Sergei Davidenkov, the father of Soviet neurogenetics

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ABSTRACT

Sergei Davidenkov (1880-1961) was one of the most important Soviet neurologists of the first half of the 20th century, and the founder of neurogenetics in the Soviet Union. Davidenkov mainly studied hereditary diseases, focusing on neuromuscular disorders. He was the first author to describe scapuloperoneal amyotrophy, also known as Davidenkov syndrome, as well as hereditary myoclonic dystonia. He spent most of his career in Leningrad and had a close relationship with Ivan Pavlov and other members of his school, and became interested in eugenics. A tireless researcher, he published numerous studies and created a fruitful school of neurologists and geneticists. As did many other scientists of his time, he suffered the injustices of Stalinism; in 1948, he was forced to give up his studies on genetics and lost a son in the Gulag.

KEYWORDS

Hereditary myoclonic dystonia, Ivan Pavlov, neurogenetics, scapuloperoneal amyotrophy, Sergei Davidenkov, Stalinism

Introduction

The great Soviet neurologist Sergei Davidenkov (Давиденков) is considered the father of neurogenetics in his country and developed a productive school of neurologists and geneticists (Figure 1). Unlike their predecessors (Kojevnikov, Bekhterev, Rossolimo, Minor, and other well-known scientists), the neurologists from Davidenkov's generation, in the first half of the 20th century (Krol', Kramer, Konovalov, Grinshtein), are virtually unknown in the Western world. This is explained by the great difficulties they endured as a result of Stalinist policies.[1]

This article aims to provide an insight into Davidenkov's life and achievements, based on the international literature. In the West, Davidenkov is essentially known for his descriptions of two syndromes, which were published in English and in German. This is the price many scientists and intellectuals have to pay for not systematically publishing in an international lingua franca. Despite the scarcity of available information, we hope this article contributes to the recognition of the figure of Sergei Davidenkov.

Development

Early years

The son of a mathematics professor and a pianist, Sergei Nikolajevich Davidenkov was born in Riga (present-day Latvia) in 1880. He became interested in music and the

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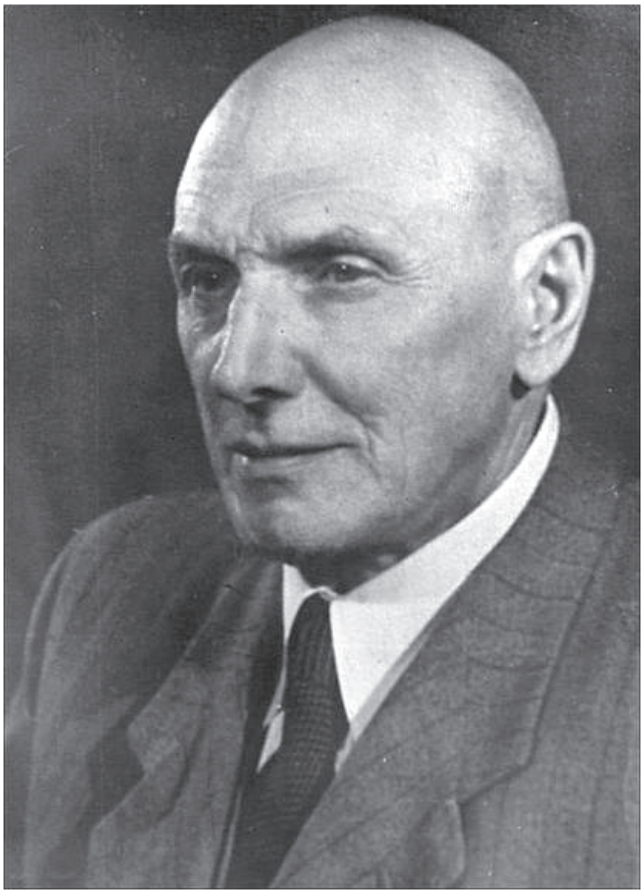

