



# HHS Public Access

Author manuscript

*Am J Obstet Gynecol.* Author manuscript; available in PMC 2019 December 01.

Published in final edited form as:

*Am J Obstet Gynecol.* 2018 December ; 219(6): 519–522. doi:10.1016/j.ajog.2018.10.036.

## Ignaz Semmelweis: “The Savior of Mothers” On the 200th Anniversary of the Birth

**Nicholas Kadar, MD, JD, LLM,**  
11 Jackson Court, Cranbury, NJ

**Roberto Romero, MD, DMedSci,** and  
Perinatology Research Branch, Division of Obstetrics and Maternal-Fetal Medicine, Division of Intramural Research, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, National Institutes of Health, Bethesda, MD and Detroit, MI

Department of Obstetrics and Gynecology, University of Michigan, Ann Arbor, MI

Department of Epidemiology and Biostatistics, Michigan State University, East Lansing, MI

Center for Molecular Medicine and Genetics, Wayne State University, Detroit, MI

**Zoltán Papp, MD, PhD, DSc, FACOG (Hon), FIAPM\***  
Department of Obstetrics and Gynecology, Semmelweis University, Budapest, Hungary

Maternity Private Department, Kútvölgyi Clinical Block, Semmelweis University, Budapest, Hungary

---

Semmelweis University and the journal *Hungarian Medical Weekly* celebrated the bicentennial of the birth of Ignaz Philip Semmelweis (1818–1865) in Budapest on June 30th of this year. A commemorative coin with Semmelweis’ profile on one side, and a picture of two hands being washed on the other, was minted to celebrate the occasion (FIGURE 1); the post office issued a commemorative stamp (FIGURE 2); a book recounting Semmelweis’ life was published (FIGURE 3)<sup>1</sup>; and a sculpture was unveiled after the ceremony honoring him (FIGURE 4). The *American Journal of Obstetrics & Gynecology* joins Semmelweis University in celebrating this important figure of our discipline.

### Who was Ignaz Semmelweis?

Ignaz Semmelweis was a Hungarian obstetrician who first showed that, in all but a few cases, puerperal fever—also known as childbed fever—was caused by an infection introduced into the birth canal from outside, which could be prevented by chlorinous disinfection of the hands of the obstetricians and midwives before they examined mothers in labor. It could be said that he was the father of preventive medicine and, some have argued, of asepsis in obstetrics and gynecology as well as surgery.<sup>2</sup> But the most far-reaching

---

\*Professor Zoltán Papp MD, PhD, DSc, FACOG (hon.), FIAPM, the former director of the First Department of Obstetrics and Gynecology, Semmelweis University, in Budapest, Hungary, from 1990 to 2007, was the eighth successor of Dr. Ignaz Semmelweis. Dr. Papp is the founding director of the Maternity Private Department of Obstetrics, Gynecology and Fetal Diagnosis, Kútvölgyi Clinical Block, at Semmelweis University.

**Disclosure:** The authors report no conflicts of interest.

significance of his work was its influence on the development of the “Germ Theory of Disease”<sup>3</sup> and the ushering in of an entirely new way of thinking about diseases as having necessary causes.<sup>4</sup> Because the significance of bacteria was unknown at the time, Semmelweis called the causative agent of childbed fever “decomposing animal organic matter.”

Semmelweis was born on July 1, 1818, in what is now Budapest. He was the son of a wealthy grocer and grew up in a bustling enclave of German-descendant merchants, where he attended Catholic schools. Semmelweis enrolled in the University of Vienna to study law, but switched to medicine after a year, and graduated as a physician in 1844.

The story of his discovery begins two years later, on July 1, 1846, when at the age of 28 he was appointed First Assistant (the equivalent of a Chief Resident) in Obstetrics in the First Division of the Allgemeines Krankenhaus (Vienna General Hospital). The Maternity Clinic housed two divisions in 1833, each headed by a professor, and beginning in 1840, only medical students were taught on the First Division, whereas midwives attended births in the Second Division. Within a year of his appointment as First Assistant, he had discovered why maternal mortality from childbed fever was high on his service.

