Neuroanniversaires 2025: A Journey Through Neurological Milestones

Neuroaniversários 2025: Uma Jornada pelos Marcos Neurológicos

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ABSTRACT

In 2025, we commemorate the anniversaries of key figures who made lasting contributions to the fields of neurology, neuroscience, politics, and culture. This paper revisits the contributions of key figures in neurology, including Thomas Willis (1621–1675), Domenico Mistichelli (1675–1715), Guillaume-Benjamin-Amand Duchenne (1806–1875), Jean-Martin Charcot (1825–1893), Nikolaus Friedreich (1825–1882), Ernst von Strümpell (1853–1925), August Paul von Wassermann (1866–1925), John Newport Langley (1852–1925), Cécile Vogt (1875–1962), and Henry Hallett Dale (1875–1968), whose influential work formed the foundation of modern neurology. Alongside these scientific pioneers, Pedro II of Brazil (1825–1891), Maurice Ravel (1875–1937), and Thomas Mann (1875–1955) exemplify the profound connection between politics, science and culture. Through an examination of these commemorations, we investigate how their pioneering work continues to influence modern research across neuroscience, medicine, and the humanities.

Key-words: Neurology, Neuroscience, Culture, History, Medical History

RESUMO

Em 2025, comemoramos os aniversários de figuras chave que fizeram contribuições duradouras nas áreas de neurologia, neurociência, política e cultura. Este artigo revisita o trabalho de pioneiros como Thomas Willis (1621–1675), Domenico Mistichelli (1675–1715), Guillaume-Benjamin-Amand Duchenne (1806–1875), Jean-Martin Charcot (1825–1893), Nikolaus Friedreich (1825–1882), Ernst von Strümpell (1853–1925), August Paul von Wassermann (1866–1925), John Newport Langley (1852–1925), Cécile Vogt (1875–1962) e Henry Hallett Dale (1875–1968), cujas conquistas coletivas lançaram as bases para a neurologia moderna. Junto a esses pioneiros científicos, Pedro II do Brasil (1825–1891), Maurice Ravel (1875–1937) e Thomas Mann (1875–1955) exemplificam a profunda conexão entre política, ciência e cultura. Ao refletir sobre essas comemorações, exploramos como seus trabalhos continuam a moldar a pesquisa contemporânea em neurociência, medicina e artes.

Palavras-chave: Neurologia, Neurociência, Cultura, História, História Médica

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INTRODUCTION

The history of neurology is defined by the profound contributions of pioneering individuals who established the foundations of modern brain science. As we approach 2025, it is an opportune moment to reflect on the anniversaries of neurologists and physicians whose groundbreaking work continues to shape contemporary neuroscience. Among the most influential figures are Thomas Willis (1621–1675), Domenico Mistichelli (1675–1715), Guillaume-Benjamin-Amand Duchenne (1806–1875), Jean-Martin Charcot (1825–1893), Nikolaus Friedreich (1825–1882), Ernst von Strümpell (1853–1925), August Paul von Wassermann (1866–1925), John Newport Langley (1852–1925), Cécile Vogt (1875 – 1962), and Henry Hallett Dale (187 –1968). Their groundbreaking discoveries, highlighted in Figures 1 and 2, have profoundly influenced clinical practice and neurological research.

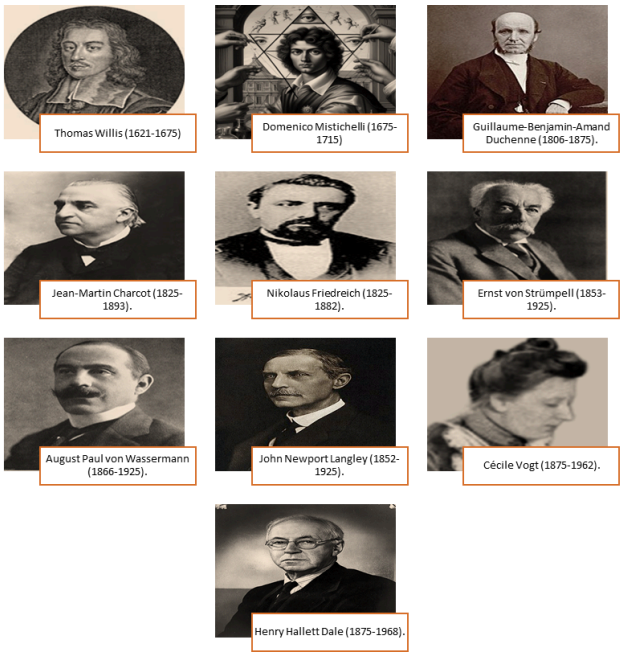

Figure 1: Pioneers of Neurology and Neurophysiology. This figure includes portraits of prominent historical figures sourced from Wikipedia, with the depiction of Domenico Mistichelli generated by DALL-E based on a prompt by MMG.

