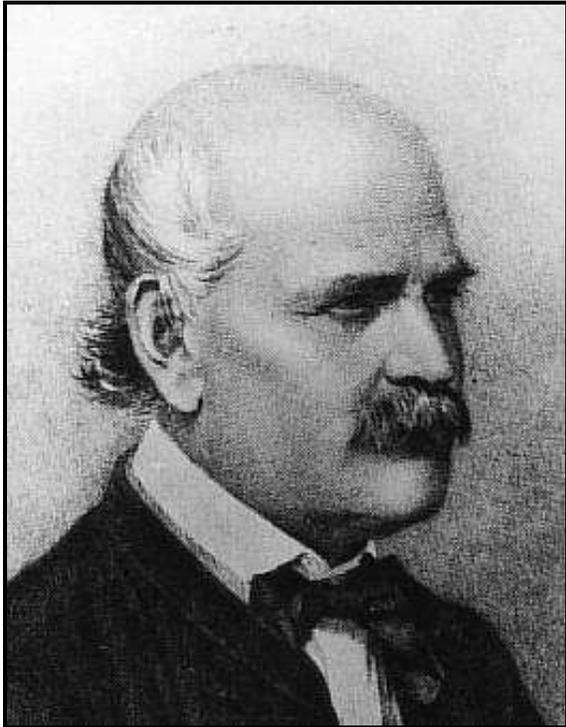


The Etiology, Concept and Prophylaxis Of Childbed Fever (excerpts)

Ignaz Semmelweis



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From Chapter 1: Autobiographical Introduction

The large gratis Viennese maternity hospital is divided into two clinics; one is called the first, the other the second. By Imperial Decree of 10 October 1840, Court Commission for Education Decree of 17 October 1840, and Administrative Ordinance of 27 October 1840, all male students were assigned to the first clinic and all female students to the second. Before this time student obstetricians and midwives received training in equal numbers in both clinics.

The admission of maternity patients was regulated as follows: Monday afternoon at four o'clock admissions began in the first clinic and continued until Tuesday afternoon at four. Admissions then began in the second clinic and continued until Wednesday afternoon at four o'clock. At that time admissions were resumed in the first clinic until Thursday afternoon, etc. On Friday afternoon at four o'clock admissions began in the first clinic and continued through forty-eight hours until Sunday afternoon, at which time admissions began again in the second clinic. Admissions alternated between the two clinics through twenty-four hour periods, and only once a week did admissions continue in the first clinic for forty-eight hours. Thus the first clinic admitted patients four days a week, whereas the second clinic admitted for only three days. The first clinic, thereby, had fifty-two more days of admissions [each year] than the second.

From the time the first clinic began training only obstetricians until June 1847, the mortality rate in the first clinic was consistently greater than in the second clinic, where only midwives were trained. Indeed, in the year 1846, the mortality rate in the first clinic was five times as great as in the second, and through a six-year period it was, on the average, three times as great. This is shown in Table 1.

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Table 1						
	First clinic			Second clinic		
	Births	Deaths	Rate	Births	Deaths	Rate
1841	3,036	237	7.7	2,442	86	3.5
1842	3,287	518	15.8	2,659	202	7.5
1843	3,060	274	8.9	2,739	164	5.9
1844	3,157	260	8.2	2,956	68	2.3
1845	3,492	241	6.8	3,241	66	2.03
1846	4,010	459	11.4	3,754	105	2.7
Total	20,042	1,989		17,791	691	
Average			9.92			3.38

The difference in mortality between the clinics was actually larger than the table suggests, because occasionally, for reasons to be examined later, during times of high mortality all ill maternity patients in the first clinic were transferred to the general hospital. When these patients died, they were included in the mortality figures for the general hospital rather than for the maternity hospital. When the transfers were undertaken, the reports show reduced mortality, since only those who could not be transferred because of the rapid course of their illness were included. In reality, many additional victims should be included. In the second clinic such transfers were never undertaken. Only isolated patients were transferred whose condition might endanger the other patients.

The additional mortality in the first clinic consisted of many hundreds of maternity patients, some of whom I saw die from puerperal processes, but for whose deaths I could find no explanation in the existing etiology

[...]

