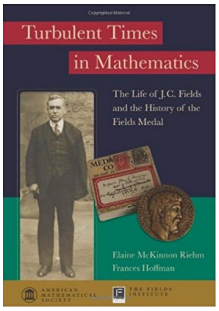
Turbulent Times in Mathematics: The Life of J.C. Fields and the History of the Fields Medal, Elaine McKinnon Riehm and Frances Hoffman, AMS, 2011 (258 p.) isbn: 978-0821869147.



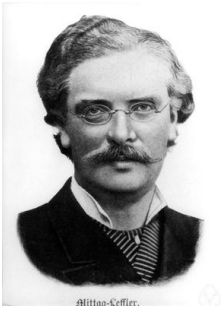
John Charles Fields

That there is no Nobel Prize for mathematics and that the Fields Medal is considered to be a mathematical Nobel Prize is known by every mathematician. But who was Fields? Not so many will be able to tell you. There is not a famous theory or theorem named after him. When Norway proposed the Abel Prize to complete the Nobel Prize, it was obvious that it was named after the famous mathematician Niels Hendrik Abel (1802-1829) who died very young of tuberculosis. A first proposal for that prize was made during a centennial conference in 1902 in his honour but the first one officially awarded was to Jean-Pierre Serre in 2003 (about 750K€) and is given annually ever since.

The Fields Medal (about 10K€) is awarded during the International Mathematics Congress (IMC) of the International Mathematical Union (IMU) held every 4 years to 2 (later up to 4) young mathematicians (under 40). Together with the Abel Prize, it is still considered to be one of the highest possible recognitions in mathematics. It was first awarded in 1936 during the IMC in Oslo, but because of WWII, and because the IMU had to reinvent itself, the next ones were only given in 1950, but they are awarded regularly since then.

You can of course look up the necessary key-words on Wikipedia, but all the juicy details of how it came about and who John Charles Fields (1863-1932) was can be found described in all detail in this book.

Fields' father was a tanner who arrived in Harrington (Canada) when the town was just outgrowing a Wild-West pioneering status. J.C. had an older sister and a younger brother that survived childhood. He was an excellent student in mathematics. His father died when he was 11 and his mother at his 18. He could however continue his studies at the nearby University of Toronto. Got a PhD in 1987 and did some postdoc years in the US and came to Europe in 1892-1900 (Paris, Göttingen, Berlin which were considered the main knowledge centres for mathematics). He was especially pleased by the German way of teaching mathematics in seminar style, much more than the French approach. He returned to the US and was appointed at the University of Toronto, where he wanted to promote the research in mathematics. In those days, there was not a tradition of mathematical research, it just was growing out on infancy.



G. Mittag-Leffler

the Djursholm villa

He did publish papers and he wrote a book (*Theory of Algebraic Functions of a Complex Variable*, 1906) but his mathematical research work is not of a ground breaking quality. His urge to promote research has been a driving force and his admiration for the Europeans made him travel to Europe almost every summer when he was not teaching (he learned French and German). During these travels, he expanded his network and made many friends everywhere around the globe. The Swedish mathematician Gösta Mittag-Leffler (1846-1927), had created another attraction pole in his villa in the Stockholm suburb of Djursholm. It was flooded by visitors from all over the world and the journal *Acta Mathematica* that he founded was and still is highly respected. He was the one to organize the Abel centennial conference in 1902 where he had invited Fields. The popularity of Mittag-Leffler, also with women as a defender of women's rights was in stark contrast with the personality of Alfred Nobel who was a celibatarian. So there

is no Nobel Prize for mathematics to prevent that Mittag-Leffler would get it.

When the war started in 1914, Belgium was quickly conquered and the news of Leuven being burned was spreading the world. The subsequent scientific schism was partly caused by a manifesto signed by 93 prominent Germans among which 13 scientists that wanted to defend what had happened in Belgium claiming it was all false news and that it was all self-defence of the German troops. Klein and Planck where among the ones that signed, Hilbert and Carathéodory refused. Thereafter the French expelled all Germans form their Académie.

Leuven 1914

An international group of scientists met in London and Paris in 1918 and founded the International Research Council (IRC) with the French mathematician Émil Picard as president. Picard had lost a son during the war and strongly insisted on the rule that Germany and its allies would be excluded from all future participation. The inaugural meeting was held in Brussels in 1919 presided by King Albert I and had 224 delegates. G.H. Hardy and Mittag-Leffler tried to mollify the banning of the Germans, but it was nevertheless retained. A next IMC was organized in Strasbourg in 1920 without the Germans, who claimed that it was therefore not "International" any more. There it was decided to organize science in unions. For mathematics this was the International Mathematical Union (IMU) that had been organizing the previous IMCs (e.g. in Paris (1900), where Hilbert proposed his millennium problems). The Belgian Charles de la Valleé-Poussin became its president in 1919, and it was proposed that the next meeting in 1924 would take place in the US.