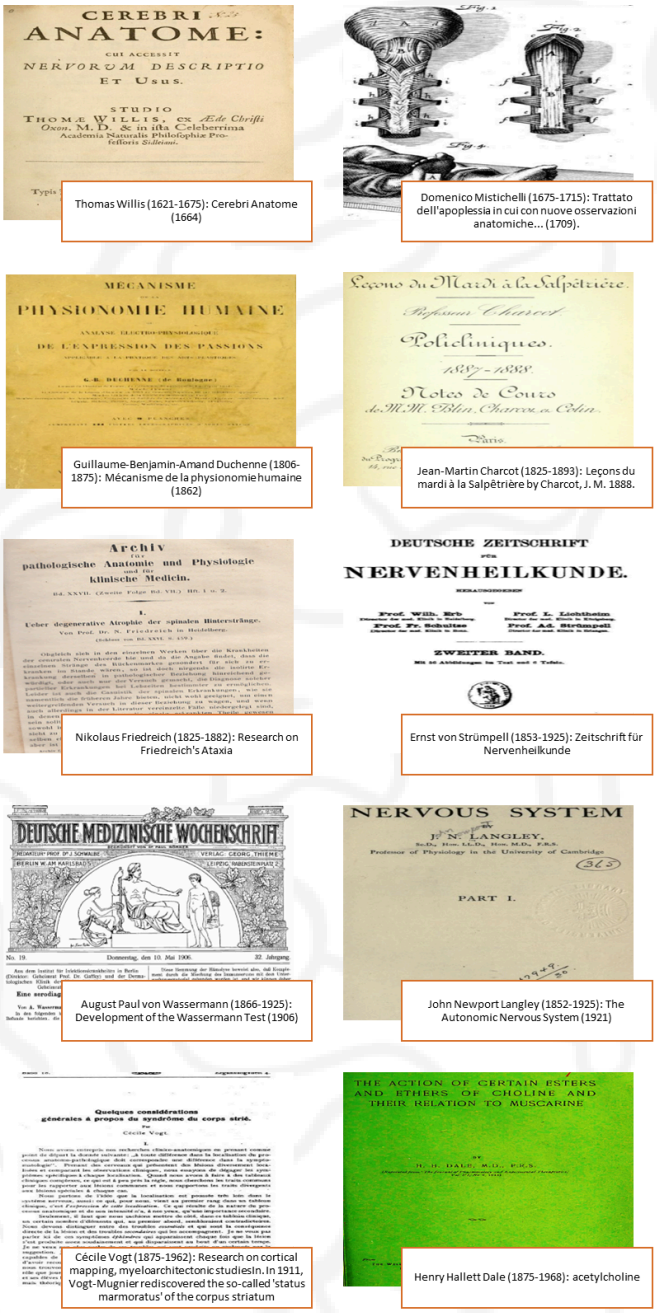

Figure 2: Covers of Seminal Works by Pioneers in Neurology and Neurophysiology. This figure showcases reproductions of the covers / representative sample of key works authored by influential figures in the fields of neurology and neurophysiology[5,7,9,11,13,16,18,19,23,26]: The *Cerebri Anatome* by Thomas Willis (1664); *Trattato dell'apoplessia* (1709) by Domenico Mistichelli's; Mécanisme de la physionomie humaine by Guillaume-Benjamin Duchenne (1862); Leçons du mardi à la Salpêtrière (1887) by Jean-Martin Charcot; Ueber degenerative Atrophie der spinalen Hinterstränge (1863) by Nicholas Friedreich; the journal Deutsche Zeitschrift für Nervenheilkunde, the collective efforts of Wilhelm Erb, Friedrich Schultze, Ludwig Lichtheim, and Adolph Strümpell; *Eine serodiagnostische Reaktion bei Syphilis* (1906) by August Wassermann, Albert Neisser, and Carl Bruck; *Autonomic Nervous System* (1901) by Edward Langer;*Quelques considerations generales a propos du syndrome du corps strié* (1911) by Cécile Vogt-Maugnier's; *The action of certain Esters and ethers of choline, and their relation to muscarine* by Henry Hallett Dale.

In addition to these scientific trailblazers, this paper also pays tribute to cultural figures such as Pedro II of Brazil (1825–1891), Maurice Ravel (1875–1937), and Thomas Mann (1875–1955), whose portraits and notable achievements are presented in Figure 3. These individuals bridged the gap between neurology and broader societal themes, underscoring the interplay between science, culture, and the humanities.

The 2025 *Neuroanniversaries* commemorate the enduring legacies of these 13 exceptional individuals who transformed the fields of neurology, medicine, politics, and the arts. Their contributions, spanning centuries and disciplines, illuminate the deep connections between scientific discovery and cultural expression. From Thomas Willis's pioneering insights into neuroanatomy to Henry Dale's groundbreaking research on neurotransmission, their work continues to inform and inspire contemporary understanding in their respective fields.

This paper emphasizes the interdisciplinary essence of neuroscience, where the convergence of science and culture provides a richer understanding of the human brain. These commemorations serve not only as a tribute to their achievements but also as a reminder of the vital relationship between medical science and the broader cultural landscape. By reflecting on their legacies, we aim to inspire future generations of researchers and practitioners to embrace this integrative perspective.

The framework for this exploration draws on insights from *Marcos Históricos da Neurologia* (*Historical Milestones of Neurology*) by da Mota Gomes[1], which provides a foundation for examining these historical milestones within their broader scientific and cultural contexts.

Tributes to Pioneers in Neuroscience and Medicine

Thomas Willis (1621–1675): The Founder of Clinical Neuroscience

As we commemorate 350 years since the Willis´s death, he is celebrated as the "founder of clinical neuroscience." Willis authored six seminal works that laid the foundation for neuroanatomy, including Cerebri Anatome (1664), *Pathologiae Cerebri et Nervosi Generis Specimen* (1667), and *De Anima Brutorum* (1672)[2-5].

Educated at Oxford, Willis earned degrees in chemistry and medicine before joining the Royal Society of London, where he advanced medicine as a scientific discipline. His research unified the study of the brain, nerves, and behavior, forming the basis of modern neurology. In *Cerebri Anatome*, he emphasized the importance of anatomy in understanding the mind, proposing that nerves transmit stimuli and describing the brain's structure with unprecedented detail[2].

Among his numerous contributions, Willis coined terms such as "neurology" and "corpus striatum" and identified the Circle of Willis, a key cerebral blood supply system. His work in neurophysiology and neuropathology introduced groundbreaking theories on epilepsy and seizures, underscoring the brain's centrality to behavior and personality.