I was convinced that the greater mortality rate at the first clinic was due to an endemic but as yet unknown cause. That the newborn, whether female or male, also contracted childbed fever convinced me that the disease was misconceived. I was aware of many facts for which I had no explanation. Delivery with prolonged dilation almost inevitably led to death. Patients who de-

livered prematurely or on the street almost never became ill, and this contradicted my conviction that the deaths were due to endemic causes. The disease appeared sequentially among patients in the first clinic. Patients in the second clinic were healthier, although individuals working there were no more skillful or conscientious in their duties. The disrespect displayed by the employees toward the personnel of the first clinic made me so miserable that life seemed worthless. Everything was in question; everything seemed inexplicable; everything was doubtful. Only the large number of deaths was an unquestionable reality.

The reader can appreciate my perplexity during my first period of service when I, like a drowning person grasping at a straw, discontinued supine deliveries, which had been customary in the first clinic, in favor of deliveries from a lateral position. I did this for no other reason than that the latter were customary in the second clinic. I did not believe that the supine position was so detrimental that additional deaths could be attributed to its use. But in the second clinic deliveries were performed from a lateral position and the patients were healthier. Consequently, we also delivered from the lateral position, so that everything would be exactly as in the second clinic.

I spent the winter of 1846-47 studying English. I did this because my predecessor, Dr. Breit, resumed the position of assistant, and I wanted to spend time in the large Dublin maternity hospital. Then, at the end of February 1847, Dr. Breit was

named Professor of Obstetrics at the medical school in Tübingen. I changed my travel plans and, in the company of two friends, departed for Venice on 2 March 1847. I hoped the Venetian art treasures would revive my mind and spirits, which had been so seriously affected by my experiences in the maternity hospital.

On 20 March of the same year, a few hours after returning to Vienna, I resumed, with rejuvenated vigor, the position of assistant in the first clinic. I was immediately overwhelmed by the sad news that Professor [Jakob] Kolletschka, whom I greatly admired, had died in the interim.

The case history went as follows: Kolletschka, Professor of Forensic Medicine, often conducted autopsies for legal purposes in the company of students. During one such exercise, his finger was pricked by a student with the same knife that was being used in the autopsy. I do not recall which finger was cut. Professor Kolletschka contracted lymphangitis and phlebitis [inflammation of the lymphatic vessels and of the veins respectively] in the upper extremity. Then, while I was still in Venice, he died of bilateral pleurisy, pericarditis, peritonitis, and meningitis [inflammation of the membranes of the lungs and thoracic cavity, of the fibroserous sac surrounding the heart, of the membranes of the abdomen and pelvic cavity, and of the membranes surrounding the brain, respectively]. A few days before he died, a metastasis also formed in one eye. I was still animated by the art treasures of Venice, but the news of Kolletschka's death agitated me still more. In this excited condition I could see clearly that the disease from which Kolletschka died was identical to that from which so many hundred maternity patients had also died. The maternity patients also had lymphangitis, peritonitis, pericarditis, pleurisy, and meningitis, and metastases also formed in many of them. Day and night I was haunted by the image of Kolletschka's disease and was forced to recognize, ever more decisively, that the disease from which Kolletschka died was identical to that from which so many maternity patients died.

Earlier, I pointed out that autopsies of the

newborn disclosed results identical to those obtained in autopsies of patients dying from childbed fever. I concluded that the newborn died of childbed fever, or in other words, that they died from the same disease as the maternity patients. Since the identical results were found in Kolletschka's autopsy, the inference that Kolletschka died from the same disease was confirmed. The exciting cause of Professor Kolletschka's death was known; it was the wound by the autopsy knife that had been contaminated by cadaverous particles. Not the wound, but contamination of the wound by the cadaverous particles caused his death. Kolletschka was not the first to have died in this way. I was forced to admit that if his disease was identical with the disease that killed so many maternity patients, then it must have originated from the same cause that brought it on in Kolletschka. In Kolletschka, the specific causal factor was the cadaverous particles that were introduced into his vascular system. I was compelled to ask whether cadaverous particles had been introduced into the vascular systems of those patients whom I had seen die of this identical disease. I was forced to answer affirmatively.

