

# Hermann von Helmholtz (1821-1894): a pioneer in physiology and medical physics

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## ABSTRACT

The purpose of this article is to present in brief the life and work of Hermann Ludwig Ferdinand von Helmholtz, and to point out his contribution in medical physiology and physics. Original manuscripts of Helmholtz were carefully studied, as well as, contemporary reviews articles, biographies, whereas a detailed online search was conducted. We were able to identify Helmholtz's most important contributions in the Medical Physiology, including his work on vision, acoustics and transmission of nerve impulses. His work on the physiology of senses also set the basis of modern psychology. Parallely with this, his work in Physics and especially in the formulation of the law of energy conservation is also commemorable and, by all means, monumental. Overall, Helmholtz was the first to settle medical physiology on a pure scientific basis rejecting all vitalistic influence and theories, connecting it with physics. Undoubtedly, Hermann Helmholtz is to be considered as one of the most prestigious and eminent scientists of the German school of Medicine in 19th century.

**Key words:** *physiology, health physics, medicine, Germany, biography.*

### Biographical data and studies

Hermann Ludwig Ferdinand von Helmholtz was born in Potsdam, Germany in 31th August 1821, from a middle-class family. Hermann was the eldest child in a family of six children. As a child, he suffered from hydrocephalus, as a result of meningitis and was in bed for long periods of time.<sup>1</sup> Because of his delicate health, Hermann was confined at home till the age of seven and tutored by his father, Ferdinand, who had studied classical philology and philosophy, a close friend of the publisher and philosopher Immanuel Hermann Fichte and a poorly paid teacher at the Gymnasium of Potsdam.<sup>2</sup> Ferdinand was an artistic man and his influence meant that Hermann grew up to have a strong love of music and painting. Caroline Penne Helmholtz, Hermann's mother, was the daughter of an artillery officer. From her Hermann inherited: "... the placidity and reserve which marked his character in later life".<sup>3</sup>

Like many other scientists, he was not fond of Latin since his

early schooldays. Moreover, he lacked a capacity for parrot learning and no talent for mathematics, but he showed an extreme interest in Physics (Williams). His father taught him the classical languages, as well as French, English, and Italian. He also introduced him to the philosophy of Immanuel Kant (1724-1804) and Johann Gottlieb Fichte (1762-1814) and to the approach to nature that flowed from their philosophical insights.

Due to severe economic difficulties, Helmholtz's father persuaded him to enter in the Friedrich Wilhelm Institute that provided free medical studies for students who agreed to serve ten years as doctors in the Prussian Army.

In 1837 Helmholtz was awarded a government grant to enable him to study medicine at the Royal Friedrich-Wilhelm Institute of Medicine and Surgery in Berlin, in which he enrolled at 1838.<sup>1,2</sup> During his medical studies, Helmholtz came under the influence of Johannes Müller and the professor of Physics H.G. Magnus (1802-1870). Helmholtz began research in physiology under Johannes Müller (1801-1858), where he become acquainted with his other students who would all become eminent scientists and renovators of German Physiology freeing it from the hindrances of vitalism and natural philosophy.<sup>1,2</sup>

Given Helmholtz's contributions to mathematics later in his career it would be reasonable to have expected him to have taken mathematics courses at the University of Berlin at this time. However he did not, rather he studied mathematics on his own, reading works by Laplace, Biot and Daniel Bernoulli.<sup>4</sup> He also read philosophy works at this time, particularly the works of Kant. His research career began in 1841, when he began work on his dissertation. He rejected the direction which physiology had been taking which had been based on vital forces which were not physical in nature. Helmholtz strongly argued for founding physiology completely on the principles of physics and chemistry. In 1842, he presented his thesis on the connection between nerve fibers and nerve cells.<sup>2</sup> His first post (1842-1843) was that of a house surgeon at the Charité Hospital in Berlin. During this period, Helmholtz published a demonstration of the strictly chemical nature of fermentation and noted that a vitalistic account would be equivalent to assuming a perpetual-motion process. Afterwards, in 1843, Helmholtz was appointed surgeon to a hussar regiment in Potsdam. In parallel, he maintained his contacts with Müller's group, since the hussar regiment was not an intellectually stimulating environment.

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