Willis's insights extended beyond anatomy. In Cerebri Anatome, he challenged Galen's prevailing view that

intellect resided in the ventricular system, asserting instead that higher cognitive functions resided in the cerebral cortex. He also highlighted the medulla oblongata's role in regulating vital functions and demonstrated an early understanding of nerve impulses and reflex actions. Terms he introduced, such as "vagus nerve" and "cerebral peduncles," and his anatomical discoveries, like the Circle of Willis, significantly advanced knowledge and shaped medical education for over two centuries.

Influenced by the Renaissance, the Scientific Revolution, and the English Civil War, Willis integrated his religious beliefs with scientific inquiry, distinguishing humans from animals through the concept of a divinely granted immortal soul. His interdisciplinary approach and enduring legacy continue to influence neuroscience today.

Domenico Mistichelli (1675–1715): Early Investigator of Neural Pathways

As we mark the 350th anniversary of Domenico Mistichelli's birth, his contributions to neuroanatomy remain significant. Born in Fermo, Italy, Mistichelli's work on the pyramidal tract crossing, detailed in his 1709 book on apoplexy, was groundbreaking. He described a unique "braid of hair" (treccia di capelli) configuration of nerve fibers in the medulla oblongata, offering an explanation for the phenomenon where paralysis on one side of the body is linked to lesions on the opposite side, a concept dating back to Hippocrates[6,7].

Although Mistichelli's work preceded Pourfour du Petit's more detailed description in 1718, Mistichelli was the first to highlight the site of motor fiber decussation. His "plait of a lady" analogy emphasized the complexity of this crossing.

Mistichelli also suggested treatments for apoplexy, such as applying a branding iron to the foot. Despite a strained relationship with Giovanni Maria Lancisi, his observations laid the foundation for later understanding of the pyramidal tract. Mistichelli's early insights into neural pathways have left a lasting impact on neuroanatomy.

Guillaume-Benjamin-Amand Duchenne (1806–1875): Pioneer of Neuromuscular Medicine

As we mark the 150th anniversary of Duchenne de Boulogne's death, his transformative contributions to neuromuscular medicine remain as impactful as ever. Renowned for identifying Duchenne muscular dystrophy (DMD), his innovative application of electrical stimulation revolutionized the study of muscle function. This pioneering work shaped diagnostic and therapeutic approaches for muscular dystrophies and other neuromuscular disorders. As Ehling[3] aptly notes, "Duchenne revived Galvani's research and greatly advanced the science of electrophysiology, contributing to our understanding of neural pathways and diagnostic innovations, including deep tissue biopsy and nerve conduction tests." Similarly, Tandon and Chandra[4] emphasize that "Duchenne's methodologies laid the groundwork for modern electromyographic techniques."

Duchenne's impact extended beyond neurology. His methodologies, including the development of muscle biopsy techniques and the application of electrical stimulation, significantly advanced neurophysiology. Additionally, his exploration of emotional expression influenced Charles Darwin's work on human evolution, as recognized in Darwin's studies[8,9].

Despite these monumental achievements, Duchenne's personal life was marked by profound adversity. After losing his first wife, the mother of his only son, he endured a decades-long estrangement from his son, deepening his sense of isolation. His early work faced rejection from the medical establishment, subjecting him to professional humiliation. Nevertheless, Duchenne's perseverance, as highlighted by Maranhão-Filho and Vincent[8], ensured his enduring legacy in medicine and neurophysiology.

Though professional recognition came later in life, Duchenne's final years were overshadowed by personal loss. He passed away in 1875, just shy of his 69th birthday. Today, his legacy is immortalized with a medallion at the Myology Institute, Hôpital Pitié-Salpêtrière, honoring his groundbreaking contributions that continue to inspire advancements in neurology and medicine.

Jean-Martin Charcot (1825–1893): Father of Modern Neurology

As we commemorate the bicentennial of Jean-Martin Charcot's birth, it is an opportune moment to reflect on his monumental contributions to the field of neurology. Widely regarded as the father of modern clinical neurology, Charcot revolutionized the understanding and classification of major neurological diseases. His legacy, characterized by groundbreaking research and a profound impact on neurology and psychiatry, continues to influence the medical sciences today[3,4,10].

Charcot's career was defined by his innovative application of the anatomoclinical method, which involved correlating clinical symptoms with post-mortem findings. This method enabled him to identify and describe neurological conditions such as multiple sclerosis, Parkinson's disease, amyotrophic lateral sclerosis, and Charcot-Marie-Tooth disease. He also distinguished hysteria from other neurological disorders, making significant strides in both neurology and psychopathology. His tenure at the Salpêtrière Hospital, beginning in 1860, saw the establishment of the first major neurological clinic, where his clinical lessons attracted a generation of students who would later become luminaries in their own right, including Georges Gilles de la Tourette, Joseph Babinski, and Sigmund Freud.

Charcot's seminal works, including Leçons sur les Maladies du Système Nerveux (Lectures on the Diseases of the Nervous System, 1872–1883) and Leçons du Mardi à la Salpêtrière (Tuesday Lessons at the Salpêtrière, 1888)[11],

established him as a preeminent figure in the field of neurology. His pioneering work on cerebral localization, vascular brain diseases, tremors, and arthropathies deepened the understanding of neurological and psychiatric disorders. Charcot's research into specific brain functions laid the foundation for modern neurodegenerative and neuropsychiatric studies.

Beyond his scientific achievements, Charcot was a man of diverse intellectual pursuits. Born in modest circumstances in Paris in 1825, he rose to prominence, aided in part by his marriage to a wealthy widow. This union not only transformed his personal life but also allowed him to explore his passions for art, music, and politics. His son, Jean-Baptiste Charcot, became a celebrated polar explorer, further cementing the family's legacy of excellence.

