Adolf Beck (1863–1942) – A Pioneer of Electroencephalography

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Adolf Beck was born on January 1, 1863, in Kraków, in what then was Polish territory of the Austro-Hungarian monarchy. His parents were Jewish; what we know about his father Szai Beck is that he was an impecunious craftsman. Having graduated from a gymnasium in 1883, Beck took up his medical studies at the Jagiellonian University in Kraków. In 1886, while still a student, he started to work in the Department of Physiology headed by Napoleon Cybulski (1854–1919), who was also Dean of the Medical Faculty at that time. His first publication, with Cybulski, was ‘Researches on the sense of taste in a tongueless human being’ [1]. Beck studied the nervous system and established that nerves have the same sensitivity and potential for electrical response throughout their length. He gained a university prize with a paper on the excitability of a nerve, later published under the title ‘On the excitability of a nerve at different points’ [2]. He graduated in medicine in 1889 and was subsequently offered a position at the Physiological Institute. In 1890, he obtained a doctorate with a thesis on localization in the brain and spinal cord by means of electrical phenomena [3], with special emphasis on distinguishing functional centers in the brain through recording electrical activity after peripheral stimulation. His numerous contributions were published in German and in Polish.

Under Cybulski’s supervision, Beck continued his pioneer studies on the activity of the cerebral cortex in response to peripheral nerve stimulation in dogs and mon-

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keys. Electrodes were placed on the skull to record the changes in the electric potential. [4]. In this way, they invalidated William Horsley’s notion that these changes reflected the activity of muscles of the skull. By further analyses of potential changes, they mapped out sensitive regions of the cerebral cortex. They also showed that the

amplitude of the signal depended on the strength and kind of the sensory stimulus and on the level of animal anesthesia. They suspected that brain function was mediated by bioelectrical activity of neurons. Their studies on brain mapping and nerve stimulation were absolutely innovative. They were not familiar with earlier research by Richard Caton (1842–1926) on changes in bioelectrical activity of the dog brain according to sleep, activity and changes in behavior.

It is important to emphasize that in this period, Beck and Cybulski closely collaborated. One of Beck's papers about this method [5] triggered off a stormy international dispute about priority. Richard Caton put an end to the dispute by referring to his paper from 1875 [6] in which he gave an explanation of a similar method to detect electrical brain activity. However, his paper was very succinct and mostly unknown. There is no doubt that Beck and Cybulski arrived at their results quite independently from others. In addition, they found spontaneous potential activity of the brain which was independent of heart rate and breathing. Beck and Cybulski were also the first to describe changes in synchronicity of brain waves following external stimulation such as irritation of a nerve or stimulation of the eyes with light. In other words, they discovered desynchronization in the EEG. The names of Caton, Cybulski and Beck should be ranked at the same level when one recalls the pioneers of detecting the electrical activity of the brain, before Berger's formal method of electroencephalography with multiple electrodes.

Beck also detected that sciatic nerve irritation influenced the electrical activity of the lumbar spine [7]. And in his academic thesis (habilitation) of 1894, he pointed out that the brain cortex is responsible for the inhibition of spinal reflexes [8].

In 1895, he was appointed to the University of Lwów in the position of Assistant Professor of Physiology; this was followed by a full professorship in 1898. In the same year, he conducted neurophysiological studies in Naples' famous zoological lab. Between 1903 and 1904, he served as Dean of the Medical Faculty, and in the years 1912–1913, he was Rector of the University of Lwów. During the First World War, he exerted himself to preserve not only the buildings and assets but also the Polish identity of the University in Lwów. As a consequence, in 1915, he was arrested by the Russian secret police for a few months. After the war, he valiantly strived to reconstruct the Medical Faculty and the University. Subsequently, he returned as Head of the Institute of Physiology until his retirement in 1930.

In that period in Lwów, he continued his research on the nervous system. One of his projects was the influence of radium rays on nerve conduction of impulses for pain and touch [9]. From 1905, Beck had been involved in studying the electrical activity of the brain after partial destruction. He estimated that if the region of destruction was small, the brain areas necessary for sensory perception were located around the scar in the cortex. If the area of cortex destruction was much bigger, they were located in the lower parts of the brain [10]. Subsequently, Beck in cooperation with Gustaw Bikeles (1861–1918) set out to analyze the influence of the excision of the motor cortex and transection of the spinal cord on the reflexes in the more caudal parts of the spinal cord [11]. Between 1911 and 1912, again in cooperation with Bikeles, he located the sensitive representation of the upper and lower limb in the cerebellum cortex [12].

In cooperation with Leon Zbyszewski (1882–1943), Beck examined the electrical potential of the sweat and salivary glands, as one of the first in this field. He indicated that urobilin is a product of bile intestinal destruction of bilirubin. He refuted the notion that was known for centuries that common sleep is caused by poisoning of urinary factors. He estimated that only the light-sensitive layer of the eye is responsible for the electrical and neurological response.

Adolf Beck was a member of the Polish Academy of Learning. In 1937, he was the first physiologist awarded with the Medal and the title of an Honorary Member of the Polish Physiological Society.

Beck was married to Regina Mandelbaum; they had a son, Henryk, who became a professor of obstetrics and gynecology. Adolf Beck's private passions were playing the violin, literature, painting and the history of Poland. He considered himself Polish. During the Second World War, he became a victim of the Nazi Holocaust. During the German occupation, he was initially hidden in the house of a Polish watchman. Unfortunately, he had to be admitted to hospital, was arrested and sent to the ghetto in Lwów. Just before being deported to a Nazi concentration camp, he committed suicide on August 7, 1942.

Disclosure Statement

There are no conflicts of interest.

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