Marie-Sophie Germain (1776 – 1831)

From Wikipedia, the free encyclopedia,
http://en.wikipedia.org/wiki/Sophie_Germain

Marie-Sophie was a French mathematician, physicist, and philosopher. Despite initial opposition from her parents and difficulties presented by a gender-biased society, she gained education from books in her father's library and from correspondence with famous mathematicians such as Lagrange, Legendre, and Gauss. One of the pioneers of elasticity theory, she won the grand prize from the Paris Academy of Sciences for her essay on the subject. Her work on Fermat's Last Theorem provided a foundation for mathematicians exploring the subject for hundreds of years after. Because of prejudice against her gender, she was unable to make a career out of mathematics, but she worked independently throughout her life.

Work in elasticity:

When Germain's correspondence with Gauss ceased, she took interest in a contest sponsored by the Paris Academy of Sciences concerning Ernst Chladni's experiments with vibrating metal plates. The object of the competition, as stated by the Academy, was "to give the mathematical theory of the vibration of an elastic surface and to compare the theory to experimental evidence." Lagrange's comment that a solution to the problem would require the invention of a new branch of analysis deterred all but two contestants, Denis Poisson and Germain. Then Poisson was elected to the Academy, thus becoming a judge instead of a contestant, and leaving Germain as the only entrant to the competition.

In 1809 Germain began work. Legendre assisted by giving her equations, references, and current research. She submitted her paper early in the fall of 1811, and did not win the prize. The judging commission felt that "the

true equations of the movement were not established," even though "the experiments presented ingenious results." Lagrange was able to use Germain's work to derive an equation that was "correct under special assumptions."

The contest was extended by two years, and Germain decided to try again for the prize. At first Legendre continued to offer support, but then he refused all help. Germain's anonymous 1813 submission was still littered with mathematical errors, especially involving double integrals, and it received only an honorable mention because "the fundamental base of the theory [of elastic surfaces] was not established." The contest was extended once more, and Germain began work on her third attempt. This time she consulted with Poisson. In 1814 he published his own work on elasticity, and did not acknowledge Germain's help (although he had worked with her on the subject and, as a judge on the Academy commission, had had access to her work).

Germain submitted her third paper, "Recherches sur la théorie des surfaces élastique" under her own name, and on 8 January 1816 she became the first woman to win a prize from the Paris Academy of Sciences. She did not appear at the ceremony to receive her award. Although Germain had at last been awarded the prix extraordinaire, the Academy was still not fully satisfied. Sophie had derived the correct differential equation, but her method did not predict experimental results with great accuracy, as she had relied on an incorrect equation from Euler, which led to incorrect boundary conditions. [more in the Wikipedia article]

Germain published her prize-winning essay at her own expense in 1821, mostly because she wanted to present her work in opposition to that of Poisson. In the essay she pointed out some of the errors in her method.

In 1826 she submitted a revised version of her 1821 essay to the Academy. According to Andrea del Centina, a math professor at the University of Ferrara in Italy, the revision included attempts to clarify her work by "introducing certain simplifying hypotheses." This put the Academy in an awkward position, as they felt the paper to be "inadequate and trivial," but they did not want to "treat her as a professional colleague, as they would any man, by simply rejecting the work." So Augustin-Louis Cauchy, who had been appointed to review her work, recommended she publish it, and she followed his advice.

One further work of Germain's on elasticity was published posthumously in 1831: her "Memoir sur la courbure des surfaces." She used the mean curvature in her research…

In 1829 Germain learned she had breast cancer. Despite the pain, she continued to work. In 1831 Crelle's Journal published her paper on the curvature of elastic surfaces.

Despite Germain's intellectual achievements, her death certificate lists her as a "rentière – annuitant" (property holder), not a "mathematicienne." But her work was not unappreciated by everyone. When the matter of honorary degrees came up at the University of Göttingen six years after Germain's death, Gauss lamented, "[Germain] proved to the world that even a woman can accomplish something worthwhile in the most rigorous and abstract of the sciences and for that reason would well have deserved an honorary degree."

Germain's resting place in the Père Lachaise Cemetery in Paris is marked by a crumbling gravestone. At the centennial celebration of her life, a street and a girls' school were named after her, and a plaque was placed at the house where she died. The school houses a bust commissioned by the Paris City Council.