Charcot's approach to clinical neurology emphasized rigorous observation and the integration of scientific inquiry, which is highlighted as pivotal in shaping the field. His work influenced not only his contemporaries but also future generations of neurologists and psychiatrists. Charcot's multilingual skills and broad intellectual interests underscored his versatility, while his death from pulmonary edema in 1893 marked the end of an era.

Today, Charcot's contributions remain a cornerstone of neurology. His clinical insights, mentorship, and commitment to advancing medical science continue to inspire and guide the field, ensuring his place among the most influential physicians in history.

Nikolaus Friedreich (1825–1882) and Ernst von Strümpell (1853–1925): Pioneers in Genetic Neurological Disorders

Friedreich and Strümpell played pivotal roles in uncovering the genetic foundations of neurological disorders. Friedreich's research on Friedreich's ataxia and Strümpell's contributions to conditions such as Strümpell-Lorrain disease. Respectivelly, their birth bicentennial and death centennial commemorations provide a timely opportunity to reflect on how their groundbreaking discoveries continue to shape modern understanding of genetic neurodegenerative diseases. As Tandonand Chandra[4] note, "These pioneers laid critical groundwork for the study of hereditary neurological conditions."

Nikolaus Friedreich, a prominent figure in German medicine, is best remembered for his pioneering contributions to neurology, particularly his studies on ataxia[12,13]. Born in Würzburg, Germany, into an academic family, he followed in the footsteps of his grandfather, Nikolaus Anton Friedreich, an early describer of acute peripheral facial nerve palsy, and his father, Johannes Baptist Friedreich, a professor of pathology.

Friedreich began his medical education in Würzburg in 1844 and earned his doctorate in 1850 with a thesis on intracranial tumors. His career was significantly shaped by his collaboration with Rudolf Virchow, which redirected his focus from clinical practice to pathology. In 1857, Friedreich succeeded Virchow as professor of pathology at Würzburg and, a year later, assumed the role of professor and director of the medical clinic at Heidelberg, where he remained until he died.

Friedreich is renowned for his comprehensive descriptions of hereditary spinal ataxia, now referred to as Friedreich's ataxia, along with its pathological features, such as spinal cord degeneration and neuronal loss. His 1873 monograph on progressive muscular atrophy was a seminal contribution, though later research revised some of its conclusions. Additionally, he identified paramyoclonus multiplex (Friedreich's disease), described acute leukemia, and introduced eponymous terms such as Friedreich's sign (constrictive pericarditis) and Friedreich's sound change (a percussion sign).

Friedreich's legacy is embodied in 51 papers and eight monographs, which highlight his expertise in neurology, pathology, and internal medicine. His dedication to teaching influenced a generation of scholars, ensuring his contributions extended well beyond his lifetime.

Ernst Adolf Gustav Gottfried von Strümpell was a distinguished German physician celebrated for his pioneering contributions to neurology and internal medicine[14,15,16]. Born in Neu-Autz, Courland (modern-day Jaunauce, Latvia), he came from a family of remarkable intellectual pedigree. His father, Ludwig von Strümpell, was a renowned philosopher and educator, particularly recognized for his influential work in psychological pedagogy.

Von Strümpell began his medical studies at the universities of Dorpat and Leipzig, earning his doctorate in 1875 with a dissertation examining the effects of uremia and altered body temperature in Bright's disease. Early in his career, he gained valuable experience in Leipzig's pathology and chemistry departments and trained under prominent mentors Carl Wunderlich and Ernst Wagner at the Medical University Clinic. By 1878, he had completed his habilitation with a thesis on the influence of anesthesia on motor functions and consciousness.

In 1883, von Strümpell was appointed associate professor of internal medicine and subsequently took over as director of the medical polyclinic in Leipzig, succeeding Wilhelm Erb. During this period, he collaborated with notable contemporaries such as Julius Cohnheim, Wilhelm Erb, and Paul Flechsig. His *Textbook of Special Pathology and Therapy of Internal Diseases* became a cornerstone of medical education.

His illustrious career led him to hold esteemed positions at Erlangen (1886), Breslau (1903), Vienna (1909), and Leipzig (1910), where he also served as dean and rector. In 1923, he participated in a high-profile medical consultation for Lenin in Moscow. A fervent proponent of neurology as a distinct discipline, von Strümpell was instrumental in establishing it as a specialized field within internal medicine. He co-founded and edited the *Zeitschrift für Nervenheilkunde*, a leading journal in neurology, in 1891,

and the Society of German Neurologists in 1907.

Von Strümpell made enduring contributions to neurology, with several medical conditions named in his honor, including Morbus Bechterew-Strümpell-Marie (ankylosing spondylitis), Strümpell-Lorrain disease (spastic spinal paralysis), and diagnostic Strümpell signs. Beyond his medical achievements, he was an accomplished violinist and cultivated friendships with eminent musicians such as Johannes Brahms and Clara Schumann.

His legacy was further cemented by numerous honors, including the title of Prussian Geheimer Medizinalrat, the Knight's Cross of the Bavarian Order of Merit in 1893 (marking his knighthood as Adolf Gustav Gottfried von Strümpell), and honorary doctorates, including one from Christiania in 1911. Von Strümpell's pioneering contributions left a lasting impact on neurology and medicine, helping establish neurology as a distinct specialty.

August von Wassermann (1866-1925) and John Newport Langley (1852-1925): Pioneers in Diagnostics and Autonomic Research

The centenary of the deaths of August von Wassermann and John Newport Langley provides an opportunity to reflect on their groundbreaking contributions to medicine and science, which continue to shape modern practices. Wassermann's development of the Wassermann test revolutionized the diagnosis of neurosyphilis, while Langley's work fundamentally transformed our understanding of the autonomic nervous system.