Because of the anatomical orientation of the Viennese medical school, professors, assistants, and students have frequent opportunity to contact cadavers. Ordinary washing with soap is not sufficient to remove all adhering cadaverous particles. This is proven by the cadaverous smell that the hands retain for a longer or shorter time. In the examination of pregnant or delivering maternity patients, the hands, contaminated with cadaverous particles, are brought into contact with the genitals of these individuals, creating the possibility of resorption. With resorption, the cadaverous particles are introduced into the vascular system of the patient. In this way, maternity patients contract the same disease that was found in Kolletschka.

Suppose cadaverous particles adhering to hands cause the same disease among maternity patients that cadaverous particles adhering to the knife caused in Kolletschka. Then if those particles are destroyed chemically, so that in examinations

Table 2*			
1847	Births	Deaths	Rate
June	268	6	2.38
July	250	3	1.20
August	264	5	1.89
September	262	12	5.23
October	278	11	3.95
November	246	11	4.47
December	273	8	2.93
Total/Average	1,841	56	3.04

*Table 6 in the German original

patients are touched by fingers but not by cadaverous particles, the disease must be reduced. This seemed all the more likely, since I knew that when decomposing organic material is brought into contact with living organisms it may bring on decomposition.

To destroy cadaverous matter adhering to hands I used *chlorina liquida*. This practice began in the middle of May 1847; I no longer remember the specific day. Both the students and I were required to wash before examinations. After a time I ceased to use *chlorina liquida* because of its high price, and I adopted the less expensive chlorinated lime. In May 1847, during the second half of which chlorine washings were first introduced, 36 patients died—this was 12.24 percent of 294 deliveries. In the remaining seven months of 1847, the mortality rate was below that of the patients in the second clinic (see Table 2).

In these seven months, of the 1,841 maternity patients cared for, 56 died (3.04 percent). In 1846, before washing with chlorine was introduced, of 4,010 patients cared for in the first clinic, 459 died (11.4 percent). In the second clinic in 1846, of 3,754 patients, 105 died (2.7 percent). In 1847, when in approximately the middle of May I instituted washing with chlorine, in the first clinic of 3,490 patients, 176 died (5 percent). In the second clinic of 3,306 patients, 32 died (0.9 percent). In 1848, chlorine washings were employed throughout the year and of 3,556 patients, 45 died (1.27 percent). In the second clinic in the year 1848, of 3,219 patients 43 died (1.33 percent). The mortality

rates for the individual months of 1848 are shown in Table 3.

In March and August 1848 not a single patient died. In January 1849, of 403 births 9 died (2.23 percent). In February, of 389 births 12 died (3.08 percent). March had 406 births, and there were 20 deaths (4.9 percent). On 20 March Dr. Carl Braun¹ succeeded me as assistant.

As mentioned, the commissions identified various endemic factors as causes of the greater mortality rate in the first clinic. Accordingly, various measures were instituted, but none brought the mortality rate within that of the second clinic. Thus one could infer that the factors identified by the commissions were not causally responsible for the greater mortality in the first clinic. I assumed that the cause of the greater mortality rate was cadaverous particles adhering to the hands of examining obstetricians. I removed this cause by chlorine washings.

Consequently, mortality in the first clinic fell below that of the second. I therefore concluded that cadaverous matter adhering to the hands of the physicians was, in reality, the cause of the increased mortality rate in the first clinic. Since the chlorine washings were instituted with such

¹ Carl Braun (1822-91) was Klein's assistant from 1849 until 1853. He succeeded Klein as Professor of Obstetrics at the University of Vienna and became Rector of the University. Braun was consistently hostile to Semmelweis; he was not conscientious in using the prophylactic measures necessary to prevent childbed fever, and he did not accept Semmelweis's etiological characterization of the disease.

