

# Hyphenated History: Erb-Duchenne Brachial Plexus Palsy

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## Abstract

Throughout history, the discoveries of their predecessors have led physicians to revolutionary advances in the understanding and practice of medicine. The result is a plethora of hyphenated eponyms paying tribute to individuals connected through time by a common interest.

The history of Guillaume Duchenne de Boulogne, the “father of electrotherapy and electrodiagnosis,” and Wilhelm Heinrich Erb, the “father of neurology,” offers insight into the personal and professional lives of these astute clinicians and their collaborative medical breakthrough in the area of neurologic paralysis affecting the upper limbs.

## DUCHENNE

French physician Guillaume Benjamin Armand Duchenne lived from 1806 to 1875. Born in the coastal town of Boulogne, France, to a sea captain who received the Croix de la Legion d’Honneur from Napoleon in 1804 for his leadership during wartime, Duchenne was expected to continue the family’s nautical legacy.<sup>1-4</sup> However, his interest in medicine led him to Paris to study under many respected physicians, including Baron Guillaume Duputryn (1777–1853) and Francois Magendie (1783–1855).<sup>2-5</sup> After having mediocre success as a student of Parisian medicine, Duchenne returned to Boulogne to practice as a family doctor.<sup>1,3,5,6</sup> After the 1834 death of Barbe Boutroy, his first wife, and his 1839 marriage to Honorine Larde, he became less interested in his practice and more fascinated with the diagnostic and therapeutic potential of electrical stimulation.<sup>1,3</sup>

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Unlike the invasive electropuncture method recently developed by Magendie and Jean-Baptiste Sarlandiere (1781–1838), Duchenne invented a portable machine that used surface electrodes to minimize the spread of electric current, resulting in less pain and tissue damage to the patient.<sup>2,3,5</sup> Duchenne referred to his process as *local faradization*, giving credit to Michael Faraday (1791–1867), the scientist who invented the induction coil in 1831.<sup>3,4</sup> In 1842, Duchenne moved to Paris to explore the uncharted territories this field offered.

Known as Duchenne de Boulogne in Paris, he was considered an eccentric by his peers for his provincial mannerisms until many years later, when his work and expertise earned him international attention.<sup>2,6</sup> Without any official position with a hospital or university, Duchenne made his rounds by following his patients from hospital to hospital for years.<sup>2,5,6</sup> Through these extensive clinical studies and observations, he was able to identify many neuromuscular diseases, including atrophic paralysis of childhood, progressive locomotor ataxy, glossolabiolaryngeal paralysis, and facioscapulohumeral muscular dystrophy (now known as Landouzy-Dejerine syndrome). He has several eponymic namesakes, including Aran-Duchenne spinal muscular atrophy (chronic progressive wasting of muscles leading to weakness and paralysis), Duchenne syndrome (nuclear amyotrophy in chronic bulbar paralysis), Duchenne trocar (a Duchenne-designed harpoon-like biopsy needle that required no anesthesia for patients), Duchenne-Griesinger disease (pseudohypertrophy of affected muscles), and the “Duchenne smile” (a sincere smile that Duchenne claimed uses muscles of the mouth and eyes).<sup>3,5</sup>

Duchenne is considered a pioneer in electrotherapy, electrodiagnosis, neurology, and medical photography. Famous for his photographs of electrical stimulation performed on “Old Man”—appearing in a primary work, *Mecanisme de la Physionomie Humaine (The Mechanism of Human Facial Expression)* in 1862—he also presented a detailed atlas of the human brainstem with the first photographic illustrations of brain neurons and nuclei.<sup>3</sup> Duchenne had a profound effect on later innovative medical explorers, including Jean Martin-Charcot (1825-1893), Robert Remak (1815–1865), and Hugo von Ziemssen (1829–1902), and was held in high esteem by Charles Darwin (1809–1882).<sup>2,7</sup> An avid admirer of the arts, Duchenne used his scientific findings to participate in the dialogue of the aesthetic world. He criticized such works as the *Laocoon* in the Vatican Museum for



**Figure 1.** Guillaume Benjamin Armand Duchenne, also known as Duchenne de Boulogne (1806–1875).



**Figure 2.** Wilhelm Heinrich Erb (1840–1921) in one of the last photographs taken of him (1920, age 80).

displaying anatomically impossible lateral forehead lines of the frontalis muscle. Still today, Duchenne's extensive studies of facial muscles have relevance in the fields of plastic surgery and computerized facial expression.<sup>3</sup>

