

## EFFECT OF SEMMELWEIS 3.

### The role of animal experiments conducted by Ignaz Philipp Semmelweis in the elucidation of puerperal fever

### Welche Rolle spielten Tierexperimente bei der Aufklärung des Kindbettfiebers durch Ignaz Philipp Semmelweis?

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*Initially submitted October 10, 2015; accepted for publication november10, 2015*

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#### **Abstract:**

Semmelweis was miles ahead of his time in the fight against puerperal sepsis and thus his failure was inevitable despite the fact that he could prove his theory by animal experiments. The autopsy findings in laboratory animals were equal to those found in human septicaemia cases. His letters must be interpreted as a constant struggle for his theories and beliefs. Despite support from Škoda, Rokitansky, Hebra and Brücke – leading scientific figures of the Vienna Medical School at that time – his theses gained full recognition and acceptance all over the world only 20 years after his death. The findings derived from the autopsy of Dr. Kolletschka, who died of bacterial sepsis after having been injured by a dissecting medical student, emphasize the importance of post-mortem examinations.

**Zusammenfassung:** Semmelweis war im Kampf gegen die Puerperalsepsis seiner Zeit weit voraus; dadurch war sein Scheitern vorprogrammiert. Die von ihm durchgeführten Experimente und die makroskopischen Sektionsbefunde der Versuchstiere bestätigten seine Theorie: Sie entsprachen den Organbefunden von Menschen, die an Sepsis verstorben waren. Das Leben von Semmelweis war ein ständiger Kampf. Dies belegen seine Briefe. Trotz Unterstützung durch Škoda, Rokitansky, Hebra und Brücke – führende Köpfe der Wiener medizinischen Schule – fand die Lehre von Semmelweis erst 20 Jahre nach seinem Tod weltweit volle Anerkennung. Seine Beobachtungen bei der Sektion von Dr. Jakob Kolletschka, der nach einer Skalpell-Verletzung an Sepsis erkrankt war, unterstreichen die Wichtigkeit der autoptischen Befunderhebung.

**Keywords**\_Semmelweis, puerperal sepsis, animal experiments

**Schlüsselwörter:** Semmelweis, Puerperalsepsis, Tierversuche

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The literature contains a large number of articles on Semmelweis, his discovery, his

personality and the tragedy of his life (1,2,3,4,5,11,12,15,16,25,26,29,30). To prove his theory on childbed fever he conducted animal experiments together with Dr. Lautner, who worked for Professor Carl von Rokitansky (Institute of Pathology) in Vienna [21,22].

Before, Professor Hebra, professor of dermatology at the Vienna University Hospital, had given a lecture entitled “Highly significant experiences on the etiology of the epidemic puerperal fever in maternity clinics” (1847) and another lecture in 1848 where he mentioned Semmelweis’s discovery for the first time in public [6,7].

The second impulse came from his friend, Professor Josef v. Škoda, who wrote about the true cause of the unusually high incidence of fever in puerperae in the Vienna Maternity Clinic discovered by Dr. Semmelweis and the method to reduce these diseases to a normal level (v. Škoda 1849). According to the files, the Mathematical Scientific Class of the Imperial Academy of Science in Vienna decided to pay 100 gulden to Dr. Semmelweis and to express praise to him [29].

Animal experiments were important for the clarification of the cause of childbed fever, as Semmelweis wrote in his book “Etiology, Concept and Prophylaxis of Puerperal Fever”, which appeared in 1861 [21,22]. The respective autopsy reports are still available in Vienna. The records include macroscopic descriptions of septic conditions. They reflect the great care applied by Semmelweis in his work.

In their experiments, Semmelweis and Lautner inserted a brush with a greyish-red exudate into the uterus of rabbits which had just given birth. The first three animals died. At autopsy, they all showed the same findings: pneumonia and exudative pericarditis. The uterine horns were moderately dilated and filled with dirty-greyish red exudate. In two cases, signs of peritonitis were seen.

In the fourth animal, the brush was first dipped into blood diluted with water from a man who had died from marasmus, then into pleural exsudate and finally into tuberculous peritoneal exsudate. The animal remained healthy and gave birth to a further litter.

In Experiment 5, the animal was treated with peritoneal exsudate from Experiment 4 about one hour after giving birth. The animal became pregnant again. After delivery “the brush was dipped into pleural exsudate” and inserted into the uterus. No symptoms of sepsis and no pyemia developed.

In Experiment 6, septic endocarditis was found in addition. On the tricuspid valve, a pea-sized and a hempseed-sized vegetation were discernible. As in Case 4, the uterus showed pathological changes.

In Experiment 7, the animal was again treated after giving birth. The brush was dipped in material from an abscess of a cholera victim. In order to avoid mechanical trauma, the inflammatory fluid was inserted six consecutive times with a syringe used to treat gonorrhoea. The animal lost weight and died. Autopsy revealed bilateral exsudative pleuritis and a membranous exsdate in the abdominal cavity.

Experiment 8: For this experiment, the animal of Experiment 4 was used. Between 24 June and 8 July, regular dabbing was performed. The animal lost weight and died. Autopsy showed large- lent peritonitis extending into the lower abdomen.