Childbed fever was rampant at that time in all maternity clinics throughout Europe, frequently occurring in epidemics with mortality rates exceeding 10%. In the First Division of the Maternity Clinic in Vienna, the maternal mortality rate fluctuated around 9%, three times higher than in the Second Division. No one could understand why, despite investigations by several committees. When confronted firsthand with the terrible toll that the disease was taking on young mothers and their families, Semmelweis was determined to find the cause. To do so, he personally autopsied all the mothers who had died of childbed fever the previous day before starting his ward rounds every morning.

To paraphrase Louis Pasteur, “Discovery comes to the prepared mind,” and so it was with Semmelweis. He was presented with what amounted to the results of a randomized study of childbed fever (albeit one that did not have an acceptable randomization scheme by today’s standards), as mothers were admitted to the First and Second Divisions of the Maternity Clinic on alternate days, and the hospital had been compiling detailed statistics of the number of mothers who had delivered and then died of childbed fever in both Divisions every month dating back to 1784, when the hospital first opened.

Childbed fever was thought to have myriad causes, some outlandish, such as embarrassment of mothers at being examined by male doctors. In conjunction with his autopsies, Semmelweis further expanded his quest by looking for factors that differed between the two clinics, likely believing that similar aspects of practice performed in both Divisions could not be the cause of the difference in their mortality rates. Semmelweis had excluded every putative cause by the time that he was required to relinquish his position in October 1846 because his predecessor had been granted an extension of his First Assistantship; but when Semmelweis resumed his position on March 20, 1847, after his predecessor obtained a Professorship in Tübingen, Germany, a serendipitous—if tragic—event provided the clue that Semmelweis needed to understand the root cause of the problem.

## A Moment of Insight: the Death of Jakob Kolletschka

Upon returning from a vacation in Venice before resuming his post as First Assistant in March 1847, Semmelweis was shocked to learn that his friend, Professor Jakob Kolletschka, a forensic pathologist, had died after a student accidentally cut Kolletschka's finger during the course of an autopsy. Semmelweis examined Kolletschka's autopsy findings and realized that they were identical to those he had seen in women dying of childbed fever, except, of course, for the genital organs: he concluded that Kolletschka, too, had died of a process akin to "childbed fever."

Semmelweis then made the key inference that changed how physicians would think about the cause of diseases for the next hundred years:<sup>4</sup> if Kolletschka died of childbed fever-like process, the cause of death of mothers dying of childbed fever must be the same as the cause of Kolletschka's death. This was the inference that his contemporaries found impossible to accept, as they believed there were up to 30 causes of childbed fever.

As soon as he made the connection, Semmelweis understood the cause: he called it "cadaveric particles." These particles were introduced into Kolletschka's bloodstream by the cut to his finger during an autopsy. Similarly, the particles were introduced into the birth canal of mothers via the hands of their attendants, who had performed autopsies prior to the examinations (which were done without gloves in those days). They had washed their hands with only soap and water before examining mothers in labor, but this did not remove the cadaveric particles, as one could tell from the smell that lingered on the hands long after handwashing. The mystery was solved: maternal mortality from childbed fever was higher in the First Division because medical students and physicians participated in autopsies but midwives did not, and, therefore, mothers in labor were examined more frequently by attendants whose hands were contaminated by cadaveric particles than mothers in the Second Division.

## Hand Washing with a Chlorine Solution

After experimenting with various solutions, Semmelweis determined that a chlorine solution was the most effective in removing the characteristic smell that lingered on his hands after performing an autopsy, and in May, 1847, he obtained permission from his Chief to implement chlorinous handwashing before patients were examined on the labor ward. Personnel were required to disinfect their hands before entering the labor ward. Once on the labor ward, they could wash their hands with soap and water between patient examinations.

