

New Pages in the Biography of Nikolai Alexandrovich Bernstein

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It seems... that the fundamental questions raised by Bernstein in 1962 remain equally fundamental and equally unanswered 20 years later. We may optimistically suggest that they will provide many individuals with a way to pass the time for the next 20 years (Agarwail and Gottlieb [1])

At present, theoretical neuroscience may be considered an independent branch of brain science. The importance of the studies by N.A. Bernstein in this respect may be compared to the importance of Maimonides' reform of Judaism, Luther's reform of Christianity, or Maxwell's revolution in physics (Latash [2])

Abstract Nikolai Alexandrovich Bernstein (1896–1966) is well known today primarily for formulating the problem of redundant degrees of freedom and their elimination in motor control, as well as his hierarchical theory of movement coordination. This paper aims to uncover new pages in the biography of N.A. Bernstein, based on materials from the archive of his nephew Alexander Sergeevich Bernstein, as well as recent interviews with the former pupils of N.A. Bernstein. Concentrated around several interdisciplinary seminars, they grew into a young generation of physiologists in the late sixties and made remarkable contributions inspired by Bernstein's new principles of neuroscience. These include the discovery of the spinal automatism of stepping in the cat, the “equilibrium point” hypothesis, the hindlimb wiping reflex of the frog as an example of a targeted trajectory organized at the spinal level, and the probabilistic prognosis in human activity.

Keywords Motion • Neuroscience • Motor control • Physiology

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1 Introduction

Only a great optimist might think that science benefited from the fact that Nikolai Alexandrovich Bernstein (1896–1966) was fired from all his positions at the end of the 1940s. It was after this that he started working on his final articles and books, and summarizing experimental material that he had gathered before, as well as the data of young researchers who visited him at home. It is possible, however, that if it were not for this fact, Bernstein would have not become an icon at the beginning of the 1960s, when the worldwide interest in cybernetics reached Russia [3]. In this paper, we intend to reveal new pages of Bernstein's biography, reflected in his letters and interviews with his pupils and relatives. After half a century from his death, they considered themselves lucky to have known a man of genius.

2 Childhood and Youth

Bernstein descended from a family of doctors. His father Alexander Nikolaevich Bernstein (1870–1922) was not only a well-known Moscow physician, but also a broadly educated scholar who laid foundations for the specialization and progress of Russian psychiatry. Nikolai's grandfather Nathan Osipovich Bernstein was the chairman of the Odessa Society of Physicians.

In 1913, Nikolai graduated from high school with a silver medal and was accepted at the Department of History and Philology of Moscow University. He was interested in languages and philosophy. But in August 1914 the war broke out. Like the rest of the country, the young generation of the Bernstein family was swept by a wave of patriotism. Nikolai transferred to the Medical Department of the University. In the fall of 1914, he began the new school year as a medical student (Fig. 1). In the spring of 1919, he graduated from the First Moscow University, obtained his medical degree, and was drafted into the Red Army as a doctor [4, 5]. In spring 1921, Bernstein came back from the front. His father helped him to get a job in the field, and he became a physician at the Gilyarovsky Psychiatric Clinic. After his father's death in 1922, he took over his practice. However, in August 1922, he met Alexey Kapitonovich Gastev—and so began Bernstein's famous period of work at the Central Institute of Labor.

As for Nikolai's younger brother, Sergei Alexandrovich Bernstein, he kept the railroad passion inherited from his mother Aleksandra Karlovna Bernstein (nee Ioganson, 1867–1941) and her father, a lineman on the railway. By 1921, Sergei graduated from the Department of Physics and Mathematics of Moscow University, and in 1926 from the Moscow Railroad Institute. During his studies at Moscow University he met Tatyana Popova (see the history of her family in [6]) and married her in 1922. Later on, she would join Bernstein's lab at the Central Institute of Labor.

