From the Stars to the Gutter: The (Almost) Untold Story of a Neurological Genius

(History of Neurology)

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Abstract

Charles-Édouard Brown-Séquard (1817–1894) is primarily remembered for the eponymous spinal cord hemisection syndrome. Yet his scientific contributions extended far beyond this single observation, encompassing groundbreaking work on sensory pathways in the spinal cord, the vital role of the adrenal glands, and the pioneering concept of "internal secretions" that foreshadowed modern endocrinology. His extraordinary career, however, was marked by profound personal restlessness—later attributed to a bipolar disorder—financial hardship, and perpetual professional instability across three continents. In 1889, at the age of seventy-two and at the pinnacle of his career as professor at the Collège de France, Brown-Séquard publicly announced that he had reversed the effects of ageing through self-injections of testicular extracts from dogs and guinea pigs. While this announcement inadvertently anticipated the field of hormone replacement therapy, it brought him immediate and devastating ridicule, effectively eclipsing decades of legitimate scientific achievement. His therapy, despite having had several distinguished aged followers (including Pasteur and Charcot), became the subject of satirical songs, cartoons, and dismissive commentary from the medical establishment. This article traces Brown-Séquard's remarkable trajectory from a childhood in Mauritius through his peripatetic career in France, England, and the United States, to his final hours, when he turned his own fatal cerebral haemorrhage into one last act of clinical self-observation. We argue that the derision provoked by his rejuvenation experiments has unjustly overshadowed his substantial and lasting contributions to the contemporary neurosciences.

Keywords:

Brown-Séquard; Brown-Séquard syndrome; history of neurology; endocrinology; organotherapy; spinal cord

June 1, 1889: the eminent Professor Charles-Édouard Brown-Séquard appeared before the Société de Biologie and confidently described his latest discovery:

> *I am seventy-two years old. My general strength, which has been considerable, has notably and gradually diminished during the last ten or twelve years. Before last May 15th I was so weak that I was always compelled to sit down after one hour's work in the laboratory. Even when I remained seated all the time, or almost all the time, in the laboratory, I used to come out of it quite exhausted after three or four hours' experimental labor, and sometimes after only two hours. For many years, on returning home in a carriage by six o'clock, after several hours passed in the laboratory, I was so extremely tired that I invariably had to go to bed after having hastily taken a very small amount of food. Very frequently the exhaustion was so great, that although extremely sleepy, I could not for hours go to sleep, and I only slept very little, waking up exceedingly tired* (Dunbar 1889, 15–16).

He further explained that he had self-administered a treatment of his own design to counteract age-related physical decline. In line with his hypothesis on the "dynamogenic power" of substances released into the bloodstream by the testicles (Brown-Séquard 1889b), this new therapy consisted of subcutaneous injections of testicular extracts derived from dogs and guinea pigs.

In 1889, the concept of hormones was not yet understood; the word itself would only be coined in 1905 by Ernest Starling. Thus, on June 21st, 1889, when Brown-Séquard published the text of his speech in the *Comptes Rendus* of the Société (Brown-Séquard 1889a), he could only acknowledge that the scientific investigation into the composition of these extracts would be left to future researchers. The specific male hormone, testosterone, which we now know is primarily produced in the testicles and is responsible for many of the effects Brown-Séquard was observing, would not be isolated until 1935 by Ernst Laqueur's group (1880 – 1947) and then synthesised independently by Adolf Butenandt (1903 – 1995) and Leopold Ruzicka (1887 – 1976), who shared the Nobel Prize in Chemistry in 1939 (Nieschlag and Nieschlag 2019). What Brown-Séquard could do, however, was document and describe effects on himself:

> *The day after the first subcutaneous injection and still more after the two succeeding ones a radical change took place in me, and I had ample reason to say and to write that I had regained at least all the strength I possessed a good many years ago. Considerable laboratory work hardly tired me. To the great astonishment of my two principal assistants, Drs. D'Arsonval and Henocque, and other persons, I was able to make experiments for several hours while standing up, feeling no need whatever to sit down* (Dunbar 1889, 16–17).

He then commented on the return of his muscular strength:

> *I have measured comparatively, before and after the first injection, the jet of urine in similar circumstances—that is, after a meal in which I had taken food*

> *and drink of the same kind in similar quantity. The average length of the jet during the ten days that preceded the first injection was inferior by at least one quarter of what it came to be during the twenty following days. It is therefore quite evident that the power of the spinal cord over the bladder was considerably increased* (Dunbar 1889, 17).

He made similar observations regarding the force of defecation. Next came the counterproof. On June 4th, he discontinued the injections:

> *For four weeks no marked change occurred, but gradually, although rapidly, from the 3rd of this month (July) I have witnessed almost a complete return of the state of weakness which existed before the first injection. This loss of strength is an excellent counterproof as regards the demonstration of the influence exerted on me by the subcutaneous injections of a spermatic fluid* (Dunbar 1889, 19).