August von Wassermann, a German physician and bacteriologist, earned his degree in 1888 and, after working with Robert Koch at the Institute of Infectious Diseases in Berlin, became head of the department of therapeutics and serum research in 1907. He is best known for developing the Wassermann test in collaboration with Albert Neisser, and Carl Bruck, which became a precursor to modern diagnostic tests like the VDRL test. Wassermann's influence extended beyond syphilis diagnostics to treatments and vaccines for diphtheria, cholera, typhoid fever, and tetanus[17,18].

John Newport Langley, an English physiologist educated at St. John's College, Cambridge, made major contributions to the study of glandular secretions and the autonomic nervous system. In 1898, he coined the term "autonomic nervous system" and, in 1921, proposed the parasympathetic nervous system as a subdivision of the autonomic system. His 1921 publication, The Autonomic Nervous System, cemented his legacy. Langley was also a pioneer of the chemical receptor theory and introduced the concept of the "receptive substance." As a Fellow and Vice President of the Royal Society, he mentored numerous notable figures, including future Nobel Prize winners, shaping the future of neurophysiology and scientific mentorship[3,4,19].

Cécile Vogt-Mugnier (1875–1962) and Henry Hallett Dale (1875–1968): Architects of Brain Structure and Neurotransmission

As we commemorate the 150th anniversary of the birth of both neuroscientists, their groundbreaking contributions to the field continue to resonate.

Cécile Vogt-Mugnier, born Augustine Marie Cécile Mugnier in Annecy, France, was a pioneering neuroscientist whose research in neuroanatomy, psychotherapy, and brain cytoarchitecture significantly advanced the field[20-23]. One of the few women of her time to earn a medical doctorate, she completed her degree in Paris in 1900. Vogt-Mugnier's work focused on the myeloarchitectonic organization of the thalamus, the pathology of the corpus striatum, and the cytoarchitecture of the cerebral cortex. In 1911, she defined the "corpus striatum syndrome," a major advancement in understanding neurological conditions based on her functional interpretation of the corpus striatum.

In 1899, Vogt - Mugnier married German neurologist Oskar Vogt, and their scientific partnership lasted over six decades, profoundly shaping brain research. Together, they merged studies of brain cytoarchitecture with electrical stimulation, making groundbreaking contributions to the understanding of brain function.

The "Kaiser - Wilhelm - Institut für Hirnforschung" (KWI for Brain Research) was founded in Berlin in 1914, evolving from Oskar Vogt's 1898 Neurologische Zentralstation. The couple played a central role in the institute's creation. After Lenin's death in 1924, Oskar Vogt studied his brain in Moscow and founded the Moscow Brain Institute. The KWI's first dedicated building opened in 1931, establishing it as a leading center for brain research. In 1937, Hugo Spatz succeeded Oskar Vogt, expanding the institute with departments for neuropathology and tumor research. However, during the Nazi era, Spatz and Hallervorden were involved in unethical research, studying the brains of euthanasia victims. In 1948, the Max Planck Society replaced the Kaiser Wilhelm Society, and the institute became the Max Planck Institute for Brain Research. In 1990, the Max Planck Society honored the victims of these atrocities with a burial and memorial ceremony.

Despite her significant scientific contributions, Vogt-Mugnier often faced professional overshadowing due to the gender biases of her time. She balanced her career with raising three daughters, one of whom was adopted by Oskar Vogt. Nevertheless, she achieved considerable recognition, including membership in the German Academy of Sciences and several honorary doctorates. Her work influenced neurology and psychiatry, particularly in her critiques of Freudian psychoanalysis and her introduction of the concept of dysamnesia. With over 3,000 pages of publications and editorial roles, Vogt-Mugnier became a trailblazer not only in science but also in advocating for

gender equity in the scientific community. She challenged the exclusion of women from science, demonstrating that intellectual ability transcends biological determinism, and paved the way for future generations of women in the field.

Henry Hallett Dale, knighted in 1932, was a British physician and pharmacologist known for his research in neurophysiology and biochemistr[24-26]. He studied at Trinity College, Cambridge, and St. Bartholomew's Hospital, earning his M.D. in 1909. Dale worked with Paul Ehrlich and Otto Loewi, contributing to the pharmacology of ergot alkaloids and histamine.

In 1913, Dale discovered acetylcholine, later recognizing its role as a neurotransmitter, especially in parasympathetic nerve function. Inspired by Otto Loewi's "vagusstoff" discovery, Dale's 1929 confirmation of acetylcholine's natural presence in animals solidified its role in neurotransmission. Influenced by Thomas Renton Elliott's work on adrenaline, Dale also showed acetylcholine was more active than adrenaline.

In 1933, Dale's breakthrough with the eserinised leech muscle preparation (Physostigmine, also known by the brand name Eserine) allowed for better observation of acetylcholine's effects, providing key evidence for its role in the autonomic nervous system. Dale directed the National Institute for Medical Research from 1928 to 1942 and later helped administer the Wellcome Trust. He was elected a Fellow of the Royal Society in 1914 and served as its President from 1940 to 1945.

Dale shared the Nobel Prize in 1936 with Loewi for their work on neurotransmitters. He received the G.B.E. in 1948 and the Medal of Freedom in 1947. His published works include *Adventures in Physiology* (1953) and *An Autumn Gleaning* (1954).

