excitatory and inhibitory microcircuits and limbic, sensory, and motor networks interact within the PFC. Her current focus is on the medial prefrontal anterior cingulate cortex (ACC) in rhesus monkeys, an area important for attention, emotions, and context-to-action transformations, selectively disrupted in many affective disorders such as depression and anxiety disorders.

M. Marsel Mesulam, MD, was a student of Drs. Pandya, Van Hoesen, and Geschwind at the Harvard Neurology department of Boston City Hospital from 1970 to 1976. Formerly Professor of Neurology at Harvard Medical School, he is currently Ruth Dunbar Davee Professor of Neuroscience at Northwestern University Feinberg School of Medicine and Founding Director Emeritus of the Mesulam Center for Cognitive Neurology and Alzheimer's Disease.

Elliott Mufson, PhD, has investigated the neurobiology of dementia for more than 30 years and is currently an Institutional Professor in the Departments of Translational Neuroscience and Neurology and the Greening Chair in Neuroscience at the Barrow Neurological Institute, Phoenix, AZ. He began his training at the Harvard Medical School, working in the Department of Neurology headed by Professor Norman Geschwind. During this period, he worked with Drs. Mesulam and Pandya on a series of classic articles on connectivity in the nonhuman primate brain. He was recruited to help develop the Sun Health Research Institute, Sun City, AZ, for the study of aging and Alzheimer's disease (AD) as the Associate Director, where he assisted in the development of what is now one of the more prestigious human AD brain banks in the country. In 1991, he was recruited to the Department of Neurological Sciences at Rush University Medical Center in Chicago, IL, to create a research program in the molecular biology of presymptomatic AD and was instrumental in providing the impetus and development of what is now the highly regarded

NIA-supported Rush Religious Order Study. His research has always been translational as evidenced by the influence of his studies on nerve growth factor and its receptors as a therapeutic tool to treat cholinergic cell degeneration in AD. The Institute for Scientific Information recognized him as one of the most highly cited researchers in neuroscience.

Michael Petrides, PhD, focuses his research on neuropsychological examination of patients with brain damage with various tasks developed to assess specific aspects of executive function and behavioral assessment of the effects of selective excisions of prefrontal cortex in macaque monkeys. In addition, he has conducted functional neuroimaging studies in normal human subjects to assess specific activation in cortical areas. These studies established the role of the mid-dorsolateral prefrontal cortex (areas 46 and 9/46) in the monitoring of information in working memory, the role of area 8 in the allocation of attention and the ventrolateral prefrontal cortex in the selective retrieval of information. Dr. Petrides has carried out various neuroanatomical studies with Dr. D. N. Pandya that included a comparative cytoarchitectonic map of the human and macaque monkey prefrontal cortex. His academic appointments include Professor, Department of Neurology and Neurosurgery, Montreal Neurological Institute, McGill University and Department of Psychology, McGill University (1991–); Distinguished James McGill Professor (since May 1, 2022) to recognize exceptional research accomplishments. Education: BSc University of London, UK, 1972; MSc in Neurological Science (Neuroanatomy and Neurophysiology), University of London, UK, 1974; PhD University of Cambridge, UK, 1977; Postdoctoral Research Fellow, McGill University (March 1, 1977–February 28, 1979); Research Fellow in Neurology, Department of Neurology, Harvard University, Beth Israel Hospital (April 1–August 31, 1979).

Kathleen Rockland, PhD, did her graduate work with Dr. Pandya ("Cortical Connections of the Occipital Lobe in the Rhesus Monkey," PhD, 1979), and then sequential postdocs with John Allman (Caltech, 1978–1979) and Jennifer Lund (1980–1982, MUSC). Returning to Boston with her first R01, she worked on modular patterns of horizontal intrinsic connections before moving back to extrinsic cortical connections, visualized at the level of anterogradely labeled single axons (~1989–2006). From 1991 to 2000, she was in the Department of Neurology at the University of Iowa, which, with Gary Van Hoesen, had become a robust and productive Midwest branch of the Pandya Family. Continuing westward, she joined RIKEN Brain Science Institute as lab head (2000–2010); and then, coming full circle, returned to BU Anatomy & Neurobiology in 2012.

