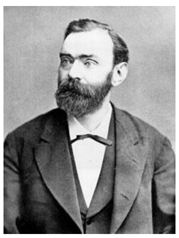
Math Excellence

The Top Mathematics Award

Florin Diacu[†]

Fields Medal

There is no Nobel Prize for mathematics. Its top award, the Fields Medal, bears the name of a Canadian.



Alfred Nobel

In 1896, the Swedish inventor Alfred Nobel died rich and famous. His will provided for the establishment of a prize fund. Starting in 1901 the annual interest was awarded yearly for the most important contributions to physics, chemistry, physiology or medicine, literature, and peace. The economics prize appeared later founded by the Central Bank of Sweden in 1968 to commemorate its 300th anniversary.

Why did Nobel choose these fields? Nobel, the inventor of dynamite, loved chemistry and physics. Literature was his great passion; in spite of a busy life, he found time to read and write fiction. Medicine and peace were natural choices for the benefit of humankind. But what about mathematics?

Gösta Mittag-Leffler

Rumour has it Gösta Mittag-Leffler, a charismatic professor at the University of Stockholm, had an affair with Nobel's wife. Outraged at discovering the liaison, Nobel damned all mathematicians. The gossip, however, is groundless; Nobel never married.

Still, a kernel of truth exists. During the decade he spent in Europe, Canadian mathematician John Charles Fields developed a close friendship with Mittag-Leffler. A colleague of Fields at the University of Toronto, J.L. Synge, recalled in 1933, "I should insert here something that Fields told me and which I later verified in Sweden, namely, that Nobel hated the mathematician Mittag-Leffler and that mathematics would not be one of the domains in which the Nobel prizes would be available."

John Charles Fields

Whatever the reason, Nobel had little esteem for mathematics. He was a practical man who ignored basic research. He never understood its importance and long term consequences. But Fields did, and he meant to do his best to promote it.

Fields was born in Hamilton, Ontario in 1863. At the age of 21, he graduated from the University of Toronto with a B.A. in mathematics. Three years later, he finished his Ph.D. at Johns Hopkins University and was then appointed professor at Allegheny College in Pennsylvania, where he taught from 1889 to 1892. But soon his dream of pursuing research faded away. North America was not ready to fund novel ideas in science. Then, an opportunity to leave for Europe arose.

For the next 10 years, Fields studied in Paris and Berlin with some of the best mathematicians of his time. After feeling accomplished, he returned home—his country needed him. In 1902, he received a special lectureship at the University of Toronto and in 1923, he was promoted to research professor, a position he kept for life. He was also elected Fellow of the Royal Societies of Canada in 1907 and London in 1913.

As organizer and president of the 1924 International Congress of Mathematicians (ICM) in Toronto, Fields attracted many sponsors and saved a large amount of money. The Committee he chaired decided to use this fund for establishing an outstanding award. Against the nationalistic mood of his time, Fields proposed that the prize be "as purely international and impersonal as possible" and that the name of no country, institution, or person be attached to it.

In the following years, he continued to lobby the international acceptance of this idea. At the beginning of 1932, the Committee's proposal was submitted to the ICM, to be held in September in Zürich. But in May, Fields fell seriously ill and sensed his end approaching. With Synge as a witness, he dictated his will. His estate was to be donated for the establishment of the prize. On August 9, Fields died of a severe stroke.

One month later, the ICM adopted the proposal with an overwhelming majority. To respect Fields' wish, the award was named the "International Medal for Outstanding Discoveries in Mathematics." But everybody called it the "Fields Medal." At the ICM in 1936 in Oslo, the first two prizes were awarded to a Finn, Lars Ahlfors, and an American, Jesse Douglas.

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In agreement with Fields' proposal that the prize recognize both existing work and the promise of future achievement, eligibility is restricted to mathematicians under the age of 40. Four awards are now given every four years at the opening of the ICM. Each consists of a medal and \$15,000 Cdn, a modest sum compared to the Nobel Prize.

The medal, struck by the Royal Canadian Mint, is a gold plated cast, 25 centimeters in diameter. Designed in 1932 by the Canadian sculptor Robert Tait McKenzie, it shows the profile of Archimedes and a Latin quotation attributed to him: TRANSIRE SUUM PECTUS MUNDOQUE POTIRI (to rise above human limitations and grasp the world). The reverse side bears the inscription: CONGREGATI EX TOTO ORBE MATHEMATICI OB SCRIPTA INSIGNIA TRIBUERE (mathematicians from all over the world gathered here to honour outstanding achievement).