Other Historical and Cultural Tributes

Cultural and Political Influences: Pedro II of Brazil (1825–1891)

Pedro II was a monarch who profoundly valued science and its potential to advance society. As we celebrate the 200th anniversary of his birth, his intellectual contributions offer a compelling example of how politics, science, and culture intersected during his reign. His patronage of scientific endeavors not only elevated the status of Brazilian science but also played a key role in the broader cultural and societal understanding of neurology.

Pedro II's influence in the scientific community was especially notable in his support for research in neurophysiology[27-30]. Pedro II's support for transnational studies on curare also played a pivotal role in advancing neurophysiological research in Brazil. As noted by Santos et al.[28],these studies contributed significantly to the understanding of neuromuscular transmission and the development of modern neurophysiology in Brazil. Curare, a poison obtained from various plant species in South America and traditionally used by native peoples in arrows, became a subject of intense scientific inquiry due to its lethal paralyzing potential and its mechanism of action. In their study, Santos et al.[28] highlight how the research on curare and the fruitful exchanges between the Brazilian Emperor Dom Pedro II and researchers such as João Baptista de Lacerda, Louis Couty, and Alfred Vulpian significantly contributed to the development of experimental neurophysiology in Brazil. Vulpian's work, in particular, was groundbreaking: he demonstrated that curare did not affect the nerve itself but rather acted between the nerves and the muscle, proposing the concept of a "ligand substance" involved in the process—an idea often mistakenly attributed to Claude Bernard. This pioneering insight, coupled with the collaboration of prominent figures like Lacerda and Couty, played a crucial role in the transnational exchange of scientific knowledge that ultimately led to the preparation of a purified extract of curare, which was later used in convulsive therapy and anesthesia.

Pedro II's direct involvement in facilitating these scientific collaborations and his patronage of researchers in Brazil helped to foster an environment where scientific inquiry and innovation flourished. The Brazilian Physiological School, particularly in its early years, was significantly influenced by European developments, including Vulpian's contributions to neurophysiology, while integrating Brazilian scientific practices that shaped its unique perspective on neurobiology. His involvement in global scientific developments, such as Emil du Bois-Reymond's work on bioelectricity, demonstrated his vision for Brazil's role in international science[29].

Pedro II's health was closely linked to his scientific interests. His engagement with figures like Charles Brown-Séquard, a pioneer in neurophysiology, influenced the direction of neurological research in Brazil[27].

Pedro II sought advice from leading physicians, including neurologists Jean-Martin Charcot and Brown-Séquard. Da Mota Gomes[30] notes that his declining health, likely due to neuropathogenic conditions, sparked discussions about neurological health in Brazil, shaping his own care and broader research on such conditions.

In conclusion, Pedro II's intellectual legacy highlights the interplay of cultural and political factors in shaping Brazil's scientific landscape. His support for scientific research, also in neurosciences, had a lasting impact on the development of physiology in Brazil.

Figure 3: Portraits of Cultural and Scientific Luminaries. This figure showcases portraits sourced from Wikipedia, celebrating individuals whose contributions profoundly shaped science, music, and literature.

Joseph Maurice Ravel (1875-1937) and Thomas Mann (1875–1955): Neurology in the Humanities

Ravel and Mann are cultural icons who explored neurological themes through their art. Ravel, a celebrated French composer, and Mann, a prominent German writer, both confronted neurological challenges in their lives and work, offering profound insights into the intersection of neurology, creativity, and the human condition. As we commemorate their 150th anniversaries, we reflect on how their art illuminated these connections.

Joseph Maurice Ravel, renowned for his compositions such as Boléro, began experiencing a gradual decline in his mental and physical abilities in the late 1920s. In 1927, symptoms like difficulty speaking, writing, and remembering started to appear, coinciding with the completion of his famous works, *Boléro* and the *Piano Concerto for the Left Hand*. His condition progressively worsened after a car accident in 1932, leading to cognitive impairments such as apraxia, aphasia, and amusia. Despite his mental decline, Ravel continued to hear music in his mind but struggled to transcribe it, ultimately feeling that his creative process had come to an end[31,32].

By 1933, Ravel's symptoms had intensified, and he found himself unable to perform basic tasks, including writing and playing the piano. His apraxia and tremors became more pronounced, and his ability to express his music deteriorated significantly. However, his auditory perception remained intact, allowing him to recognize and critique his own music.

The exact cause of Ravel's illness remains speculative. Some theories suggest that he may have had Alzheimer's disease, while others propose primary progressive aphasia or corticobasal degeneration. It is widely believed that his condition was linked to cerebral atrophy, possibly affecting the right hemisphere of his brain, which may have influenced his later compositions. *Boléro's* repetitive structure is often interpreted as reflecting his neurological state, while works like the *Piano Concerto for the Left Hand* feature unconventional timbres and rhythmic patterns.

In 1937, doctors attempted neurosurgery to identify the cause of his condition, but no clear physical abnormalities were found. Shortly after, Ravel lapsed into a coma and passed away nine days later. Despite his cognitive decline, Ravel remained socially active until his death. Though his illness ultimately silenced his genius, his case offers valuable insights into the relationship between the brain's functioning and artistic expression.

Thomas Mann, whose literary career clearly began with *Buddenbrooks* (1901), is renowned for his exploration of psychological and neurological themes[33-34]. His works, including *Death in Venice* (1913) and *The Magic Mountain* (1924), skillfully delved into the inner workings of the human mind, often through the lens of illness and suffering. Mann vividly portrays neurological conditions like migraines, epilepsy, neurosyphilis, meningitis, and essential tremor, emphasizing both their physical and psychological impacts. Notable cases include epilepsy in *The Buddenbrooks, Felix Krull*, and *The Magic Mountain*; meningitis, neurosyphilis, and migraines in Doctor Faustus; and essential tremor in *The Magic Mountain* and *Doctor Faustus*. These depictions underscored the profound shifts in mental and emotional well-being that neurological conditions can induce, reflecting a time when neurology was still in its formative stages. For instance, Doctor Faustus (1947) delves into themes of artistic brilliance and human vulnerability, symbolized by a Faustian bargain, and portrays the destructive effect of syphilis on the protagonist's creativity and eventual spiral into madness.