Experiment 9: After giving birth, the animal was contaminated with peritoneal exsudate (from Experiment 7). Again there was extensive peritonitis extending into the lower abdomen. Apart from changes in the uterus, the veins in the uterine broad ligaments were filled with inflammatory fluid.

Ignaz Philipp Semmelweis himself gave a report to the Imperial-Royal Society of Physicians in Vienna. For Semmelweis these experiments largely confirmed his opinion about childbed

fever. , professor of pathology at the Vienna University, was of the same opinion. He gave a lecture about the animal experiments and Semmelweis's theories in the same Society in Vienna [19].

In his book published 10 years later, Semmelweis wrote (1861): "The changes found in the dead rabbits are the same seen in humans who died from puerperal diseases and generally from pyemia." [21,22].

At the Gynecological Clinic of the Vienna University Hospital, Semmelweis assumed the following at that time: "My predecessor was also granted a two-year service extension, so there is no reason to worry." His first attempt to be appointed as a university lecturer was unsuccessful, but he never gave up. With the support of Rokitansky, Škoda and Hebra he was finally granted the status of a lecturer for theoretical obstetrics on 10 October 1850 – but with limitation to the demonstrations and practices using manikins. For him this position, which was indicated in the schedule of lectures of the Vienna University, was too narrow and he did not start his work there [23,24].

Apart from Rokitansky, Škoda, Hebra and the physiologist Ernst Wilhelm Brücke nobody from the medical faculty in Vienna supported him. In 1849, Professor Brücke sent a report on Semmelweis's theory to Berlin. On 23 February 1849, Carl Haller gave a lecture on the success of chlorine hand washing to the Medical Society in Berlin, in which he presented detailed statistical data [13,14]. As a consequence, the Society asked Semmelweis to explain his discovery himself and to give a talk about it.

Due to the unsatisfactory job situation Semmelweis could not continue his animal experiments considered necessary even by him. So he hurriedly moved to Pest still in October 1850 and was appointed head of the obstetrical department of the St. Rochus Hospital after some waiting on 20 May 1851. Afterwards only 8 of 933 puerperae died in his Department.

On 18 July 1855, Dr. Semmelweis was appointed full professor of theoretical and practical obstetrics at the University of Pest through a decree of Emperor Franz Joseph. Most of his teaching at the university was in German.

His visions and ideas were correct just as the animal experiments, in which he tried to investigate and reproduce the manifestations of puerperal sepsis [17,18,32]

Semmelweis's book and numerous papers show the problems constantly faced by him in Vienna and his struggle. It was a constant fight against windmills [5]. After he had left Vienna, particularly Rokitansky and Škoda continued to support Semmelweis, and in 1856 they spontaneously proposed him as successor for the position of the late Professor Klein in Vienna, but without success [14,19].

Semmelweis sent letters to several professors of obstetrics abroad, but received a reply only from Professor Michaelis in Kiel [20], who had been forced to close his hospital in 1847 and 1848 because of puerperal sepsis. When he learnt about Semmelweis's discovery on 21 December 1848, he successfully introduced the method. Positive comments also came from the Krakow specialist in internal medicine, Dietl, from the chemist Justus von Liebig, from Josef Steiner in Graz, candidate of surgery, and from Dr. F. Routh in England. Through personal contacts he won supporters for his teachings, for example Dr. Kussmaul, and Dr. Arneth, Vienna (personal note, 27]

In a second period Semmelweis sent also letters to Scanzoni (Würzburg) and Spaeth (Vienna), which were probably not very diplomatic but clear [23]. Nevertheless, they rejected his theory and continued their deadly behavior. And he sent further open letters to all of them [24]. No breakthrough was in sight for his teachings [15,10,17,19].

Hegar from Freiburg [8] was the next to support him against Rudolf Virchow, the father of cellular pathology. Already in 1848, Virchow had rejected Semmelweis's discovery in the Berlin Medical Society [5,9]. In 1863, Professor Virchow (Charité Berlin) attacked Semmelweis again in Speyer. Only the Heidelberg gynecologist Lange defended Semmelweis and his teachings. In his Heidelberg clinic, the mortality rate had dropped to 0.3% after the introduction of the Semmelweis method (minutes of the 36 Meeting of German Scientists and Physicians in Speyer, p. 57). Virchow partly admitted his error as late as in 1879.

Semmelweis's method was recognized and accepted only 20 years after his death with significant contributions from Lister and Pasteur, whose discoveries were not yet available at the time of Semmelweis.

Semmelweis's pioneering finding was and will always be the discovery of the cause of sepsis and childbed fever. He elucidated the pathophysiological cause of puerperal fever. His animal experiments helped to prove his theory and it was his idea to combine clinical pathology, statistics and adequate prophylaxis. His findings obtained from the autopsy of Dr. Jakob Kolletschka underline the importance of postmortem investigations, which are often neglected nowadays.

According to Romhányi [personal communication, the discovery of the etiology of childbed fever is not the only ingenious discovery of Ignaz Philipp Semmelweis: The disinfectant chlorinated lime actually destroys bacteria and microbes not yet known at that time without affecting the skin. Right up to now no more effective agent has been found. By introducing hand washing with chlorinated lime Semmelweis became the pioneer of preventive medicine.

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