Figure 1. Sergei Davidenkov[2]

arts from an early age. His drawing skills enabled him to make faithful schematic representations of the features of different neurological diseases.[2]

He studied at a secondary school in Smolensk, at the Military Medical Academy of Saint Petersburg, and at Moscow University, where he graduated in 1904. For several years, he worked as a clinical assistant in psychiatry and earned his doctorate in 1911 after presenting a pioneering histopathological study on acute ataxia (Leyden-Westphal syndrome), suggesting a systemic, postinfectious cause. Subsequently, he described patients experiencing recurrent episodes of acute ataxia and families including patients at different stages of the disease, and postulated that the condition was hereditary.[2]

He ran the department of nervous diseases of the Women's Medical Institute at Kharkiv from 1912 and, between 1920 and 1923, he was chair of the first neurology clinic at the University Hospital of Baku, Azerbaijan, later becoming vice-chancellor.[2-4]

From 1925 to 1931 he ran the neurological diseases section at the V. A. Obuha institute for occupational diseases in Moscow. He ran the neurological diseases section of the Medical Academy of Postgraduate Studies in Leningrad from 1932 until his death in 1961. He was distinguished with the title Honoured Scientist of the Russian Soviet Federated Socialist Republic in 1934.[2,3]

Scientific activities

Davidenkov focused on hereditary neurological diseases; he was the first to use the term "neurogenetics" in his country and one of the first researchers in the world to define the phenomenon of genetic anticipation. Through thorough genealogical inquiry and detailed clinical examination, he identified the heterogeneity of many phenotypically similar disorders. In 1925, Davidenkov published *Hereditary disorders of the nervous system*, in which he proposed classifying disorders based on a systematic genetic catalogue rather than by phenotype. Other major works were *The problems of polymorphism in hereditary disorders of the nervous system* (1934) and *The problems of evolution and genetics in neurology* (1947).[1,2]

Davidenkov was the first Soviet neurologist to systematically study disorders with polygenic inheritance, for instance several forms of epilepsy, amyotrophic lateral sclerosis, and narcolepsy, and mainly focused on neuromuscular disorders. In 1927, the Moscow Society of Neurologists and Psychiatrists created a genetics bureau for the study of hereditary diseases, to be run by Davidenkov; in 1934, Davidenkov himself established a similar bureau for genetic counselling in Leningrad.[2,5]

His writings describe the symptoms of such hereditary diseases as scapuloperoneal amyotrophy, Dejerine-Sottas disease, latent forms of myopathy, Friedreich ataxia, etc.[1]

He also studied nervous system infections, identifying a subgroup of Russian spring-summer tick-borne encephalitis characterised by fever and bilateral horizontal saccadic dysfunction. During an epidemic of encephalitis lethargica in Azerbaijan, Davidenkov wrote a thorough description of its symptoms, identified

a myoclonic variant, and described two cases of encephalitis lethargica associated with considerable alterations in the substantia nigra.[2]

Davidenkov syndrome

In the 1920s and 1930s, Davidenkov described a group of patients with muscle weakness and scapuloperoneal atrophy; he proposed the term "scapuloperoneal amyotrophy" and included the entity among the muscular dystrophies. This classification was later debated when in 1929 he found several familial cases of scapulohumeral atrophy with distal sensory loss and reduced motor and sensory conduction velocities.[2,6-8]

For some authors, the spinal muscular atrophies would include this hereditary form of scapuloperoneal atrophy, which involves the shoulder girdle and distal muscles bilaterally, and which may be asymmetric and selective. Initially described by Brossard in 1889 and subsequently reported by Davidenkov in 1929 in German[6] and in 1939 in English,[7] scapuloperoneal atrophy was also known as "Davidenkow syndrome," since the last letter of the surname (в, in Russian) was transliterated as "w" in the German-language article, whereas in English and Spanish it was transliterated as "v". The eponym should therefore be written with a "v" in English and Spanish.

