Turbulent Times in Mathematics: The Life of J. C. Fields and the History of the Fields Medal

by Elaine McKinnon Riehm
and Frances Hoffman

AMERICAN MATHEMATICAL SOCIETY AND FIELDS INSTITUTE, 2011, 258
PP., \$51.00, ISBN: 978-0-8218-6914-7

REVIEWED BY MICHAEL J. BARANY

If John Charles Fields had his way, his name would be a mostly forgotten footnote in the history of mathematics. A talented student, competent researcher, and mediocre expositor, Fields made noteworthy but generally undistinguished direct contributions to mathematical theory. His most significant interventions in his lifetime involved networking, fundraising, and organizing. As lead organizer for the 1921 American Association for the Advancement of Science (AAAS) meeting and 1924 International Mathematical Congress, both in Toronto, Fields confirmed his place in the history of Canadian and international mathematics as a figure singularly dedicated to bringing scholars together.

As Elaine McKinnon Riehm and Frances Hoffman note at the start and close of their 2011 biography of Fields, *Turbulent Times in Mathematics*, it is therefore ironic that the name of such “a minor mathematician” (p. ix) has come to be associated with the leading lights of mathematical innovation. It is more ironic still that this association comes by way of an international prize, the Fields Medal, whose very name contradicts Fields’s adamant belief that “purely international” prizes ought to be as “impersonal as possible,” uncontaminated by “the name of any country, institution or person.” (This view, discussed at several points in *Turbulent Times*, is expressed in Fields’s memorandum “International Medals for Outstanding Discoveries in Mathematics,” reproduced in [8] as Appendix I; the quotations are on p. 174.) Built around a considerable effort to track Fields’s life and career through an impressive array of archives and contextual sources, Riehm and Hoffman’s accessible and engaging biography offered at the time of its publication in 2011 a perceptive account of a period of great transformation in Canadian and international science and mathematics. A decade later, new historical research has accentuated many of Riehm and Hoffman’s hard-won insights while adding some twists and revisions to their account.

Most significantly, by building their narrative around a comparatively undistinguished mathematician from the comparative fringes of his era’s mathematical research landscape, Riehm and Hoffman show the everyday mix of

idealism (sometimes self-delusion) and legwork that defined international mathematics from the end of the nineteenth century to the outbreak of World War II. Much of the most significant activity played out at a personal scale, in the correspondence and travel of individual mathematicians, building on friendships and circumstantial connections. Like many contemporary mathematicians with international connections and significant organizational ambitions, Fields was a prolific correspondent whose letters and activities appear far and wide. As with other mathematicians who were respected but hardly part of the pantheons of their times, much of his paper trail is lost or scattered, not having obviously demanded preservation.

Riehm and Hoffman’s effort to reconstruct Fields’s life and times thus required reconstructing many of his travels and connections, piecing together fragments of his life from the records and histories of people and institutions he encountered. Their bibliography and acknowledgments are testaments to a determined pursuit that yielded many noteworthy findings. Key names and events reverberate across the biography, providing links and explanations to anchor and motivate the important developments in Fields’s life. Where the paper trail runs thinner, the authors draw more extensively on published primary sources and historical analyses to describe the contours of Fields’s world, even if his exact path through that world was less clear.

The world of J. C. Fields was dominated by two interacting themes that structure the biography. The first was Canada’s (and specifically Toronto’s) emergence as a place of modern science, transformed between Fields’s early studies and late-career advocacy into a significant country (and city) for advanced training and research—internationally noteworthy, if not preeminent. The second was the shifting dynamic of migration, cooperation, influence, and conflict in international mathematics, defined especially by the contrast before and after the Great War of 1914–1918. Fields’s career was both indicative of and, eventually, a significant factor in the historical links between these two major developments of the late nineteenth and early twentieth centuries. Though the biography sometimes leans on clichés and questionable generalizations in characterizing the two sides of this story separately, the authors are informed by a solid (albeit sometimes dated) base of historical scholarship on each and develop the ties between them with greater nuance.