McKenzie had his own impression about the greatest mathematician of antiquity. In 1932 he wrote to Synge: "I feel a certain amount of complacency in having at last given to the mathematical world a version of Archimedes that is not decrepit, bald-headed, and myopic, but which has the fine presence and assured bearing of the man who defied the power of Rome." Since 1936, 42 mathematicians have received the Fields Medal. Their names and affiliations at the time of the award are provided in the table below. The country indicates the location of the institution, not the nationality of the recipient. The first Fields Medals of the 21st century will be awarded in the year 2002 in China.

1936	Lars V. Ahlfors	Harvard University, USA
	Jesse Douglas	M. I. T., USA
	Fields Medals were not	awarded during WW II
1950	Laurent Schwartz	University of Nancy, France
	Alte Selberg	Institut des Hautes Études
1954	Kunihiko Kodaira	Princeton University, USA
	Jean-Pierre Serre	University of Paris, France
1958	Klaus F. Roth	University of London, UK
	René Thom	University of Strasbourg, France
1962	Lars V. Hörmander	University of Stockholm, Sweden
	John W. Milnor	Princeton University, USA
1966	Michael F. Atiyah	Oxford University, UK
	Paul J. Cohen	Stanford University, US)
	Alexander Grothendieck	University of Paris, France
	Stephen Smale	Univ. California, Berkeley, USA
1970	Alan Baker	Cambridge University, UK
	Heisuke Hironaka	Harvard University, USA
	Serge P. Novikov	Moscow University, USSR
	John G. Thompson	Cambridge University, UK
1974	Enrico Bombieri	University of Pisa, Italy
	David B. Mumford	Harvard University, USA
1978	Pierre R. Deligne	Institut des Hautes Études Scientifiques, France)
	Charles L. Fefferman	Princeton University, USA
	Gregori A. Margulis	Moscow University, USSR
	Daniel G. Quillen	M.I.T., USA
1982	Alain Connes	Institut des Hautes Études Scientifiques, France
	William P. Thurston	Princeton University, USA
	Shing-Tung Yau	Institute for Advanced Study, Princeton, USA
1986	Simon Donaldson	Oxford University, UK
	Gerd Faltings	Princeton University, USA
	Michael Freedman	University of California, San Diego, USA
1990	Vladimir Drinfeld	Physical Institute Kharkov, USSR
	Vaughan Jones	University of California, Berkeley, USA
	Shigefumi Mori	Kyoto University, Japan
	Edward Witten	Institute for Advanced Study, Princeton, USA
1994	Pierre-Louis Lions	University Paris-Dauphine, France
	Jean-Christophe Yoccoz	University Paris-Sud, France
	Jean Bourgain	Institute for Advanced Study, Princeton, USA
	Efim Zelmanov	University of Wisconsin, USA
1998	Richard E. Borcherds	Cambridge University, UK
	W. Timothy Gowers	Cambridge University, UK
	Maxim Kontsevich	Institut des Hautes Études Scientifiques, France
	Curtis T. McMullen	Harvard University, USA

Math Jokes

HOW TO PROVE IT:

Proof by wishful citation:

- The author cites the negation, converse, or generalization of a theorem from the literature to support his claims.

Proof by funding:

- How could three different government agencies be wrong?

Proof by eminent authority:

- "*I saw Karp in the elevator and he said it was probably NP–complete.*"

Proof by personal communication:

- "Eight-dimensional coloured cycle stripping is NP–complete [Karp, personal communication]."

Proof by reduction to the wrong problem:

- "To see that infinite-dimensional coloured cycle stripping is decidable, we reduce it to the halting problem."

Proof by reference to inaccessible literature:

- The author cites a simple corollary of a theorem to be found in a privately circulated memoir of the Slovenian Philological Society, 1883.

Proof by importance:

- A large body of useful consequences all follow from the proposition in question.

Proof by accumulated evidence:

- Long and diligent search has not revealed a counterexample.

Proof by cosmology:

- The negation of the proposition is unimaginable or meaningless. Popular for proofs of the existence of God.

Dana Angluin, Sigact News, Winter–Spring 1983, Volume 15 #1