Mann's engagement with neurology was not limited to his writings. In 1929, he was awarded the Nobel Prize in Literature, cementing his status as one of the most influential writers of his era. However, his growing opposition to the Nazi regime led him to flee Germany in 1933. He moved to Switzerland, and in 1936, he was formally expatriated, obtaining Czechoslovakian citizenship. His anti-fascist novel *Mario und der Zauberer* (1930) warned of the dangers of dictatorship and totalitarianism, while his public lectures continued to challenge fascism.

Mann's exile deepened his commitment to freedom and human rights. By 1938, he had relocated to the United States, where he continued his activism and writing. In 1944, he became an American citizen. His works during this period reflected his concerns about the impact of fascism on society and culture. In 1952, Mann returned to Switzerland, where he spent his final years, continuing to write until his death in 1955.

Mann's legacy, shaped by his exploration of illness and its psychological effects, bridges the fields of literature and neurology. His works continue to inspire scholars in

both disciplines, offering enduring contributions to our understanding of the human condition.

CONCLUSION

The 2025 Neuroanniversaries commemorate the enduring influence of 13 extraordinary individuals who transformed neurology, medicine, politics, and the humanities. Spanning centuries and disciplines, their achievements underscore the profound interplay between scientific discovery and cultural expression. Thomas Willis (1621–1675) laid the groundwork for modern neuroanatomy with his discovery of the "Circle of Willis" and the seminal publication Cerebri Anatome (1664), reshaping our understanding of brain function and circulation. This foundational work finds parallels in Domenico Mistichelli (1675–1715), who expanded knowledge of motor control through studies on pyramidal decussation, and Jean-Martin Charcot (1825–1893), the father of clinical neurology, whose research into motor neuron diseases and hysteria bridged neurology and psychiatry.

In the realm of neuromuscular medicine, Guillaume-Benjamin-Amand Duchenne (1806–1875) revolutionized the study of muscle function with his pioneering use of electrical stimulation, while Nikolaus Friedreich (1825–1882) and Ernst von Strümpell (1853–1925) advanced genetic neurology by investigating hereditary disorders such as Friedreich's ataxia and familial spastic paraplegia. Similarly, August Paul von Wassermann (1866–1925) developed the Wassermann test, a pivotal diagnostic tool for syphilis, and John Newport Langley (1852–1925) enhanced understanding of the autonomic nervous system, introducing terms that shaped physiological and clinical paradigms.

This legacy of scientific exploration resonates in the groundbreaking cortical mapping of Cécile Vogt-Maugnier (1875–1962), whose contributions were not only scientific but also emblematic of resilience against the gender barriers of her time. As one of the first women to achieve prominence in neurology, Vogt-Maugnier faced significant societal and professional discrimination but persevered to make enduring contributions to neuroscience, setting a precedent for future generations of women in science.

The pioneering spirit of these figures finds further expression in Henry Hallett Dale (1875–1968), whose Nobel Prize-winning discoveries on neurotransmitters, including acetylcholine, transformed the understanding of synaptic transmission.

Beyond scientific inquiry, Pedro II of Brazil (1825–1891) exemplified how visionary leadership could champion both science and culture, advancing neurology while fostering broader intellectual and cultural progress. The arts, too, reflect the impact of neurology, as seen in the music of Maurice Ravel (1875–1937), shaped by his neurodegenerative illness, and in the writings of Thomas Mann (1875–1955), which delve into the intersections of art, psychology, and medicine.

Together, these luminaries highlight the interdisciplinary nature of neuroscience, where science and culture converge to deepen our understanding of the human brain. The 2025 commemorations honor their timeless achievements, inspiring future research and reaffirming the inseparable bond between medical science and the broader cultural landscape.