The 1939 series included 13 cases, 12 of which were familial. According to a 1975 review by Schwartz and Swash,[8] who first used this eponym, the autosomal recessive form is more common and more severe than the dominant form of the disease, usually manifesting in late adolescence or early adulthood, and is slowly progressive. Recessive forms are frequently associated with pes cavus, involvement of the intrinsic muscles of the hand, and severe weakness of the periscapular and shoulder muscles and foot dorsiflexors, potentially resulting in severe disability. Many patients also display reduced sensitivity of the distal limbs.[8,9] In 1980, Harding and Thomas described a patient with symptoms compatible with Davidenkov syndrome in a family with type 1 hereditary motor and sensory neuropathy.[10]

Electrophysiology studies revealed decreased nerve conduction and long distal motor latencies; these findings are more suggestive of sensorimotor neuropathy than anterior horn disease. Some patients have been found to have mutations in the *TRPV4* gene, which is associated with a plasma membrane calcium channel (this is not specific to the syndrome), and cases of 17p11.2 deletions.[11-13] A recent study reports the case of a patient with scapuloperoneal syndrome associated with hereditary neuropathy with liability to pressure palsies and a deletion in the *PMP22* gene on chromosome 17p11.2.[14] Scapuloperoneal syndrome is probably heterogeneous; molecular biology will help better define its characteristics.[11]

Hereditary myoclonic dystonia

Davidenkov first used the term "hereditary myoclonic dystonia" in 1926 to refer to familial cases with onset during childhood or adolescence and characterised by a combination of slow, dystonic movements and rapid muscle jerks.[15] Obeso et al.[16] reintroduced the concept in 1983 to describe familial cases of idiopathic torsion dystonia and myoclonic jerks, frequently involving the same muscle groups. Patients respond favourably to alcohol consumption and treatment with clonazepam. There is controversy regarding whether this entity overlaps with hereditary essential myoclonus.[16,17]

Pavlov's influence

During the first half of the 1930s, Davidenkov directed the clinic of neurosis of the All-Union Institute of Experimental Medicine, in Leningrad, where he worked with Pavlov. Within the Institute, Pavlov also established a psychiatry clinic in 1931, which was directed by Ivanov-Smolensky. These clinics were created to extrapolate his results from experiments with dogs to human disease, and to transfer laboratory data to the clinical setting, providing specific examples of the applicability of his findings to daily clinical practice. Davidenkov adapted Pavlov's physiology model for explaining different neurological symptoms and spread it among Soviet neurologists. He was a regular attendee of the "Pavlovian Wednesdays," where scientists would discuss their research. It was in the Institute that Davidenkov met Evgenia Kulkova, who later became his second wife and closest collaborator, continuing Davidenkov's research on genetics after he died.[2,18]

After Pavlov's death, Davidenkov continued to have a close relationship with Pavlov's successor, Leon Orbeli. In 1940, Davidenkov told Orbeli about the difficulty of classifying traits in dogs and identifying the potentially heritable basic elements of higher nervous activity. He suggested that Pavlov's three main features of the central nervous system (strength, balance, and lability) may serve both purposes.[18]

In 1936, the clinic of neurosis published *Neurology and genetics*, a volume of over 200 pages.[5]

Influence of genetics and eugenics

In the 1920s and 1930s there was a large community of geneticists in the Soviet Union, and eugenics flourished. The Russian Eugenics Society was created in the 1920s; Pavlov was its first president and Davidenkov one of its most active collaborators. Soviet Marxists advocated a proletarian eugenics free of racism and elitism in order to build socialism.[18]

Davidenkov acted as a consultant at the main genetics institution in the 1930s, the Institute of Medical Genetics in Moscow, directed by Solomon Levit.[19]

In April 1930, Davidenkov published a long article, "Our eugenic perspectives," proposing a "practical eugenic programme" for the socialist society and the creation of the Supreme State Eugenic Council.[5]