Douglas Rosene, PhD, received his BA in Psychology from Stanford University where he worked in the laboratory of Dr. Karl Pribram, one of the pioneers in neurobiological studies of memory systems in primates. He received a joint PhD in Psychology and Neurobiology from the Department of Psychology and the Center for Brain Research at the University of Rochester, where Garth J. Thomas was his advisor. He came to Boston in 1974 for a postdoctoral fellowship in primate neuroanatomy with Drs. Deepak N. Pandya and Gary W. Van Hoesen at the Harvard Neurological Unit at Beth Israel Hospital before assuming an Assistant Professorship in the Department of Anatomy at Boston University Chobanian & Avedisian School of Medicine in 1978. He is currently a Professor of Anatomy & Neurobiology and Co-Director of the Laboratory for Cognitive Neurobiology at BU. His major research focus is on the neurobiological bases of learning and memory in primate models of amnesia, dementia, and age-related disorders, as well as studies of neural plasticity and recovery of function in a monkey model of limited, reproducible, cortical stroke. These studies utilize methods ranging from behavioral assessments of brain function to quantitative neuroanatomy and histopathology of monkey brain in search of the neural bases of brain function.

Jeremy Schmahmann, MD, FAAN, FANA, FANPA, is Professor of Neurology at Harvard Medical School (HMS), and Senior Clinical Neurologist at the Massachusetts General Hospital (MGH), where he is Founding Director (1994) of the MGH Ataxia Center, Director of the Laboratory for Neuroanatomy and Cerebellar Neurobiology, and a founding member of the Cognitive Behavioral Neurology Unit. Dr. Schmahmann received his medical degree with distinction at the University of Cape Town in South Africa, completed residency in the Neurological Unit of the Boston City Hospital, and postdoctoral fellowship with Dr. Deepak Pandya in the Department of Anatomy & Neurobiology at Boston University. He is a Fellow of the American Academy of Neurology, American Neurological Association, and the American Neuropsychiatric Association. Dr. Schmahmann's clinical and research efforts focus on the anatomical substrates of intellect and emotion, and the clinical neurology and basic science of the ataxias and other cerebellar disorders. He described the cerebellar cognitive affective syndrome, was awarded the Norman Geschwind Prize in 2000 from the American Academy of Neurology and the Behavioral Neurology Society for pioneering the field of the cognitive neuroscience of the cerebellum, and was inducted as Scholar in the Academy at Harvard Medical School in 2002. The Schmahmann and Pandya monograph, *Fiber Pathways of the Brain*, Oxford University Press, won the award for best book in the category of medical publications in 2006 from the Association of American Publishers.

Ana Solodkin, PhD, is a biophysicist and neuroanatomist by training; she applies innovative informatics methods to understanding pathological mechanisms responsible for cognitive decline in aging and neurodegeneration. For this, she takes a connectivity-based multi-scale approach where individualized patient connectomes are used in brain simulations to generate local neural population dynamics, and via mathematical solutions, to produce functional signals.

Catherine Stoodley, PhD, is a Provost Associate Professor of Neuroscience at American University, where she is the director of the undergraduate Neuroscience program. She completed her graduate training at the University of Oxford with Professor John Stein and postdoctoral fellowship with Professor Jeremy Schmahmann at Massachusetts General Hospital. The Stoodley Lab investigates the role of the cerebellum in cognition and cognitive development, including neurodevelopmental conditions such as autism. She uses a variety of experimental techniques to better understand the contribution of the cerebellum to typical and atypical cognition, including functional and structural neuroimaging, transcranial direct current stimulation, and lesion-symptom mapping in patient populations. The ultimate goal of this work is to improve outcome prediction and therapeutic options for a range of clinical conditions affecting the cerebellum.

Brent Vogt, PhD, was among the first technicians of Dr. Pandya, who served as an early mentor and provided him with the tools to begin a productive career. Dr. Vogt has spent his long career studying the structure and functions of cingulate cortex in five species: rat, mouse, rabbit, monkey, and human. His current interest is investigating brain impairments resulting from physical trauma in a rabbit adolescent model of such treatment.

In memoriam:

Deepak N. Pandya

December 6, 1932 to October 4, 2020

By Jeremy D. Schmahmann

Deepak N. Pandya passed away from natural causes at the age of 87 in Venice, Florida, on October 4, 2020, surrounded by his family. Dr. Pandya was Emeritus Professor of Anatomy and Neurobiology at Boston University Chobanian & Avedisian School of Medicine, one of the world's foremost neuroanatomists of the 20th and early part of the 21st centuries, and a pioneering researcher into the cortical organization of the nonhuman primate brain.