REFERENCES

1. da Mota Gomes M. Marcos Históricos da Neurologia. Rio de Janeiro: Editora Científica Nacional; 1997. 238 p.
2. Monteiro FC, Nardi AE, Gomes MM. The 400th anniversary of the birth of Thomas Willis (1621-1675): an invaluable contributor to neuroscience. Braz J Psychiatry. 2022;44(3):225-226.
3. Eling P. Neuroanniversary 2025. J Hist Neurosci. 2024 Sep 2:1-5. doi: 10.1080/0964704X.2024.2393959.
4. Tandon PN, Chandra PS. Evolution of neurosciences: a historical review with brief biographies of some of its selected pioneers. Neurology India. 2022;70(Suppl 1):S1-S113. Available from: https://journals.lww.com/neur/citation/2022/70001/evolution_of_neurosciences__a_historical_review.1.aspx
5. Willis T. Cerebri Anatome. 1664. Available from: https://archive.org/details/cerebrianatomecu00will/page/n7/mode/2up
6. van Gijn J, Sandrone S. Domenico Mistichelli (1675-1717). J Neurol. 2025;272(1):99.
7. Mistichelli D. Trattato dell'apoplessia in cui con nuove osservazioni anatomiche, e riflessioni fisiche si ricercano tutte le cagioni, e spezie di quel male, e si palesa frà gli altri un nuovo, & efficace rimedio. Available from: https://wellcomecollection.org/works/gng5q3ky
8. Maranhão-Filho P, Vincent M. Guillaume-Benjamin Duchenne: a miserable life dedicated to science. Arq Neuropsiquiatr. 2019;77(6):442-444.
9. Duchenne G-B. Mécanisme de la physionomie humaine ou Analyse électro-physiologique de l'expression des passions. 1862. Available from: https://archive.org/details/b2491941x_0002
10. Da Mota Gomes M, Engelhardt E. Jean-Martin Charcot, father of modern neurology: an homage 120 years after his death. Arq Neuropsiquiatr. 2013;71(10):815
11. Charcot J-M. Leçons du mardi à la Salpêtrière. 1887. Available from: https://archive.org/details/leonsdumardilasa01char/page/n9/mode/2up
12. Grimm T. Nikolaus Friedreich, der erste Heidelberger "Neurologe" [Nikolaus Friedreich, the first Heidelberg "neurologist"]. Fortschr Neurol Psychiatr. 2001;69 Suppl 1:S8-10.
13. Friedreich N. Ueber degenerative Atrophie der spinalen Hinterstränge. Virchows Arch. path. Anat. 1863;1-26. Available from: https://www.abebooks.com/Ueber-degenerative-Atrophie-spinalen-Hinterstränge-Schluss/31044236218/bd
14. Kästner I. Strümpell, Adolf von. In: Neue Deutsche Biographie. Vol. 25. 2013. p. 591–2. [Online]. Available from: https://www.deutsche-biographie.de/pnd11903476X.html#ndbcontent
15. Whonamedit.com. Ernst Adolf Gustav Gottfried von Strümpell. 2024. Available from: https://www.whonamedit.com/doctor.cfm/1658.html
16. Erb W, Schultze F, Lichtheim L, Strümpell A, editors. Deutsche Zeitschrift für Nervenheilkunde. Available from: https://archive.org/details/deutschezeitsch197unkngoog/page/n6/mode/2up
17. Haas LF. August von Wassermann (1866-1925). J Neurol Neurosurg Psychiatry. 2003;74(8):1104.

18. Wassermann A, Neisser A, Bruck C. Eine serodiagnostische Reaktion bei Syphilis. Dtsch Med Wochenschr. 1906;32(19):745-746. Available from: https://www.thieme-connect.com/products/ejournals/abstract/10.1055/s-0028-1142018
19. Langley JN. Autonomic Nervous System. 1901. Available from: https://archive.org/details/autonomicnervous01languoft/page/n5/mode/2up
20. Satzinger H. Femininity and Science: The Brain Researcher Cécile Vogt (1875-1962). Translation of: Weiblichkeit und Wissenschaft. In: Bleker, Johanna (ed.): Der Eintritt der Frauen in die Gelehrtenrepublik. Husum, 1998:75-93.
21. Metitieri T, Mele S. Women in Neuroscience: A Short Time Travel. In: Encyclopedia of Behavioral Neuroscience. 2nd edition. 2022:71-76.
22. The Max Planck Institute for Brain Research. History. 2015. Available from: https://brain.mpg.de/81041/history
23. Vogt C. Quelques considerations generates a propos du syndrome du corps strié. J Psychol Neurol. 1911. Available from: https://archive.org/details/JournalFrPsychologieUndNeurologie191118ZHypnotismus28.836S/page/n721/mode/2up
24. Tansey, E. M. "Henry Dale and the discovery of acetylcholine." Comptes rendus biologies 329.5-6 (2006): 419-425.
25. Sir Henry Dale – Biographical. NobelPrize.org. Nobel Prize Outreach AB 2025. Sun. 12 Jan 2025. Available from: https://www.nobelprize.org/prizes/medicine/1936/dale/biographical/
26. Dale HH. The action of certain Esters and ethers of choline, and their relation to muscarine, 1914 Available from: https://iiif.wellcomecollection.org/image/b30620946_0001.jp2/full/full/0/default.jpg
27. Santos RP, Nardi AE, Gomes MDM. Neurophysiology in between the interests of Dom Pedro II of Brazil, and Charles Brown-Séquard (Historical Note). Rev Bras Neurol. 2023;22-27.
28. Santos RP, Nardi AE, da Mota Gomes M. Importance des études transnationales sur le curare dans le développement de la recherche en neurophysiologie au Brésil [How studies on curare contributed to the development of neurophysiological research in Brazil]. Biol Aujourdhui. 2023;217(3-4):245-252.
29. Santos RP, Nardi AE, Gomes MDM. Emil du Bois-Reymond and Dom Pedro II: Research development on bioelectricity and electric fish. Front Physiol. 2022;13:985473.
30. Da Mota Gomes M. The decline of Dom Pedro II's empire and health: neuropathogenic implications. Arq Neuropsiquiatr. 2007;65(4B):1260-5.
31. Vitturi BK, Sanvito WL. Maurice Ravel's dementia: the silence of a genius. Arq Neuropsiquiatr. 2019;77(2):136-138.
32. Pires Maruta C, Universidade De, Lisboa Faculdade, D Medicina, and D Lisboa. The musician entrapped in the aphasic mind: The tragic story of Maurice Ravel In Primary Progressive Aphasia: Neuropsychological Analysis and Evolution. Doutoramento Em CIÊNCIAS BIOMÉDICAS Especialidade de NEUROCIÊNCIAS Lisboa, 17 de Setembro de 2015, p. 27-29. Available from: https://repositorio.ulisboa.pt/bitstream/10451/22724/1/ulsd072088_td_Carolina_Maruta.pdf
33. Thomas Mann – Biographical. NobelPrize.org. Nobel Prize Outreach AB 2025. Available from: https://www.nobelprize.org/prizes/literature/1929/mann/biographical/
34. Caputi N, Birnbaum D, Boller F. Thomas Mann and neurology. Neurological Disorders in Famous Artists-Part 4. Vol. 43. Karger Publishers; 2018. p. 76-84.