For the seventh International Eugenics Congress, to be held in Moscow in the summer of 1937, Davidenkov was to give a special presentation on human genetics and race theories. The congress was never held, however, due to the changing political climate of the Soviet Union in the summer of 1936, with the beginning of the Great Purge and the campaign against geneticists. Of the most renowned geneticists, Solomon Levit was arrested and executed, and Hermann Muller fled to Great Britain. However, some medical institutes, such as Davidenkov's, continued to study hereditary diseases.[5] In 1938, Davidenkov also wrote the entry on human inheritance for the *Great Soviet Encyclopedia*.[19]

The Great Patriotic War

During the Second World War, known in the USSR as the Great Patriotic War (1941-1945), research into medical genetics came to a halt as physicians had to contribute to the war effort. Davidenkov worked as chief neurologist during the siege of Leningrad, and published numerous studies, including "Neuritis from exposure to cold" and "Disorders of speech in wartime and its pathophysiology."[2,4]

Collaborating with psychiatrist Vladimir Gorovoi-Shaltan, he edited a book on nervous diseases, published as part of the 35-volume *The experience of Soviet medicine during the Great Patriotic War, 1941-1945*. Davidenkov postulated that hysteria and such related diseases as deaf-mutism (*glukhonemota*) were psychogenic and therefore reversible with psychotherapy. He attempted to explain deaf-mutism using Pavlov's theories, arguing that self-suggestion disconnected the brain region involved in language. He was decorated with the Order of Lenin and the Order of the Red Star for his distinguished conduct during the war.[20,21]

The post-war period

Davidenkov was elected a founding member of the USSR Academy of Medical Sciences in 1945, and became one of the elite physicians allowed to treat Kremlin officials.[19]

Soon after the war ended, in 1947, Davidenkov published an extensive treatise, *The problems of evolution and genetics in neurology*, based on his over 20 years' experience from clinical studies of human inheritance.[2]

He also became interested in shamanism, which he considered a form of hysterical worship, an elaborate, stable, socially organised form of neurosis.[22]

Stalin's final years in power, from 1947, were marked by uncertainty; the Cold War had just begun, bringing about an exacerbation of Soviet nationalism and anti-Semitism behind a façade of anti-cosmopolitanism. Soviet scientists were forced to follow the ideas of Ivan Pavlov, who had died a decade previously. Two of the most important events of that period were the August 1948 session of the All-Union Academy of Agricultural Sciences of the Soviet Union (VASKhNIL), where Trofim Lysenko's pseudogenetic theories took root among the audience, and the Pavlovian session, held in the summer of 1950, where some of the country's most important physiologists were severely criticised. Both meetings affected Davidenkov.[23]

During the Pavlovian session, Nikolai Razenkov, the vicepresident of the USSR Academy of Medical Sciences, attacked the Institute of Evolutionary Physiology and Pathology of Higher Nervous Activity, directed by Orbeli, Pavlov's most dedicated student. Razenkov began by attacking a member of the Academy, Sergei Davidenkov, a well-known psychiatrist and neurologist who had acted as a genetics consultant to the Institute until 1941 and helped Pavlov with genetic problems of higher nervous activity. Davidenkov's worst offence was his 1947 monograph *The problems of evolution and genetics in neurology*, enthusiastically praised by Orbeli. According to Razenkov, Davidenkov had tried

to legitimise "autogenetic perversions" by citing Pavlov's theories. Razenkov also criticised the Institute for following a Mendelian rather than Pavlovian approach.[24]

Orbeli had already been criticised two years previously at the meeting of the VASKhNIL. The war against Mendelian genetics was a political one, and during the meeting, Davidenkov was said to be one of the greatest enemies of Soviet science. Orbeli rebuffed the attack against the Institute, writing a report on 17 September 1948 regarding the resolutions agreed at the meeting of the VASKhNIL, which he had attended, and the criticisms made against his institute. The primary Communist Party organisation at the Institute had already prepared a resolution, criticising five members for their Mendelian-Morganist ideas; among them were Davidenkov, a member of the Institute's research council, and Natalia Kryshova, Davidenkov's first wife and collaborator, who directed the neurology clinic.[24]