The results were dramatic: compared to the period before handwashing with the chlorine solution was introduced, maternal mortality from childbed fever during the ensuing three months, June to August, 1847, fell from 7.8% to 1.8%. However, the rate spiked again in October when 12 mothers (5.2%) died of the disease, and again in November, when 11 women (4%) died.<sup>5,6</sup> Semmelweis traced the source of the infection in October to a woman who had a purulent "medullary carcinoma of the uterus" and, thereafter, required attendants to wash their hands with the chlorine solution between examining patients, and not only when the attendants first entered the labor ward. Then, he traced the infection in November

to a patient who had a purulent discharge from a knee infection. Since the attendants were by then washing their hands with the chlorine solution between patient examinations, he concluded that these cases had to be isolated because they caused the environment to become contaminated, as one could tell by the foul smell that permeated the ward.

Thus, Semmelweis quickly realized that the cause of childbed fever could be any source of “decaying animal organic matter.” He estimated that the site of infection was the birth canal itself in approximately 1% of such cases, secondary to birth trauma or a retained placenta. He called these “autoinfection” and considered them non-preventable by handwashing or isolation. In 1848, after his full prophylaxis was implemented, maternal mortality from childbed fever in the First Division fell to 1.27%—less than the rate in the Second Division (1.33%).<sup>5</sup>

These results were communicated in an unconventional manner. The preliminary results were reported in an editorial in the *Journal of the Medical Society of Vienna* in December 1847, and again in April 1848, and heads of maternity clinics in Europe were invited to confirm or refute the results.<sup>2</sup> Semmelweis and physicians visiting his department also wrote to the heads of maternity clinics throughout Europe, inviting their responses. With some notable exceptions, these responses were negative. Several objections were raised, and numerous reasons subsequently proffered for the rejection of Semmelweis’ doctrine that childbed fever was an infection almost always caused by the introduction of an external agent into the birth canal, which could be prevented by handwashing with a chlorine solution. However, the main reason for the resistance among members of the medical community was the paradigm shift that required one to accept that disease, such as childbed fever, could have just one necessary cause. That fundamental change would have to wait for the discovery of bacteria as the cause of infection and, thus, the adoption of the “Germ Theory of Disease.”<sup>3</sup>

## From Vienna Back to Budapest

Semmelweis’ appointment as First Assistant in Vienna was not extended, and his appointment as a private Attending at the hospital would not have allowed him to continue his research, so he returned to Budapest in October 1850. Conditions there were somber following Hungary’s defeat in its war of independence against Austria.<sup>7</sup> Semmelweis accepted a non-paying position as Head of Obstetrics and Gynecology at St. Rókus Hospital, which he held for six years. Due to his efforts, in the period of 1851–1857, the overall maternal mortality rate from childbed fever at the hospital was 0.85%; the maternal mortality rates from childbed fever at Prague and Vienna during the same time period were 10% to 15%.

Semmelweis was appointed Professor of Theoretical and Practical Midwifery at the University of Pest on July 18, 1855, following the death of Professor Birly, who had been Semmelweis’ ardent opponent, refusing even to try handwashing with a chlorine solution, as he firmly believed puerperal fever originated in the bowel and was a strong advocate of purgatives. Conditions at the University’s Maternal Clinic were poor, and childbed fever was rampant. Semmelweis faced innumerable obstacles and had to battle constantly with the

administration and authorities for such basics as bed linens and laundry services, but eventually succeeded in moving the clinic to a new facility. Despite all the adversities he faced, Semmelweis was able to reduce the maternal mortality from childbed fever to 0.39% during his first year as Professor, and this rate remained at 0.9% during 1859 to 1860, the last year before the clinic was moved to a new facility.

### **Publication of the Doctrine and *The Aetiology, Concept and Prophylaxis of Childbed Fever***

In the journal *Orvosi Hetilap (Hungarian Medical Weekly)*, established in 1857 by Lajos Markusovszky, another Hungarian icon of medical history, and thanks to his encouragement during that year and the next, Semmelweis published his findings on childbed fever for the first time.<sup>5,8</sup> He published again on his doctrine the following year, when he explained the difference between his view and those of the English “contagionists” who were claiming he had said nothing new, and emphasized that, unlike them, he believed that every case of childbed fever, without exception, was caused by decaying animal organic matter. Finally, in 1859, he started writing his book, *The Aetiology, Concept and Prophylaxis of Childbed Fever*, which was published in 1860 in German.

