



## HISTORY OF MEDICINE

## Professor Edmund Biernacki (1866 - 1911) and the discovery of the erythrocyte sedimentation rate

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Success in the treatment and cure of many diseases is based on an early recognition of the patient's condition. The erythrocyte sedimentation rate (ESR) is a useful test for this purpose.

The history of the discovery of this investigation includes the contributions of many medical practitioners. Ancient Greek and Roman doctors seem to have noticed changes in sedimentation of blood in various medical disorders. In the Middle Ages and during the Renaissance medical practitioners described the red blood clot as being covered with a layer of whitish fluid in some diseases, calling it 'crusta inflammatoria' or 'phlegma'. In 1772 William Hewson, and about 60 years later Herman Nasse, noticed that in blood without fibrinogen, sedimentation of red blood cells is slower than in whole blood, but they attached no clinical significance to these observations. The Polish physician Professor Edmund Biernacki described the ESR in detail for the first time, including its clinical relevance.

Edmund Faustyn Biernacki was born on 19 December 1866 in Opoczno in the Kingdom of Poland, which at that time enjoyed largely independent administration, legal and educational systems. However, politically the Kingdom was closely associated with Russia. After matriculating in 1884, Biernacki studied medicine at the University of Warsaw, graduating *cum laude* in 1889. As an undergraduate student young Biernacki began carrying out experimental work, and published it as a paper entitled 'Influence of a large amount of sodium chloride solutions injected subcutaneously on blood and urine secretion' in *Przegląd Lekarski* in 1888. He infused a 0.7% solution of NaCl into the subcutaneous tissue of laboratory animals and observed that the body size and metabolic activity were modified. Initially, diluted blood becomes condensed, the erythrocytes degrade and haemoglo-

bin appears in urine. This work earned him a gold medal from the Faculty of Medicine. This study remained a laboratory experiment and was not applied to humans.

After graduation as a doctor Biernacki obtained a position as an assistant at the Therapeutic Clinic at the University of Warsaw. He soon published four papers on neurology and gastroenterology: 'Strychnine as a medium influencing a human brain', 'Hypnotic states in frogs influenced by various drugs', 'Gastric digestion in chronic nephritis', and 'Importance of saliva for regular gastric digestion'.

As a result of recognition of his scientific work he received a scholarship from the Warsaw Medical Society for further study abroad. In 1890 he left Warsaw for Heidelberg, Giessen, and finally Paris, working under professors W Erb, F Riegel and J M Charcot. On his return to Warsaw, Biernacki was offered a post as the Head of the Diagnostic Clinic of the Faculty of Medicine. He engaged vigorously in clinical and laboratory research and academic activity. In 1894 he described the loss of sensation of the ulnar nerve as a symptom of spinal atrophy in tabes dorsalis. The paper was published simultaneously in Polish in the *Gazeta Lekarska* and in German in the *Neurologisches Centralblatt*, and the symptom is named after him.

From 1893 Biernacki turned his attention towards metabolic and haematological problems. He observed that blood has different properties in various disorders. In his studies on red blood cell volume Biernacki found what he called 'spontaneous blood sedimentation'. His paper 'On the ratio of erythrocytes to plasma and the value of various methods of estimation of total erythrocytes volume', presented in 1894, set the foundation for and led towards the discovery of the ESR. He subsequently expanded his study and proved that the ESR is accelerated in inflammatory diseases such as rheumatoid fever, chronic nephritis, tuberculosis, pneumonia, anaemia and cancer. He also proved that the ESR is faster in blood with increased plasma fibrinogen and decreased in defibrinated blood.

In 1896 Biernacki invented a sedimentation cylinder and described a method of performing the test. The outcome was based on experiments adjusting the amount of blood used (1, 5, 25 and 100 ml) and varying the time of reading, starting from 30 minutes, through 60, 90 and 120 minutes up to 24 hours, and



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using different cylinders. His original description stated that the blood should be taken from the median cubital vein with a syringe. The sample of 1 ml blood is mixed with 2 mg of sodium oxalate to prevent coagulation and placed in a 20 mm calibrated cylinder at a room temperature of 17 - 19°C. The sample is evaluated at 30 and 60 minutes. Subsequently, Biernacki analysed the value of his method in different inflammatory diseases and published his observations in 1897 as 'Spontaneous blood sedimentation as a method for scientific, practical and clinical investigation' in the *Gazeta Lekarska* (Poland) and the *Deutsche Medicinische Wochenschrift* (Germany).

