A biography of Gregory Margulis

In a glittering mathematical career, Gregory (Grisha) Margulis has introduced many influential ideas, solved long-standing open questions, and discovered deep connections between different mathematical fields. His signature approach has been to use ergodic theory in unexpected and ingenious ways, which has led to the creation of entirely new areas of study.

Born in Moscow in 1946, he gained international recognition aged 16 with a silver medal at the International Mathematical Olympiad. He attended Moscow State University, receiving his PhD in 1970 under the supervision of Yakov Sinai (Abel Prize laureate in 2014). His dissertation revealed a particularly original mind: he constructed a measure — now called the Bowen-Margulis measure — that enabled him to discover new properties about the geometry of hyperbolic space. His methods subsequently inspired many new questions and areas of active research.

Margulis won the 1978 Fields Medal, aged only 32, for his work on lattices in Lie groups, notably his arithmeticity and superrigidity theorems. The arithmeticity theorem states that all irreducible lattices in semi-simple Lie groups of rank greater than 2 are arithmetic, and the superrigidity theorem that a representation of such a lattice extends to a representation of the ambient Lie group. The superrigidity proof demonstrated novel applications of ergodic theory, establishing powerful new methods that became very influential in many fields.

Jacques Tits (Abel Prize laureate in 2008) said of Margulis in 1978: “It is not exaggerated to say that, on several occasions, he has bewildered the experts by solving questions which appeared to be completely out of reach at the time.”

Margulis, however, was unable to receive the Fields Medal since the Soviet authorities refused him a visa to attend the awards ceremony in Helsinki, Finland. He was only allowed to travel abroad in 1979 when Soviet academics were given more personal freedoms. During the 1980s, he visited academic institutions in Switzerland, France and

the U.S., before settling at Yale in 1991, where he has been ever since.

Earlier in his career, Margulis faced discrimination for being of Jewish origin. Even though he was one of the top young mathematicians in the country, he was unable to find a job at Moscow University. Instead, he worked at the much less prestigious Institute for Problems in Information Transmission. His contact with colleagues at the institute, however, led to a remarkable discovery. They told him about a type of connected network called an “expander graph”. Within days Margulis had constructed the first known example of an expander graph using ideas from representation theory, an abstract and seemingly unrelated field. His discovery was ground-breaking and has had many applications in computer science.

Margulis again demonstrated his knack for proving theorems in stunning and surprising ways when in 1978 he revealed what is now called his normal subgroup theorem, about lattices in Lie groups. His proof was a very original combination of the theory of amenable groups on one hand and the Kazhdan Property (T) from representation theory, on the other.

In 1984 he proved the Oppenheim conjecture, an idea from number theory first stated in 1929, using methods from ergodic theory. More important than the result was the whole idea of using ergodic theory in this way, and this created a new area, now called homogenous dynamics. The work of three recent Fields medallists — Elon Lindenstrauss, Maryam Mirzakhani and Akshay Venkatesh — all builds on Margulis’s earlier ideas.

Margulis has been as prolific as he has been diverse. When in 2008 the *Pure and Applied Mathematics Quarterly* ran an article listing Margulis’s major results, it ran to more than 50 pages.

In 2001 Margulis was elected to the U.S. National Academy of Sciences. He is a winner of the Lobachevsky Prize and the Wolf Prize.

Margulis and his wife Raisa (Raya) have a son and a granddaughter.