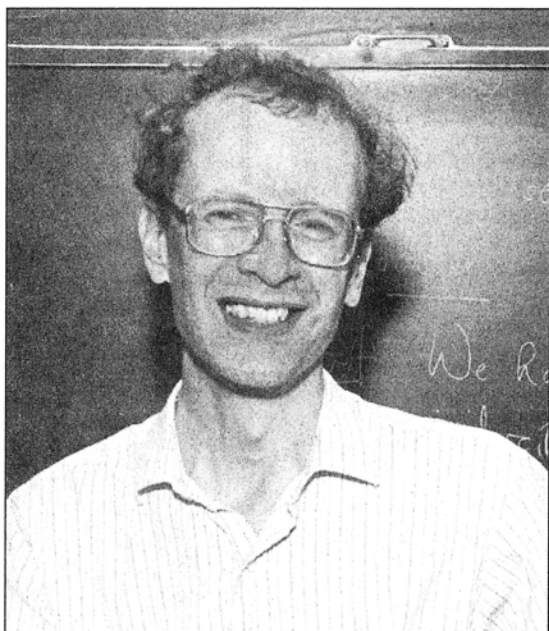# 1997 Cole Prize

Andrew Wiles

The Frank Nelson Cole Prize in Algebra is awarded every five years for a notable research memoir in algebra which has appeared during the previous five years. This prize, as well as the Frank Nelson Cole Prize in Number Theory, was founded in honor of Professor Frank Nelson Cole on the occasion of his retirement as secretary of the American Mathematical Society after twenty-five years and as editor-in-chief of the *Bulletin* for twenty-one years. The original fund was donated by Professor Cole from moneys presented to him on his retirement. It has been augmented by contributions from members of the Society, including a gift made in 1929 by Charles A. Cole, Professor Cole's son, which more than doubled the size of the fund. In recent years, the Cole Prizes have been augmented by awards from the Leroy P. Steele Fund and currently amount to $4,000.

The twenty-fifth Cole Prize has been awarded to ANDREW WILES. The prize was presented at the Society's 103rd Annual Meeting in San Diego in January 1997. The Cole Prize was awarded by the Council of the American Mathematical Society, acting through a selection committee consisting of Hyman Bass, Karl Rubin (chair), and Wolfgang Schmidt.

The text below includes the committee's citation, a brief biographical sketch, and a response from Andrew Wiles upon receiving the award.

Citation

The 1997 Frank Nelson Cole Prize in Number Theory is awarded to Andrew Wiles for his work on the Shimura-Taniyama conjecture and Fermat's Last Theorem, published in "Modular elliptic curves and Fermat's Last Theorem", Ann. of Math. **141** (1995), 443–551. Fermat proved his "Last Theorem" for exponent 4 by developing the theory of elliptic curves. But there was no apparent connection between elliptic curves and higher exponent Fermat equations, so elliptic curves played no further role in work on Fermat's Last Theorem for almost 350 years, by which time it had become the most famous unsolved problem in mathematics.

The first person in modern times to connect elliptic curves with Fermat's Last Theorem was Y. Hellegouarch in the 1970s. Then about ten years ago, G. Frey suggested and K. Ribet proved (building on ideas of B. Mazur and J.-P. Serre) that Fermat's Last Theorem follows from the Shimura-Taniyama conjecture that every elliptic curve defined over the rational numbers is modular. Precisely, if

$$a^n + b^n = c^n$$

is a counterexample to Fermat's Last Theorem, then the elliptic curve

$$y^2 = x(x - a^n)(x + b^n)$$

cannot be modular, thus violating the Shimura-Taniyama conjecture. This result set the stage for Wiles' work. Using Mazur's deformation theory of Galois representations, recent results on Serre's conjectures on the modularity of Galois representations, and deep arithmetic properties of Hecke algebras, Wiles (with one key step due jointly to Wiles and R. Taylor) succeeded in proving that all semistable elliptic curves defined over the rational numbers are modular. Although less than the full Shimura-Taniyama conjecture, this result does imply that the elliptic curve given above is modular, thereby proving Fermat's Last Theorem.

Wiles' work is highly original, a technical tour de force, and a monument to individual perseverance. In addition, it serves as encouraging evidence that the abstract machinery of modern arithmetic algebraic geometry has the power to solve long-standing classical problems.

For further reading see the introduction of Wiles' cited paper for a very readable account of the history of his attack on Fermat's Last Theorem. Among several other accounts of this work and the excitement surrounding it are four pieces in the *Notices* of the AMS (July/August 1993, 575-576; March 1994, 185-186; January 1995, 48; July 1995, 743-746) and two in the *Bulletin* of the AMS (July 1994, 15-38; October 1995, 375-402).

Biographical Sketch

Andrew J. Wiles was born in Cambridge, England, on April 11, 1953. He attended Merton College, Oxford University, starting in 1971, and he received his B.A. there in 1974. That same year he went to Clare College, Cambridge University, earning his Ph.D. there in 1980. From 1977 until 1980, Wiles was a Junior Research Fellow at Clare College and a Benjamin Peirce Assistant Professor at Harvard University. In 1981 he was a visiting professor at the Sonderforschungsbereich Theoretische Mathematik in Bonn, and later that year he was a member of the Institute for Advanced Study in Princeton. In 1982 he became a professor at Princeton University and in the spring of that year was a visiting professor at the Université de Paris, Orsay.

On a Guggenheim Fellowship he was a visiting professor at the Institut des Hautes Études Scientifiques and at the École Normale Supérieure (1985-86). From 1988 to 1990 he was a Royal Society Research Professor at Oxford University. In 1994 he assumed his present position as the Eugene Higgins Professor of Mathematics at Princeton.

Wiles was elected a Fellow of the Royal Society, London, in 1989. In 1995 he received the Schock Prize in Mathematics from the Royal Swedish Academy of Sciences. That same year he was awarded the Prix Fermat, presented by the Université Paul Sabatier and Matra Marconi Space. In 1996 Wiles received the Wolf Prize in Mathematics. Wiles was elected a foreign member to the U.S. National Academy of Sciences (NAS) in 1996 and also received the 1996 NAS Prize in Mathematics.

Response from Andrew Wiles

It is a pleasure to thank the American Mathematical Society and the Selection Committee for the award of the Cole Prize in Number Theory. Needless to say on the path to Fermat I benefited enormously from the work of many people, not only of Frey and Ribet, who directly inspired it, but also the many others who knowingly influenced my thinking along the way. I thank them all. Finally, I would like to acknowledge my debt to both Pierre and Samuel Fermat.