After this announcement, two things occurred. The first was the emergence of an unregulated market for rejuvenation elixirs that would persist for decades, anticipating the modern "lifestyle drug" industry and effectively framing ageing as a treatable disease for the first time (Eloy 1893). Among those "cured of old age" were poets, writers, politicians, athletes, and even scientists, including Louis Pasteur (1822 – 1895) (Celestin 2014).

The second consequence was the onset of isolation and the decline of Brown-Séquard's reputation.

At the time, Brown-Séquard was a respected scientist (Berthelot 1900). Born in Mauritius in 1817, he had crossed the Atlantic Ocean over sixty times to deliver seminars and lectures attended by students from around the globe. He treated long queues of patients in his clinics in Paris, London, and New York, and had received multiple accolades for his scientific discoveries. By 1878, he was at the pinnacle of his career.

But his June 1st, 1889 announcement brought him ridicule: his therapy became the subject of popular songs, satirical plays, cartoons, and jokes. The Austrian medical journal *Wiener Medizinische Wochenschrift* wrote that Brown-Séquard's actions were "the ultimate proof of the need to retire professors after the age of seventy." The *Deutsche Medizinische Wochenschrift* dismissed his work as "a senile aberration." Harvey William Cushing (1869 – 1939) referred to him as the "Ponce de León of endocrinology," alluding to the Spanish explorer who, according to legend, stumbled upon Florida while seeking a fountain of eternal youth. Upon Brown-Séquard's death, the French newspaper *L'Événement* wrote that he had been "the most ridiculed man of all time" (Celestin 2014).

This is likely why so little remains known about his scientific work and discoveries, which chiefly concerned the nascent fields of neuroscience and neurology. Beyond the eponymous syndrome involving the hemisection of the spinal cord, today's specialists recall little of Brown-Séquard's contributions. Yet his work was seminal in elucidating spinal cord pathways, requiring years of research under conditions that were often far from optimal.

Brown-Séquard's scientific work began with his dissertation, *Recherches et Expériences sur la Physiologie de la Moelle Épinière* (Brown-Séquard 1846). In this work, he considered the spinal cord and brain separately and studied their reactivity. He then showed in detail how sensory

pathways travel in the white matter of the spinal cord: he first described that tactile and proprioceptive fibres enter the dorsal root and from the ipsilateral dorsal horn travel up through posterior columns to the Goll and Burdach nuclei, then cross and reach the contralateral thalamus after travelling through the medial lemniscus. On the other hand, nociceptive fibres cross immediately through the anterior commissure and travel up to the contralateral thalamus through the antero-lateral spinothalamic ascending systems. Decades later, these observations led to the definition of the so-called Brown-Séquard Syndrome (BSS), a rare neurological condition caused by damage to one side (hemisection) of the spinal cord. Different aetiologies may provoke BSS, including trauma, infections, tumours, multiple sclerosis, ischaemia, and, rarely, syringomyelia. Clinical manifestations of the hemicord syndrome are ipsilateral loss of motor function (weakness or paralysis) due to corticospinal tract damage and reduced or absent proprioception, vibration, and fine touch due to posterior column involvement. These ipsilateral signs are associated with reduction or loss of pain and temperature sensations contralateral to the lesion site, due to spinothalamic tract damage, which crosses—as Brown-Séquard had discovered—at spinal entry level.

It is worth recounting certain details of Charles-Édouard Brown-Séquard's personal history, an extraordinary yet ill-fated story marked by profound restlessness that later biographers have attributed to a bipolar disorder characterised by severe depressive episodes.

Born in Port Louis in 1817, three years after Mauritius came under British rule by the Treaty of Paris that followed Napoleon's defeat, Brown-Séquard acquired British nationality despite being of French descent. His mother, Charlotte Séquard, was French, while his father, Charles Edward Brown—an American sea captain of Irish origin born in Philadelphia—died at sea before his son's birth. Brown-Séquard took his father's given name (in a French-adapted form) and surname; later, he added his mother's French surname, Séquard, to underscore his cultural affiliation.

As a young man, Brown-Séquard showed an interest in poetry and a certain literary talent—he was reportedly called the "young Shakespeare of Port Louis." At the age of twenty, he proposed to his mother that they travel to France so he could pursue his studies. His mother sold all their Mauritian holdings, including slaves, and set out with him.

However, events did not unfold as he had imagined. Once in Paris, Brown-Séquard submitted his writings to Charles Nodier (1780 – 1844) (Aminoff 2011), who advised him to abandon a literary career. Consequently, Brown-Séquard decided to study medicine, particularly the functions of the nervous system.