Table 3*			
1848	Births	Deaths	Rate
January	283	10	3.53
February	291	2	0.68
March	276	0	0.00
April	305	2	0.65
May	313	3	0.99
June	264	3	1.13
July	269	1	0.37
August	261	0	0.00
September	312	3	0.96
October	299	7	2.34
November	310	9	2.90
December	373	5	1.34
Total	3,556	45	
Average			1.27

* Table 7 in the German original

dramatic success, not even the smallest additional changes in the procedures of the first clinic were adopted to which the decline in mortality could be even partially attributed. The instruction system for midwives is so instituted that pupils and instructors have less frequent occasion to contaminate their hands with cadaverous matter than is the case in the first clinic. Thus, the unknown endemic cause of the horrible devastations in the first clinic was the cadaverous particles adhering to the hands of the examiners.

In order to destroy the cadaverous material, it was necessary that every examiner wash in chlorinated lime upon entry into the labor room. Because students in the labor room had no opportunity to contaminate their hands anew, I believed one washing was sufficient. Because of the large number who gave birth each year in the first clinic, patients were seldom alone in the labor room; as a rule several were there simultaneously. For purposes of instruction, those in labor were arranged and examined sequentially. I regarded it as sufficient that after each examination the hands were washed with soap and water only. Within the labor room, it seemed unnecessary for the hands to be washed with chlorine water between examinations. Once the hands had been cleaned of cadaverous particles, they could not become contaminated again.

In October 1847, a patient was admitted with discharging medullary carcinoma [cancer of the innermost part] of the uterus. She was assigned the bed at which the rounds were always initiated. After examining this patient, those conducting the examination washed their hands with soap only. The consequence was that of twelve patients then delivering, eleven died. The ichor from the discharging medullary carcinoma was not destroyed by soap and water. In the examinations, ichor was transferred to the remaining patients, and so childbed fever multiplied. Thus, childbed fever is caused not only by cadaverous particles adhering to hands but also by ichor from living organisms. It is necessary to clean the hands with chlorine water, not only when one has been handling cadavers but also after examinations in which the hands could become contaminated with ichor. This rule, originating from this tragic experience, was followed thereafter. Childbed fever was no longer spread by ichor carried on the hands of examiners from one patient to another.

A new tragic experience persuaded me that air could also carry decaying organic matter. In November of the same year, an individual was admitted with a discharging carious left knee. In the genital region this person was completely healthy. Thus the examiners' hands presented no danger to the other patients. But the ichorous exhalations of the carious knee completely satu-

rated the air of her ward. In this way the other patients were exposed and nearly all the patients in that room died. The reports of the first clinic indicate that eleven patients died in November and eight more in December. These deaths were largely due to ichorous exhalations from this individual. The ichorous particles that saturated the air of the maternity ward penetrated the uteruses already lacerated in the birth process. The particles were resorbed, and childbed fever resulted. Thereafter, such individuals were isolated to prevent similar tragedies.

The maternity hospital in Vienna was opened on 16 August 1784. In the eighteenth century and in the early decades of the nineteenth century, medicine was concerned with theoretical speculation, and the anatomical foundations were neglected. Thus in 1822, of 3,066 patients only 26 died (.84 percent). In 1841, after the Viennese medical school adopted an anatomical orientation, of 3,036 patients 237 died (7.7 percent). In 1843 of 3,060 patients 274 died (8.9 percent). In 1827, of 3,294 patients 55 died (1.66 percent). In 1842 of 3,287 patients 518 died (15.8 percent). From 1784 until 1823, over a period of twenty-five years, less than 1 percent of the patients cared for in the maternity hospital died. This is shown in Table 4.

This table provides unchallengeable proof for my opinion that childbed fever originates with the spread of animal-organic matter. At the time when the educational system limited opportunities for spreading decaying animal-organic matter, the patients cared for in the maternity hospital were much healthier.

As the Viennese medical school adopted an anatomical orientation, the health of the maternity patients worsened. When the number of births and of students became so great that one professor could not supervise the births and give instruction, the maternity hospital was divided into two clinics. At that time the same number of male and female students were assigned to each clinic. On 10 October 1840, by imperial decree, all males were assigned to the first clinic and all female students to the second. I am not able to say in which year the maternity hospital was

divided. Colleagues who taught obstetrics in the second clinic when male students were still admitted report that there was, at that time, no significant difference in mortality between the clinics. The consistently unfavorable health of patients in the first clinic dates from 1840, when all male students were assigned to the first clinic and all female students to the second. After what has been reported, it would be superfluous to explain these facts further.