### **Initial Resistance and the Eventual Acceptance of the Semmelweis Doctrine**

Semmelweis sent copies of his book to leading obstetricians around Europe, and again, with a few notable exceptions, the responses were almost uniformly negative as they had been when he first announced his findings. He faced fierce opposition from some of the most prominent physicians in Europe, such as Rudolf Virchow and Friedrich Scanzoni von Lichtenfels, who held different views about the causes of childbed fever. The famous pathologist Virchow, for example, thought that the chief cause of childbed fever was inadequate uterine contractions, which caused thrombosis in vessels in the area around the uterus, and that these thrombi were transformed into puerperal fever. He also attributed the causes to atmospheric conditions and to psychological conditions of the mother.

However, Semmelweis’ doctrine slowly gained acceptance, even if many who adopted prophylactic hand disinfection with chlorine refused to admit it. In 1864, for example, Virchow stated in a lecture, “I recognize the merit of the Vienna school and most specifically that of Semmelweis.”<sup>4</sup> Even Scanzoni, who had relentlessly attacked Semmelweis personally, acknowledged in 1867, when he wrote in the fourth edition of his textbook:

“It is to the untiring research of the last ten years that we are indebted for the fact that puerperal fever is now almost unanimously considered to be an infectious disease...Furthermore, we cannot and will not leave unmentioned the fact that, by his restless and self-sacrificing efforts in this field, Semmelweis has rendered a great service to lying-in women in our hospitals.”<sup>9</sup>

Semmelweis did not live to see his doctrine triumph, as he died on August 13, 1865, at the age of 47 in an insane asylum. Recently discovered original autopsy documents have sadly revealed that, in all likelihood, Semmelweis was beaten by his attendants when struggling to escape, and died of generalized sepsis caused by his infected injuries. The underlying cause

of the mental disorder that caused him to be admitted has been, and no doubt will continue to be, debated; but as to Semmelweis' brilliance, originality, dedication to his patients, and legacy,<sup>10</sup> there can never be any dispute.<sup>11</sup>

### Acknowledgment:

This work was supported, in part, by the Perinatology Research Branch, Division of Intramural Research, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD), National Institutes of Health (NIH), Department of Health and Human Services (NICHD/NIH); and, in part, with Federal funds from NICHD, NIH under Contract No. HSN275201300006C.

### References

1. Semmelweis Rosivall L. 200 Éve. Budapest, Hungary: Semmelweis Kiadó és Multimédia Stúdió Kft; 2018.
2. Sinclair WJ. Semmelweis: his life and his doctrine. Manchester UK: Manchester University Press; 1909.
3. Carter KC. Ignaz Semmelweis, Carl Mayrhofer and the rise of germ theory. *Med Hist* 1985;29:33–53. [PubMed: 3883083]
4. Carter KC. The rise of causal concepts of disease. Burlington, VT: Ashgate Publishing Co; 2003.
5. Semmelweis I The etiology, concept, and prophylaxis of childbed fever. Madison, WI: The University of Wisconsin Press; 1983 (1861).
6. Kadar N Rediscovering Ignaz Philipp Semmelweis (1818–1865). *Am J Obstet Gynecol*. [Epub 2018 Nov 13].
7. Rappaport M 1848: year of revolution. New York: Basic Books; 2009.
8. Kiss L [Ignác Semmelweis and the Hungarian Medical Weekly Journal]. *Orv Hetil* 2018; 159:1065–70. [PubMed: 29936855]
9. Gortvay G, Zoltán I. Semmelweis: his life and work. Budapest, Hungary: Akadémiai Kiadó; 1968.
10. Papp Z A transformative icon for modern perinatology: a salute on the 200th birthday of Ignác Semmelweis. *J Perinat Med* 2018;46:451–4. [PubMed: 29708885]
11. Balázs P [Semmelweis with a wider historic outlook]. *Orv Hetil* 2017;158:550–5. [PubMed: 28366080]



**Figure 1. Commemorative coin featuring Semmelweis' profile and hand disinfection**

Photo courtesy of Dr. Roberto Romero.