After the 1948 meeting of the VASKhNIL, genetic research was considered "bourgeois pseudoscience"; Davidenkov's activity was restricted almost exclusively to clinical research, and some of his books were defamed as "deceitful science." Soviet research into medical genetics would not be resumed until the 1960s, after Davidenkov's death.[1,2,5]

Nikolai Davidenkov

Sergei Davidenkov suffered the abuses of Stalinism, which affected both his scientific work and his private life. Soon after the end of the Great Patriotic War, his son Nikolai, a biologist who had become popular for his biography of Darwin, was arrested and sent to a gulag. His father's efforts to have him released were not enough, and Nikolai was killed in 1950. Alexander Solzhenitsyn recounts Nikolai's misfortunes in *The Gulag archipelago*.[2,25]

In 1938, while studying biology, Nikolai was arrested in Leningrad together with other students, including Lev Gumiliov, son of the Russian poet Anna Akhmatova, and released a year later. During the Great Patriotic War, he was captured by the Germans but managed to escape to England and fought against the Nazis on the Western Front. When he returned to the USSR in 1945, he was arrested and sentenced to death; the sentence was commuted to 25 years' penal labour. However, after some compromising documents came to light, he was again sentenced to death and executed in 1950.[25]

Sergei Davidenkov asked Stalin to release his son on several occasions. Davidenkov's involvement in treating the leader of the French communist party, Maurice Thorez, has been interpreted as an attempt to win the dictator's favour. Following a cerebrovascular accident in October 1950, Thorez was left with right hemiplegia and aphasia. He was attended by a group of French communist Party physicians, who consulted Moscow; a week later, a renowned Soviet neurologist, professor Davidenkov, flew to Paris to examine the patient and confirmed the diagnosis. Following Davidenkov's recommendations, Thorez was transported by aeroplane to the USSR; he was treated and eventually recovered at the Kremlin Clinic, which provided care for international Communist leaders.[26,27]

Davidenkov's legacy

Davidenkov co-edited the *Great Soviet Encyclopedia* and was the associate editor of the *Zhurnal nevropatologii in psikhiatrii imeni S.S. Korsakova*, the journal of the All-Union Society of Neurologists and Psychiatrists, of which he was also a member. He authored 311 scientific publications, including 14 monographs on theoretical and practical neurology, hereditary diseases, and nervous system trauma. He directed 60 doctoral theses.[3,21]

During the last decade of life he published the four-volume *Clinical lectures on neurological disorders*; the popular treatise became a classic on the topic.[2]

The biologist Raisa Berg studied human hereditary diseases with Natalia Kryshova, who kept Davidenkov's personal archive. Berg also co-authored Davidenkov's *Heredity and hereditary human diseases*, published in 1971.[28]

Davidenkov had a great following among neurologists and geneticists. Since 1998, Saint Petersburg has held an annual conference called "Davidenkov readings," organised by the North-Western State Medical University; the university's neurology department also bears the name of the famous neurologist.[29]

Conclusions

Sergei Davidenkov is one of the most respected Soviet neurologists of the first half of the 20th century, and he is regarded as the father of neurogenetics in the USSR. His research focused mainly on this field, although he received little recognition from Western countries as most of his research was published in Russian.

Scapuloperoneal amyotrophy is nonetheless named after Davidenkov, who was attributed the first description of hereditary myoclonic dystonia. Davidenkov was also the first to describe the phenomenon of genetic anticipation.

Most of his research was conducted in Leningrad, where he developed a close relationship with Ivan Pavlov and his school, disseminating Pavlovian ideas among neurologists. He was also interested in eugenics.

The political instability of the Soviet Union had a negative impact on Davidenkov's professional career and private life, especially during the post-war period: his studies into neurogenetics abruptly ceased in 1948 and his son Nikolai died in the Gulag in 1950.

Davidenkov left behind a fruitful school of neurologists and geneticists, and some of his works have become classics of neurological literature in his country.

Conflicts of interest

This study has received no public or private funding.

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