Dr. Pandya, known affectionately by almost all who knew him as Dee, was born in the village of Jhulasan in the western state of Gujarat in India. He obtained his undergraduate and MD degrees from Gujarat University in 1957, completed internship at the V.S. Hospital in Junagadh in 1958, and relocated to the Case Western Reserve University in Cleveland, Ohio, for internship and residency in Internal Medicine. He expressed interest in neuroanatomy early on and wrote seeking guidance from Walle Nauta, Professor of Neuroanatomy at the Massachusetts Institute of Technology (MIT). Dr. Nauta steered Dr. Pandya to Hans Kuypers, Professor of Anatomy at Case Western. There, as a postdoctoral fellow, Dr. Pandya began the journey that was to define the rest of his prolific career. As Kathy Rockland, Dr. Pandya's first graduate student, points out, the early ablation–degeneration methods using the Nauta and Fink–Heimer staining techniques to study neural pathways were not for the faint of heart. Only a few could master them to obtain reliable data, and Dr. Pandya was in that small group, demonstrating from the outset his meticulous approach to the study and interpretation of cortical organization and connections.

In 1965, Dr. Pandya presented his work-in-progress with Dr. Kuypers on corticocortical connections in the rhesus monkey at a Motor Control Symposium at MIT. Dr. Norman Geschwind, whose "Disconnexion Syndromes in Animals and Man" had just been published, was in the audience. He immediately recognized the importance of the work, particularly as it related to the frontal lobe connections of the auditory association areas. He invited Dr. Pandya to join the Aphasia Research Center at the Boston Veteran's Administration (VA) Medical Center as an Assistant

Professor in the Departments of Anatomy and Neurology at Boston University, which he did in 1966.

When Dr. Geschwind became chair of the Harvard Neurological Unit of the Boston City Hospital three years later, Dr. Pandya moved with him to establish the Neuroanatomy Laboratory on the 10th floor of the Medical Building. Dr. Pandya assembled a prolific team of connectional neuroanatomists whose studies provided the anatomical underpinning of the evolving theoretical ideas about language areas of the cortex and the pathways that support their interaction. After Dr. Geschwind moved from the Neurological Unit to the Beth Israel Medical Center in 1974, Dr. Pandya joined the faculty of the Edith Nourse Rogers Memorial VA in Bedford, Massachusetts, where he worked as an internist while directing his neuroanatomy laboratory. Throughout this time, Dr. Pandya inspired students in his lectures and tutorial sessions in Experimental Neuropathology at Harvard Medical School and in Neuroscience courses at BU, and he served as mentor and teacher to countless students, trainees, and colleagues over the years. He retired from the VA in 1995, relocating to the quiet sanctuary of his office at BU, or his solarium in Falmouth, on Cape Cod, where he continued to write, collaborate, and innovate until his retirement from academia in 2015.

Throughout his almost six-decade career, Dr. Pandya collaborated with an international Who's Who of neuroanatomical colleagues, many trained personally by him. The first seminal publication that attracted Dr. Geschwind's attention (Pandya DN, Kuypers HG. Cortico-cortical connections in the rhesus monkey. Brain Res. 1969;13(1):13-36) was followed by investigations into cytoarchitectonics and connectivity using contemporary staining and tract tracing techniques. He focused on the comparatively uncharted limbic areas of the entorhinal cortex and cingulate gyrus, the prefrontal cortices, auditory and visual association areas, posterior parietal cortex, and temporal association areas, and later subcortical structures, targeting corticothalamic, corticostriatal, and corticopontine projections. These publications are classics in the field and continue to be cited. His studies on the fiber tracts of the brain in monkeys predated human in vivo magnetic resonance tractography, and when he directed his attention to this new imaging modality, he was able to translate these pathways into the human brain, providing new insights into the brain basis of behavior.