Gábor Kereszthury, an industrial artist, designed the coin, which was minted in 2018 by the Hungarian National Bank in Budapest.

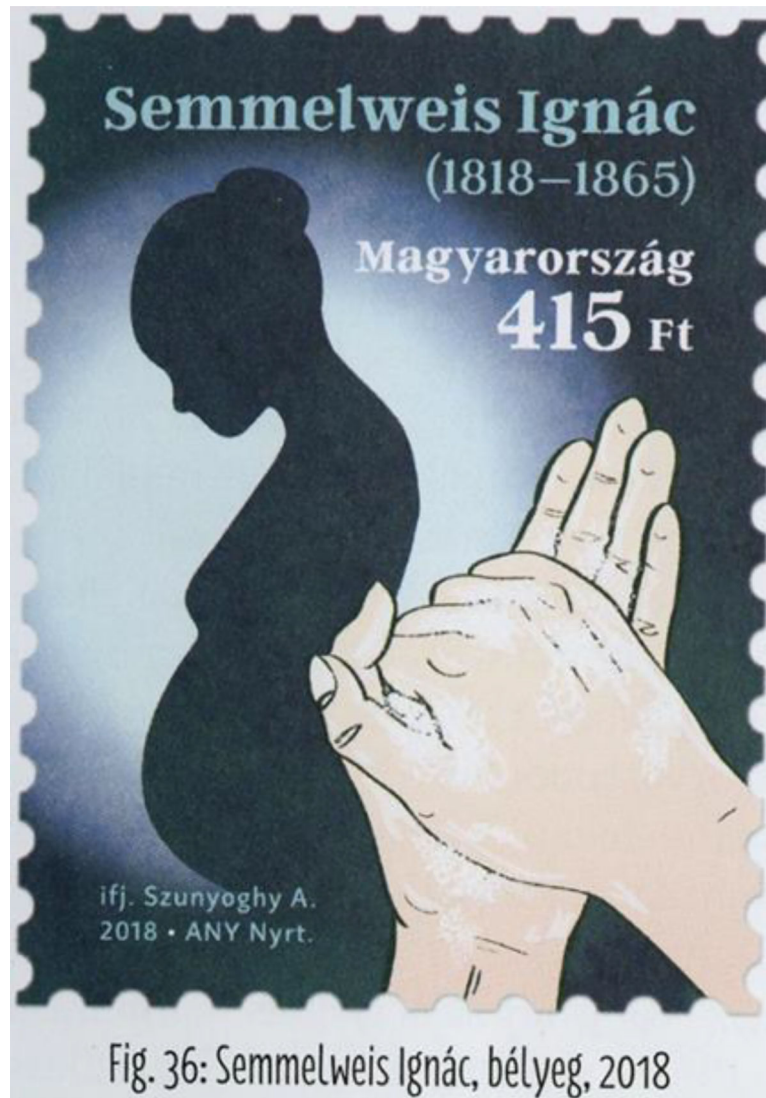


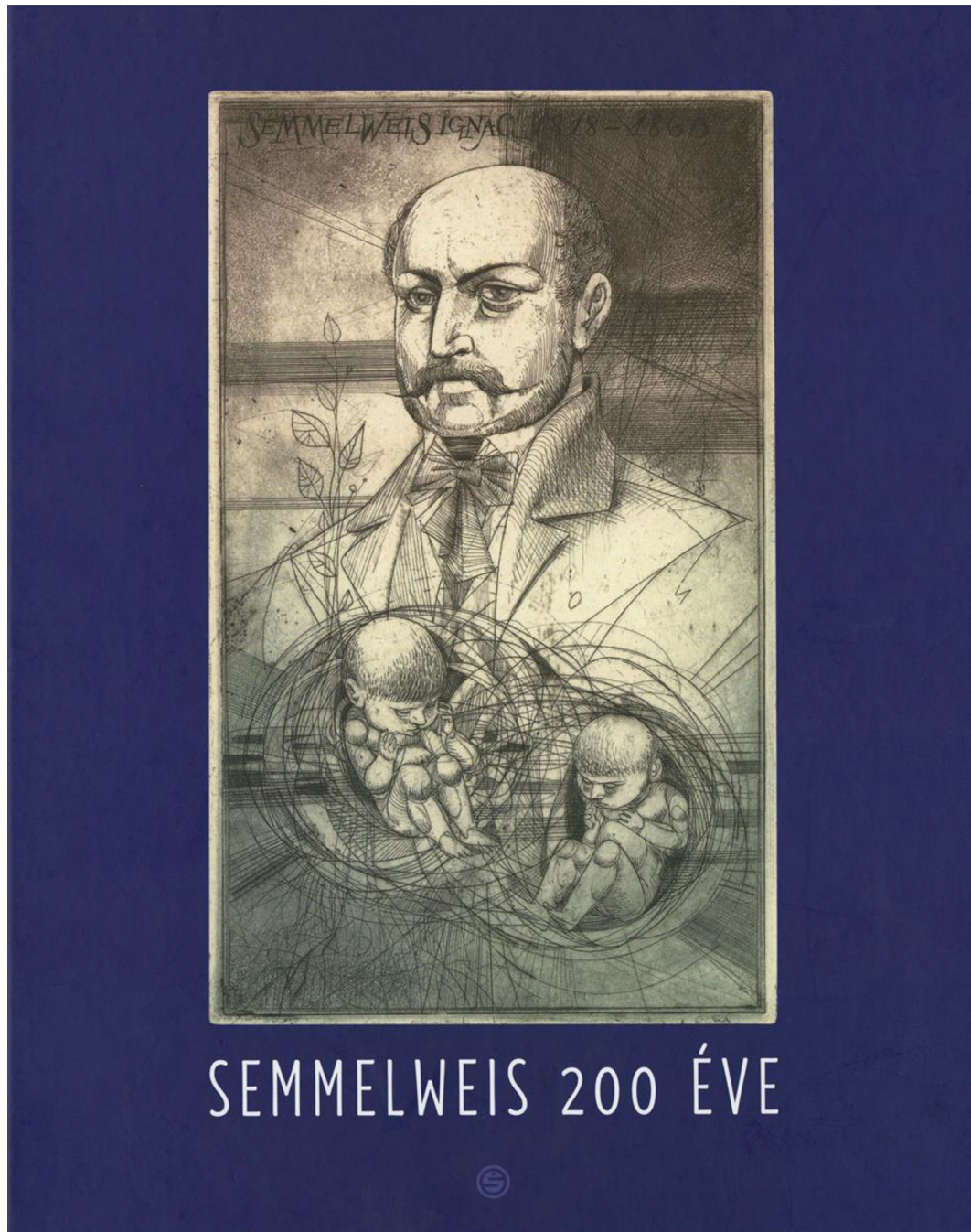
Fig. 36: Semmelweis Ignác, bélyeg, 2018

**Figure 2. Commemorative Semmelweis stamp**

Photo courtesy of Dr. Roberto Romero.

Graphic artist András Szunyoghy Jr. designed the stamp, issued by the Hungarian Post on June 30, 2018, at Semmelweis University in Budapest.





**Figure 3. Book celebrating Semmelweis' life and the 200<sup>th</sup> anniversary of his birth<sup>1</sup>**

Photo courtesy of Dr. Roberto Romero.

The book, edited by Dr. László Rosivall, university professor of pathophysiology, was published by the Semmelweis University Publishing House, Budapest, 2018.



**Figure 4. In Blessed Condition – Visitation Memory of Semmelweis**

Photo courtesy of Dr. Roberto Romero.

The sculpture, created by István Madarassy, is based on a medieval painting depicting the meeting of St. Mary and St. Elizabeth. Unveiled at the honorary ceremony on June 30, 2018, it is displayed in the Hall of the Second Department of Obstetrics and Gynecology at Semmelweis University.