In appreciation of his scientific work Biernacki received a number of awards from the Warsaw Medical Society and the Natanson Award. Despite this his academic counterparts criticised him severely for an 'incidental discovery' and deemed his approach unscientific. During the last decade of the 19th century the Medical Faculty of the University of Warsaw was intensively Russianised and the Polish language almost completely eradicated and replaced with obligatory Russian. Under those circumstances Biernacki left the University and took a position as Chief Physician of the small Wola Hospital in Warsaw in 1897. The Hospital did not have sufficient funds for medical research and Biernacki could not personally finance his scientific work because of poor pay and lack of alternative income. Frustrated, he turned to the philosophy of medicine, writing three large papers of which 'Chalubinski and current duties of doctors' (1900) was probably the most important. He wrote that the medical practitioner should aspire to be a person of high moral and ethical values, patient, self-critical, eager to learn and able to sacrifice himself for the benefit of his patients.

In 1902 Dr Biernacki's financial position worsened and he resigned from the Warsaw Medical Society as he could not afford to pay the membership fee. In the same year he decided to move to Lvov, in what is today Ukraine, but at that time in the Austro-Hungarian Empire, where the Polish population was largely autonomous.

Lvov University was a mixture of cultures, religions and languages, with students and lecturers from Russia, Poland and Austria. The Faculty of Medicine, knowing his scientific achievements, fully recognised his qualification. Soon after, Biernacki passed the examination for the position of Associate Professor and obtained the right to lecture in general and experimental pathology.

Initially he worked in the Department of Internal Medicine and a year later became a Professor in the Department of Pharmacology. He also developed a clinical practice in Karlsbad, a popular spa town, where he spent 4 - 5 months every summer. The successful practice brought him a steady income, allowing him to pursue his scientific goals. Between 1903 and 1911 he published several papers in the field of physiological chemistry, neurology and pathology of the digestive system. He also discussed his experience in the treatment of patients using various mineral waters, with which he was involved during his stays in Karlsbad.

However, most important was his continuous study of haematological problems. In 1906 he invented a 'microsedimentator' based on a capillary pipette which he used in his description of a new method of measuring the ESR that required only a drop of blood obtained from a fingertip. In 1908 Biernacki became a full professor of general and experimental pathology. However, despite the professorship, the Austrian medical authorities declined to offer him full employment and a permanent post at the University of Lvov. He worked as a second professor in the Department of Pharmacology until his sudden death on 29 December 1911 at the age of 45 years. He left about 85 publications in Polish, German and Russian. Most were scientific papers but there were also articles on the philosophy of medicine and popular medical problems related to his time.

The discovery, laboratory research and full clinical work on the ESR were performed by Professor Edmund Biernacki between 1893 and 1906, but did not gain popularity until the mid-1920s. The reason for such an important discovery being forgotten by the medical fraternity for many years seems to lie in the syringe, which at the turn of the 19th and 20th centuries was an uncommon instrument rarely used for obtaining blood samples. Recognising the limitations of his test that originally required 1 ml of venous blood, Professor Biernacki modified the method of the ESR in 1906. He introduced a special capillary pipette, a so-called 'microsedimentator'. The ESR could be carried out using a minimal amount of blood obtained by puncturing a fingertip. Despite that modification the ESR was rarely used.

In 1918 a Swedish scientist Dr Robin Fahreus of Stockholm published a paper on the sedimentation rate of the blood for detection of early pregnancy. This was followed by a monograph, 'The suspension-stability of the blood', published in the *Acta Medica Scandinavica* in 1921, on the history of discovery of the ESR and analysis of its clinical significance. Fahreus recognised the scientific work and attributed the discovery of the method of the ESR to Biernacki. Undoubtedly papers by Robin Fahreus and Alf Westergreen as well as common use of the syringe for drawing blood after World War I, made the ESR one of the most popular and important investigations in medical practice.

Photo of Edmund Biernacki courtesy of the Central Medical Library, Warsaw, Poland.

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