In 1842, the death of his mother triggered the first major depressive episode in Brown-Séquard's life. Nevertheless, he successfully obtained his medical degree in 1846. He subsequently embarked on scientific research in isolation, facing considerable hardships, particularly of a financial nature. Confined to his home laboratory, he dedicated himself entirely to his studies, often at the expense of basic needs such as food, sleep, and social interaction. During this period, he subjected his own body to various experiments, self-inflicting significant harm. Notably, he developed merycism, a rumination syndrome that would afflict him for the rest of his life. Merycism (from the Greek *merykazein*, to chew the cud) is a functional disorder characterised by the effortless, repeated regurgitation of recently ingested food, which is then re-chewed, re-swallowed, or expelled. Though historically associated with infancy and intellectual disability, it is now recognised as a condition that can affect adults. Additionally, during a cholera epidemic in Mauritius, he engaged in investigations into the disease's aetiology. It is likely that he became infected in this process and subsequently attempted to treat himself with an excessive dose of opium, leading to a near-fatal intoxication.

His lack of French nationality soon became a serious professional obstacle: for a long time, Brown-Séquard was unable to secure permanent positions in France, and therefore no steady income. On multiple occasions throughout his life, he travelled to the United States and to England, pursuing the dream of a university appointment. His restlessness, his fluctuating moods, and unfavourable circumstances—primarily political—impeded his career for decades. By the end of his life, he had amassed a very long record of journeys, relocations, and varying academic appointments, along with three widowhoods and three children: one died after only a few weeks, another suffered from severe mental health issues and alcoholism. The third, Charlotte, would become his only surviving descendant (Celestin 2014; Aminoff 2011).

Despite these challenges, Brown-Séquard managed to secure work and produced meaningful scientific contributions (Ott 1896). His research interests included the anatomy and physiology of the nervous system and its disorders, such as epilepsy. Thanks to his extensive knowledge of the spinal cord, he also hypothesised a form of "spinal epilepsy" (Olmsted 1946), a notion not subsequently supported by other investigations, that may instead correspond to what would now be recognized as ankle clonus, as highlighted by Jean-Martin Charcot (1825 – 1893) (Koehler 1994). He also studied rigor mortis. His third major area of inquiry involved identifying and clarifying the presence and role of what were then referred to as "internal secretions"—substances we now call hormones. Brown-Séquard conducted fundamental experiments on the adrenal glands, supporting the observations of Thomas Addison, who had described the chronic adrenal insufficiency syndrome that now bears his name (Williams 1949).

In 1878, Brown-Séquard finally obtained French citizenship and, just five days later, assumed the prestigious professorial chair at the Collège de France (Celestin 2014, 179). This position had previously been held by his mentor, François Magendie, and subsequently by his friend and rival, the eminent Claude Bernard, who had died earlier that same year at the age of 64. Although Brown-Séquard was only four years younger, he had just entered into his third marriage and was embarking on a more settled phase of his life. During this period, he received significant accolades: he was named Chevalier of the Légion d'Honneur, elected member of the French Academy of Sciences, and later served as President of the Société de Biologie. These honours solidified his reputation, and he gained increasing recognition as a leading figure in French science.

However, rather than consolidating his legacy and enjoying a well-earned retirement, Brown-Séquard embarked on a new line of experimentation—extracting enigmatic "testicular fluids" from guinea pigs.

Brown-Séquard's life came to an end on April 2nd, 1894 ("Obituary" 1894), and he did not miss the opportunity to turn it into one last self-experiment. While suffering a cerebral haemorrhage, he recorded his symptoms:

> *"In the first place, my sight has become almost suddenly very poor – this is persistent: and another slight trouble, almost constant, but not absolutely so, exists; it is a complete loss of sight in a small part of the vision field constituting hemiopia, limited to a small part of the left of the two retinae. This is, of course, of cerebral origin, but it does not seem to be of organic origin, because it is not absolutely constant. Most likely, there is either inhibition or a vascular spasm, which destroys at time the power of sight in two small parts of the retinae. This began on Sunday. The next morning something worse occurred. My life, and all*

> *that occurred for many months lately became suddenly a blank …"* (Celestin 2014, 224).

Within a few days, paralysis and aphasia appeared, followed by coma and, a day and a half later, death. On the last day of his conscious life, Brown-Séquard was able to write only a single word: "hyperesthesia."

A more complete report in Italian language of Brown-Séquard's personal and scientific life can be found in *"Tre colpi di genio e una pessima idea. Ascesa e caduta di uno scienziato squinternato"*, by Silvia Bencivelli, Bollati Boringhieri Editore, 2025.

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Specific Statements

Permissions

Not applicable.

Patient Consent

Not applicable.

Funding

The authors received no specific funding for this work.

Conflicts of Interest

The authors declare no conflicts of interest.

Provenance and peer review: Not commissioned; externally peer reviewed. Submitted: March 2, 2026. Received in revised form: March 4, 2026. Accepted: March 4, 2026.