Dr. Pandya built on earlier concepts of brain evolution dating back to the early part of the 20th century by another of his mentors, the great scholar of cytoarchitectonics, Friedrich Sanides. Dr. Pandya's extensive,

systematic investigations were driven by the search for the principles underlying brain organization. His findings revealed empirical evidence for a predictable and orderly relationship between brain evolution, architecture, connections, and functions, and advanced the evolutionary hypothesis of the dual hippocampal–olfactory origin of the cortex proposed by Raymond Dart and A. A. Abbie. Dr. Pandya's insights, in particular the discovery of the missing link between architecture and connections embedded in the root, core, and belt arrangement of the dorsal and ventral streams, prompted the eponymous designation of the Dart–Abbie–Sanides–Pandya hypothesis of the dual origin of the cerebral cortex. The eponym is introduced in my foreword to his monograph, which is a masterful synopsis and synthesis of his work and ideas about the dual origin theory (*Cerebral Cortex: Architecture, Connections, and the Dual Origin Concept*, by Pandya DN, Seltzer B, Petrides M, and Cipolloni PB, New York, NY: Oxford University Press, 2015).

Dr. Pandya's foundational elucidation of neural networks demonstrated the anatomical substrates necessary for the repertoire of human behaviors, influencing generations of brain scientists. His studies on the corpus callosum were instrumental in guiding the surgical treatment of epilepsy. His body of work shaped investigations into perception, attentional modulation, motivation, and judgment. His anatomical and theoretical contributions to systems neuroscience are core to understanding neurological and neuropsychiatric disease, and they have enabled the evolving field of neuromodulation of brain circuits to improve mental health.

Dr. Pandya published more than 600 original papers, chapters, proceedings, abstracts, and books. He was recognized by the Cajal Club—first through its Cortical Explorer Award and then the Krieg Cortical Discoverer Award in 1990, and the Jean-Louis Signoret Neuropsychology Prize of the Fondation Ipsen in 2002. *Our Fiber Pathways of the Brain* was awarded best book in the category of medical sciences by the Association of American Publishers in 2006. Dr. Pandya gave credit where it was due, and he never sought the limelight or aspired to office in the national and international academic societies of which he was an esteemed member. He reveled in exploring and uncovering the secrets of the brain, was moved by the beauty of the brain, and on more than one occasion remarked over the microscope that all we are doing is trying to discover truth. He was also up for mischief in adding cartoon character elements to his pencil annotations of cells or blood vessels that serendipitously looked like Mickey or Minnie Mouse. Helen Barbas recalls that he characterized some cortical areas as serene, and others full of noisy boys jumping up and down, to describe

an area with uneven distribution of large pyramidal neurons in layers III and V.

All who worked with Dr. Pandya counted those days spent with him as the most cherished times of their careers, sitting at the microscope, poring over injection sites, cortical architecture, and the details of connections, discussing their evolutionary basis, significance, and functional relevance for health and disease, while at the same time enjoying forays into philosophy, spirituality, and light-hearted banter.

As a practicing internist, Dr. Pandya provided compassionate care to his patients. He was kind and nurturing, a dedicated mentor, and a valued friend. His humility was deep and true, his modesty genuine, and he was never heard to utter a harsh word. He brought a sense of humor to his day and to his work. He was always generous with his time and wisdom, and the depth of his virtue shone through with grace and equanimity. He derived fulfillment and joy from working with his colleagues, postdocs, and technicians. He was energized by his collaborators, and he considered us all his extended family. He was revered and loved in return.

Dr. Pandya was an enthusiastic family man, and together with his devoted wife of 60 years, Bonnie Zalokar Pandya, he was proud of their children: daughter Dina Pandya, daughter Sunita Williams (a NASA astronaut) and her husband Mike Williams, son Jay Pandya and his wife Dr. Anna Radominska-Pandya, his grandchildren, nieces, and nephews. He commissioned a bench in memory of his sister Nilam and brother Navin on the Cape Cod Bike Path facing Vineyard Sound. In the tradition of the great scientists and philosophers, he was a naturalist, and the wildflowers and bird song of Falmouth reminded him of his hometown of Mangrol. For all his discoveries and accomplishments, Dr. Pandya was in his essence a gentle and spiritual person, a staunch follower of Mahatma Gandhi, and a student of Sri Aurobindo. When Dr. Pandya's ashes are spread in the Narmada River, the lifeline of Madhya Pradesh and Gujarat, he will complete his journey on Earth, but his many legacies and influence live on.

This essay will appear later in 2023 in the Special Issue of the *Journal of Comparative Neurology* (doi: 10.1002/cne.25447) in honor of Professor Pandya.