

Hensel, Kurt | Encyclopedia.com

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(*b.* Königsberg, Germany [now Kaliningrad, U.S.S.R.], 29 December 1861; *d.* Marburg, Germany, 1 June 1941)

mathematics.

Hensel was descended from a family of artists and scientists; his grandmother, the former Fanny Mendelssohn, was a sister of [Felix Mendelssohn](#)-Bartholdy. Until he was nine years old, he was educated at home by his parents; later, in Berlin, he was decisively influenced by the eminent mathematics teacher K. H. Schellbach at the Friedrich-Wilhelm Gymnasium. Hensel studied mathematics at Bonn and Berlin. Among his teachers were Rudolf Lipschitz, Karl Weierstrass, Carl Borchardt, Gustav Kirchhoff, Hermann von Helmholtz, and especially [Leopold Kronecker](#), under whose guidance he took his Ph.D. in 1884 and qualified as *Privatdozent* at the University of Berlin in 1886. In the latter year he married Gertrud Hahn, sister of the renowned educator Kurt Hahn, known for his schools at Salem, Germany, and in Scotland. They had four daughters and a son, Albert.

After Kronecker's death, Hensel devoted many years to preparing the edition of his collected papers. In close cooperation with G. Landsberg, Hensel published his first important book, *Theorie der algebraischen Funktionen* (1902). In 1901 Hensel became full professor at the University of Marburg, where he was an extremely successful teacher and wrote the important books *Theorie der algebraischen Zahlen* (1908) and *Zahlentheorie* (1913). Also in 1901 Hensel became editor of Germany's oldest mathematical periodical, *Journal für die reine und angewandte Mathematik*. He retired in 1930 but continued to teach and advise. The following year he was awarded an honorary Ph.D. by the University of Oslo.

Hensel's scientific work was based on Kronecker's arithmetical theory of algebraic number fields. The Kronecker-Hensel method also yielded a foundation of the arithmetic in algebraic function fields. The latter foundation was developed systematically in *Theorie der algebraischen Funktionen*. The Weierstrass method of power-series development for algebraic functions led Hensel, about 1899, to the conception of an analogue in the theory of algebraic numbers: p -adic numbers. The p -adic numbers must be considered his most important discovery. In evaluating it, one must bear in mind that its conceptual base did not then exist; on the contrary, Hensel's discovery was the decisive stimulus for the development of the abstract algebraic notions required for the base: the theory of valuated fields. In his *Theorie der algebraischen Zahlen and Zahlentheorie*, Hensel developed p -adic numbers into a systematic theory; he also gave an application of great interest—to the classical theory of quadratic forms—and a remarkable extension of his p -adic method by the introduction of a p -adic analysis. Further developed by Hensel's pupils, especially Helmut Hasse, the p -adic method proved highly successful in the theory of quadratic forms and in the theory of algebras over number fields and is known today as the local-global principle. Hensel's method led him to many interesting results in the theory of numbers, which were published in a great many papers. At first his p -adic numbers were generally considered of no particular consequence, but he lived to see their recognition as a highly important, widely generalizable mathematical element.

BIBLIOGRAPHY

Hensel's books and contributions to books are *Theorie der algebraischen Funktionen einer Variablen und ihre Anwendung auf algebraische Kurven und Abelsche Integrale* (Leipzig, 1902), written with G. Landsberg; *Theorie der algebraischen Zahlen* (Leipzig, 1908); *Zahlentheorie* (Berlin-Leipzig, 1913); and "Arithmetische Theorie der algebraischen Funktionen," in *Encyclopädie der mathematischen Wissenschaften*, pt. 2, sec. 5 (1921), 533–650.

Three collections of [Leopold Kronecker](#)'s work, edited by Hensel, are *Werke*, 5 vols. (Leipzig, 1895–1930); *Vorlesungen über Zahlentheorie* (Leipzig, 1901); and *Vorlesungen über die Theorie der Determinanten* (Leipzig, 1903).

Hensel's most important papers are "Arithmetische Untersuchungen über die Diskriminanten und ihre ausserwesentlichen Teiler" (Berlin, 1884), his diss.; "Über eine neue Begründung der algebraischen Zahlen," in *Jahres-bericht der Deutschen Mathematiker-Vereinigung*, **6** (1899), 83–88; "Die multiplikative Darstellung der algebraischen Zahlen für den Bereich eines beliebigen Primteilers," in *Journal für die reine und angewandte Mathematik*, **145** (1915), 92–113; **146** (1916), 189–215; **147** (1917), 1–15; and "Eine neue Theorie der algebraischen Zahlen," in *Mathematische Zeitschrift*, **2** (1918), 433–452.

H. Hasse's commemorative article "Kurt Hensel zum Gedächtnis," in *Journal für die reine und angewandte Mathematik*, 187 (1950), 1–13, contains a complete bibliography.

Helmut Hasse