Duchenne died September 17, 1875, of a cerebral hemorrhage in Paris.<sup>1,4</sup> His view of his work as both art and medical documentation is evident in his donating his photographs to the Ecole Nationale Supérieure des Beaux-Arts of Paris instead of the Faculté de Médecine. His life was quietly appreciated with a bas-relief that was placed on the wall of la Salpêtrière's Hospital and now rests at the amphitheater's entrance to the Myology Institute at the Pitié-Salpêtrière Hospital.<sup>3</sup>

## ERB

Wilhelm Heinrich Erb was a German physician who lived from 1840 to 1921. He was born in a small village in the Bavarian Pfalz to a family of woodcutters in the Black Forest.<sup>8</sup> Bertha Karoline Hermann, his first wife, died and left him a son in 1873. He married Anna Gass in 1873 and had three more sons.<sup>1</sup>

Erb studied at Heidelberg and Erlangen and received his doctorate from Munich in 1864. After working as a Privat-Dozent (assistant professor) in the Medizinische Klinik (medicine clinic) for Nikolaus Friedrich (1825–1882) at Heidelberg, he left to become professor and director of the medical polyclinic in Leipzig.<sup>1</sup> He returned to Heidelberg in 1883 to take Friedrich's place as director of the medical clinic, where he stayed for the remainder of his career.<sup>4,8</sup>

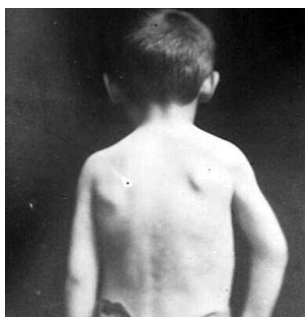
Erb's greatest contribution to medicine is his role in establishing neurology as a specialized field separate from psychiatry.<sup>4</sup> He successfully argued for the inclusion of neurology in the medical school curriculum: "Total devotion of a man and the consecration of all his powers [are] required in order to attain even approximate mastery of this huge field."<sup>4</sup> It is this belief that drove him to found *Deutsche Zeitschrift für Nervenheilkunde* (German Journal of Neurology) in 1891.<sup>4,9,10</sup> In 1907, he and Herman Oppenheim (1858–1919) founded the Gesellschaft deutscher Nervenärzte (Society of German Neurologists), with Erb serving as its first president.<sup>1,8,10</sup> Many aspects of his clinical examination of the nervous system are still practiced today.<sup>11</sup>

Although the cause of Erb's death in 1921 is unclear, he is said to have died after listening to Beethoven's *Eroica*, one of his favorite pieces of music.<sup>1,8</sup> Erb is also remembered for his prolific writing; he published more than 237 papers and several books on such topics as electrotherapy, spinal cord diseases, and peripheral nerve diseases.<sup>11</sup> While bowling with friends, Erb discovered the patellar reflex when he observed a colleague hitting himself with a heavy key under the patella, causing the involuntary knee jerk.<sup>1</sup>

The honors bestowed on Erb include a bronze statue, now located in "Erb's Department" at Krehl Medical Hospital, and many eponyms, including Erb dystrophy (a slow-progressing juvenile form of muscular dystrophy), Erb's point (the point on the side of the neck 2 to 3 cm above the clavicle and in front of the transverse process of the sixth cervical vertebra), the Erb reflex (biceps femoris reflex), Erb-Charcot paralysis (a rare syndrome consisting of spinal syphilis with various side effects), Erb-Goldflam syndrome (characterized by ptosis, strabismus, and general muscular exhaustion), the Erb-Westphal symptom (loss of knee jerk reaction, the most important reflex anomaly seen in tabes dorsalis), the Erb test (a test of degeneration), and the Erb phenomenon (increased irritability of motor nerves in tetany).<sup>4</sup>

## ERB-DUCHENNE BRACHIAL PLEXUS PALSY

Although Smellie in 1768, Danyau in 1851, and Gueniet in 1868 described a shoulder injury at birth that resulted in paralysis of the arm, Duchenne clearly stated the etiology as neurogenic paralysis and established the term *paralysie obstetricale* (obstetrical palsy).<sup>2,4</sup> In *De L'Electrisation Localisee* (1872), he presented the history of reported clinical cases to explore the causation and treatment for infantile obstetrical paralysis. Whereas previously the injury had been categorized as untreatable and had been ignored with an attitude of helpless passivity by physicians, Duchenne was aggressive in his approach to treating the injury with intent observation and experimentation. He theorized that this injury is not the result of forceps use and shifted blame to an obstetric technique in which the physician places his fingers under the armpits of the infant to extract it from the birth canal.<sup>12-15</sup> He cited 4 cases of birth palsies involving the upper roots of the brachial plexus as the basis for his etiologic finding: "In this kind of paralysis of the upper limb from obstetrical manipulations, the arm falls motionless along the side of the body, and is rotated inwards; the forearm remains extended, but the movements of the hand are preserved."<sup>15</sup> In this com-