Table 1 indicates the difference in mortality rates between the patients of the two clinics after the first was devoted exclusively to training obstetricians and the second to training midwives. This would be the place to provide a similar table for the years during which female and male students were divided equally between both clinics. It would show that during this time the mortality rate was not consistently larger in the first clinic. However, I do not have access to the necessary data. The reports were prepared in triplicate in both clinics. One copy remained in the institution; one copy was sent to the governmental administration. Those who now have these reports would do a service to science if they would release them to the public.² I possess the reports of both clinics only for 1840, when the male and female students were separated, and for the preceding year (see Table 5). The variation in mortality for both clinics can be traced to the activities of those in the process of becoming physicians. I was obstructed in disclosing this information because at the time it was construed as a basis for personal denunciation.

Professor Skoda assigned various responsibilities to the above-mentioned commission of the Viennese medical college. Among these were the

² On page 130; German edition, page 139, Semmelweis reports that he has just obtained this information and proceeds to give the table that he here omits. He refers back to this page and apologizes for not including the information where it was first needed. The figures for 1839 and 1840 were made public in Carl Haller's report on the operation of the Vienna General Hospital published in the *Zeitschrift der k. k. Gesellschaft der Ärzte zu Wien*, 5, no. 2 (1849): 535-46.

construction of a table showing, as far as the data was available, the number of deliveries and of deaths month by month, and a list of the assistants and students in the sequential order in which they served and practiced in the maternity hospital. Professor [Karl] Rokitansky³ has directed the pathological-anatomical division since 1828. From his recollections, and from autopsy reports, and with the help of other physicians and of the assistants and students who participated in the examination of corpses, it would be possible to determine whether the number of diseased patients corresponded to the activities of assistants and students in the autopsy room. As mentioned above, higher authorities prevented the commission from carrying out this assignment.

In consequence of my conviction I must affirm that only God knows the number of patients who went prematurely to their graves because of me. I have examined corpses to an extent equaled by few other obstetricians. If I say this also of another physician, my intention is only to bring to consciousness a truth that, to humanity's great misfortune, has remained unknown through so many centuries. No matter how painful and oppressive such a recognition may be, the remedy does not lie in suppression. If the misfortune is not to persist forever, then this truth must be made known to everyone concerned.

After it was realized that the additional deaths in the first clinic were explained by cadaverous and ichorous particles on the examiners' contaminated hands, various unexplained phenomena could be accounted for quite naturally. In the morning hours the professor and the students made general rounds; in the afternoons the assistant and the students made rounds. As part of their instruction, the students examined all patients who were pregnant or in labor. The

assistant was also obliged, before the morning visit of the professor, to examine those in labor and to report on them to the professor. Between these visits the assistant and the students would assume responsibility for necessary examinations. When, therefore, dilation extended over a long period and the patient spent one or more days in the labor room, she was certain to be examined repeatedly by persons whose hands were contaminated with cadaverous and ichorous particles. In this way childbed fever was induced, and as I have mentioned, these individuals died almost without exception. Once the chlorine washings were adopted and the patients were examined only by persons with clean hands, patients with extended periods of dilation stopped dying, and extended labor was no more dangerous than in the second clinic.

In order to make my next point intelligible, I must partially explain how I conceive of childbed fever. For now it is sufficient to observe that foul animal-organic particles are resorbed, and that in consequence of this resorption, disintegration of the blood [*Blutentmischung*] sets in. We have already noted that those with extended periods of dilation contracted rapidly developing childbed fever either during birth or directly thereafter. In other words, the resorption of foul animal-organic particles and the resulting disintegration of the mother's blood occurred at a time when the fetal blood was in organic exchange through the placenta with the blood of the mother. In this way, blood disintegration, from which the mother was suffering, was transmitted to the child. In consequence the newborn, whether female or male, died from a disease identical to that of the mother and in numbers equal to the mothers. Childbed fever originates in the mother because foul animal-organic matter is resorbed and leads to blood disintegration. In the infant the situation is somewhat different. The fetus, as yet unborn and in the birth canal, does not resorb foul animal-organic matter when it is touched by the examiner's contaminated fingers, but only when its blood is organically mixed with the mother's blood that has already become contaminated.