E. Picard


C. de la Vallée-Poussin

However the controversy about whether or not to exclude Germans continued and divided the AMS. If the Germans were invited, then the French refused to come, while it was unthinkable to organize a conference without calling onto the most important scientists of that time like Hilbert, Planck, Einstein, Weyl,... This is where Fields saw an opportunity to bring science to Canada and boost Canadian research and he proposed to organize it in Toronto. The Americans were glad to have the hot potato out of their hands and agreed. Fields may have underestimated the logistic and financial consequences but was confident that he would manage. Another conference (of the British Association for the Advancement of Science (BAAS)) was already planned and the IMU would follow it the week after. Fields was an admirer of Germans science and was in favour of German participation, but since the IMU was associated with the IRC, he had to comply with the exclusion of the Germans.

Fields started a crusade to raise funding. He traveled to Europe once more to personally invite people and organized his nerve center in Paris and London to make communication easier. He organized the boat trips, the lodging, and the sponsoring because many of the European countries were short of money for scientific meetings shortly after the war. He traveled by boat together with several participants back to Canada to arrive just in time for the opening.

The conference was a big success. From Belgium participated de la Vallée-Poussin (Academy, Leuven), Godeaux (National Committee, Brussels), Dumoulin (BMS, Gent), Merlin and Servais (Gent). After the conference Fields organized a long train trip across Canada as a tourist excursion for some participants which he accompanied to help with practical things and serve as a translator. Twenty more sleepless nights was the drop that makes the bucket overflow, and Fields collapsed

with angina pectoris. He had to stay in bed for several weeks, but he was barely recovered when he started to collect and edit the proceedings, together with the Program Committee. It eventually resulted in two volumes of over 800 pages that were published in 1928.

S. Pincherle

Salvatore Pincherle from Italy gave one of the invited lectures at the 1924 Congress and proposed to have the next 1928 IMC in his home town Bologna. The unabated dispute about the exclusion of the Germans continued. After signing post-war treaties, the membership restrictions of the IRC was removed on a general meeting in Brussels in 1926. Pincherle, like many others were trying to heal the wounds and to reconcile French and German mathematicians, but now the Germans refused because the IMU was associated with the IRC that had discriminated them for so long. Pincherle solved the dilemma by organizing the conference in the name of the University of Bologna, so that Germans could attend. Among them was Hilbert who said "For mathematics, the whole cultural world is a single country".

So Germany had not become a member of the IMU. Germany considered it as a political (rather than scientific) organization. In 1929 and subsequent years Fields, notwithstanding his poor health, traveled to Europe to visit people trying to reconcile them with quite diplomacy in bilateral negotiations. At the next IMC in Zürich (1932) the IMU ceased to exist and eventually dissolved itself on the next meeting in Oslo (1936). It was only re-established as a new organization in 1951 after WWII.

Fields started thinking about establishing a medal for young mathematicians during these European travels and started once more hunting for financial support. After selling 700 copies of the proceedings of the Toronto ICM, a surplus was noted and $2500 were put aside to be awarded to two medals during a forthcoming ICM. Fields insisted that the medal should have no reference to persons, countries or languages. He never explicitly required that the winners should be under 40, but his objective of promoting emerging research points in that direction. He also had tried to promote applied mathematics, so there is room to also look beyond the pure mathematicians. The first medals ware awarded in Oslo (1936) to Lars Ahlfors (Helsinki) and Jesse Douglas (MIT).

He however did not live to this moment. He died in 1932 from a cerebral hemorrhage. His friend John Lighton Synge (an Irish mathematician and physicist who was at that time in Toronto) took over from Fields to set up the design of the medal itself and the organization of the committee for the Fields Medal. The plaque was designed by the Canadian sculptor Richard Tait McKenzie and shows a bas relief of the head of Archimedes and the Latin text reads "Transire suum pectus mundoque potiri" ("Rise above oneself and grasp the world") and the name of Archmedes in Greek ΑΡΧΙΜΗΔΟΥΣ. (The date 1933 MCNXIII has a spelling error and should be MCMXXXIII). The back side reads "Congregati ex toto orbre matematici ob scripta insignia tribuere" ("Awarded by mathematicians gathered from the entire world for outstanding writings"). The name of the prize winner is written on the rim.

So far two Belgians have won the Fields Medal: Pierre Deligne (1978) and Jean Bourgain (1994). Andrew Wiles was just over 40 when his first version of his proof of Fermat's last theorem in 1993 became available. However a gap needed fixing, so he got the Silver Medal in 1998. Grigori Perelman won the medal in 2006 for his proof of the Poincaré conjecture, but by that time he was fed up with the mathematical community and refused. Maryam Mirzakhani was the first woman to get the medal in 2014.

Adhemar Bultheel