**Figure 3.** Duchenne's photograph of a 6-year-old boy with typical shoulder and elbow presentation caused by obstetrical palsy, now known as Erb-Duchenne brachial plexus palsy. Originally appeared in Duchenne's *Album de photographies pathologiques complémentaires du livre intitulé de l'electrisation localisee*. Paris, France: Bailliere; 1862.

mentary, he precisely described the most common form of brachial plexus birth injury, which now shares his name.

Duchenne used electrodiagnosis to understand the severity of the paralysis—a precursor to using electromyograms in patients with brachial plexus injuries to determine the extent of nerve damage. Offering a chance of recovery to patients who had no chance before, Duchenne advocated electrotherapy as treatment and reported success in some cases. Although Duchenne's interest in infantile obstetrical paralysis was prognostic and therapeutic, he recognized the importance of an anatomical understanding of the injury: "I leave to others the study of the anatomical cause, and to say why in these cases the same muscles (deltoid, infraspinatus, biceps, and brachialis) are paralyzed." That someone was Erb.

Erb's medical breakthrough in understanding brachial plexus injuries resulted in his detailed study of the anatomical structure, as Duchenne had suggested, which proved crucial for treatment purposes. In "Über Eine Eigentümliche von Lahmungen im Plexus Brachialis" ("Concerning an Unusual Localisation of Brachial Plexus Paralysis") (1877), Erb described 4 adult cases of upper extremity palsy in which the same muscles—the deltoid, biceps, brachialis, and sometimes infraspinatus—were paralyzed. From his observations, he concluded that the lesion site could not be where the 4 nerve branches (axillary, musculocutaneous, radial, medial) that control these muscles have already separated from the brachial plexus. Examining the supraclavicular region, he determined from experimentation with electrical stimulation which nerve roots controlled the muscles consistently injured in the common birth palsy previously described by Duchenne. Erb localized the lesion site at C5 and C6, now known as Erb's point. Erb's insightfulness proved crucial in understanding palsies associated with brachial plexus roots, an area previously ignored.<sup>16</sup>

Because Erb discovered the specific roots associated with brachial plexus palsy, he disagreed with Duchenne's theory that the cause is the physician's insertion of fingers into the infant's armpit. Given that the lesion was in the upper region of the brachial plexus, Erb suggested that the Prague maneuver was the most likely cause, which involved the physician's grasping the infant's neck in an act of forcible extraction during childbirth, putting pressure on the fifth and sixth nerve roots of the brachial plexus. Erb noted paralysis of the infraspinatus as an important clue in determining damage to the brachial plexus injury in newborns and advised that this mechanism be considered in further attempts to understand the injury.

Duchenne's etiologic finding combined with Erb's anatomical detective work introduced the world to neonatal brachial plexus injury, an area nearly ignored before their time. While Duchenne demonstrated adherence to a pioneer spirit in practicing medicine, Erb modeled the successful convergence of anatomical expertise and experimentation. Their combined efforts led to identification of the most common form of brachial plexus palsy, known today as Erb-Duchenne palsy, which was then presented to the medical community.

Despite advances in diagnosis and treatment, this clinical entity persists to the present day. Erb-Duchenne brachial plexus palsy occurs in up to 2 of every 1000 live births. Known risk factors include shoulder dystocia, large gestational size, maternal diabetes, prolonged labor, and difficult instrumental delivery. Electrical stimulation is still used to diagnose and treat the injury. However, treatment options, such as nerve grafts and transfers, muscle releases and transfers, elbow and shoulder reconstructions, joint fusions, osteotomies, and use of Botox, have improved outcomes for patients in ways not possible in the eras of Duchenne and Erb. In the spirit of these astute clinicians, clinical researchers continue to challenge themselves to change the implications of the Erb-Duchenne hyphenated eponym from something that can result in lifelong functional impairment to what it should be—an interesting bit of hyphenated-history.<sup>17-19</sup>

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