³ Karl Rokitansky (1804-1878) was Professor of Pathological Anatomy at the University of Vienna from 1844 until 1875 and was Rector of the University in 1853. He was one of the outstanding anatomists of the century—he is said to have performed more than 30,000 autopsies. Rokitansky also supported Semmelweis against the older members of the faculty until Semmelweis left Vienna in 1850.

Table 4*							
	Births	Deaths	Rate	Year	Births	Deaths	Rate
1784	284	6	2.11	1817	2,735	25	0.91
1785	899	13	1.44	1818	2,568	56	2.18
1786	1,151	5	0.43	1819	3,089	154	4.98
1787	1,407	5	0.35	1820	2,998	75	2.50
1788	1,425	5	0.35	1821	3,294	55	1.66
1789	1,246	7	0.56	1822	3,066	26	0.84
1790	1,326	10	0.75	1823	2,872	214	7.45
1791	1,395	8	0.57	1824	2,911	144	4.94
1792	1,574	14	0.89	1825	2,594	229	4.82
1793	1,684	44	2.61	1826	2,359	192	8.12
1794	1,768	7	0.39	1827	2,367	51	2.15
1795	1,798	38	2.11	1828	2,833	101	3.56
1796	1,904	22	1.16	1829	3,012	140	4.64
1797	2,012	5	0.24	1830	2,797	111	3.97
1798	2,046	5	0.24	1831	3,353	222	6.62
1799	2,067	20	0.96	1832	3,331	105	3.15
1800	2,070	41	1.98	1833	3,907	205	5.25
1801	2,106	17	0.80	1834	4,218	355	8.41
1802	2,346	9	0.38	1835	4,040	227	5.61
1803	2,215	16	0.72	1836	4,144	331	7.98
1804	2,022	8	0.39	1837	4,363	375	8.59
1805	2,112	9	0.40	1838	4,560	179	3.92
1806	1,875	13	0.73	1839	4,992	248	4.96
1807	925	6	0.64	1840	5,166	328	6.44
1808	855	7	0.81	1841	5,454	330	6.05
1809	912	13	1.42	1842	6,024	730	12.11
1810	744	6	0.80	1843	5,914	457	7.72
1811	1,050	20	1.90	1844	6,244	336	5.38
1812	1,419	9	0.63	1845	6,756	313	4.63
1813	1,945	21	1.08	1846	7,027	567	8.06
1814	2,062	66	3.20	1847	7,039	210	2.98
1815	2,591	19	0.73	1848	7,095	91	1.28
1816	2,410	12	0.49				

*Table 8 in the German original

This explains why an infant never dies of childbed fever while the mother remains healthy; childbed fever does not arise in the newborn through direct resorption. Both become ill while the child and mother are in organic interchange through the placenta and when the blood of the mother has disintegrated through the resorption of foul animal-organic matter. The mother can become ill while the child remains healthy if the organic interchange between them is ended by the birth

process before disintegration of the mother's blood has begun.

[...]

Epilogue

I do not undertake these polemics because of pugnaciousness. My four years of silence prove this. Given the opposition to my beliefs,

Table 5*						
	First clinic			Second clinic		
	Births	Deaths	Rate	Births	Deaths	rate
1839	2,781	151	5.4	2,010	91	4.5
1840	2,889	267	9.5	2,073	55	2.6

*Table 9 in the German original

however, the unbiased reader will agree not only that the time for silence is past but also that I have the right and obligation to engage in these polemics.

When, with my current convictions, I look into the past, I can endure the miseries to which I have been subjected only by looking at the same time into the future; I see a time when only cases of self-infection will occur in the maternity

hospitals of the world. In comparison with the great numbers thus to be saved in the future, the number of patients saved by my students and by me is insignificant. If I am not allowed to see this fortunate time with my own eyes, therefore, my death will nevertheless be brightened by the conviction that sooner or later this time will inevitably arrive.