In this account, the Fields Medal whose history is promised alongside that of J. C. Fields in the subtitle is more a symptom of the interactions between the histories of Canadian and international mathematics than an object of inquiry in its own right. The medal’s paper trail is even more elusive than the mathematician’s, scattered across incidental mentions and confidential missives that in many cases were not intended to be saved and in other cases are obscured by guesswork and misrecollection. The authors develop several suggestive thematic allusions between Fields’s career and the medal and assemble and synthesize the relatively scant direct evidence available of his personal role in the medal’s creation, while mostly resisting the temptation to speculate beyond what their sources about

Fields indicate about the medal, by which he is most remembered. The allusions range from a fairly superficial and dubious extrapolation of Fields's admiration of the epoch-making geniuses of European mathematics to a thoroughly convincing and insightful analysis of Fields's role in mathematicians' political conflicts of the 1920s and its implications for his proposed medal.

The biography begins in Fields's hometown of Hamilton, Ontario, unspooling a familiar brand of family history in the context of the city's growth in the second half of the nineteenth century before turning to Fields's higher education and doctoral study in the respective contexts of the University of Toronto and Johns Hopkins University, in Baltimore, Maryland. The authors then continue the pattern of pairing Fields's career to a wider discussion of his institutional situations with a survey of his postdoctoral formation, primarily in Berlin, and his developing career in Canada, culminating with his 1919–1925 presidency of the Royal Canadian Institute and the 1921 AAAS meeting that marked his maturation as an organizer and advocate for scientific research. These chapters, anchored to Fields's personal and professional development, illuminatingly sketch the small world of elite mathematics around the turn of the century and the process of networking and study needed for a promising mathematician from the discipline's margins to break in and establish a reputation and career.

Fields fades somewhat into the background in the middle chapters, which contrast a pre-1914 “golden” period of international mathematics with the conflict of the Great War and scientists' efforts to reimagine international institutions in its wake. The authors acknowledge the diversity and often the ambivalence of contemporary and retrospective views of this time, but end up taking a historiographical position whose implications are not entirely transparent in the book itself. The fundamental narrative is one of mostly unproblematic and irenic cooperation at the turn of the century, followed by a kind of fever of national sentiment that carried beyond the war in peacetime settlements that defied the ideals of scientific internationalism. The conflict of the 1920s, in this view, pitted resentful nationalist scientists against those who retained and wished to restore a prewar cooperative and international ideal, with resentment and nationalism ultimately dooming interwar cooperation. Reflecting the rhetoric of the decade, “true” or “genuine” or “full” internationalism was tantamount to including German mathematicians on equal terms, regardless of the de facto inclusion or exclusion of most of the rest of the world. It is clear where the authors' sympathies lie, even in situations in which Fields himself showed more hesitation, oscillation, or ambivalence.

Records of mathematicians' deliberations after World War II, beyond the scope of the authors' already extensive research for this book, show how this Manichean picture of the first part of the twentieth century crystallized in the rhetoric surrounding later struggles for control of the discipline's international institutions. The picture in *Turbulent Times* is ultimately sympathetic to the perspective developed by those who would found a renewed International Mathematical Union in the 1950s. This perspective, emphasizing in-principle openness and elective

participation, has continued to dominate mathematicians' understanding of the decades surrounding the Great War, including Curbera's history of the International Congresses [4] and Lehto's history of the International Mathematical Union [5]. Deriving from the views of neutral and antiwar mathematicians, most significantly Gösta Mittag-Leffler of Sweden, this historiography later became a mechanism for mathematicians to treat the interwar period and its associated conflicts as an ellipsis that need not be reckoned with in setting a post–World War II course for mathematics. Instead, they selectively imagined a golden era when mathematicians convened freely and apolitically, a fictional international ideal that they could claim to aim to restore.

To the credit of *Turbulent Times*, one does not have to read far between the lines to find alternative narratives. As recent histories of turn-of-the-century, wartime, and interwar mathematics have examined and elaborated in various ways, conflict and cooperation—as well as, importantly, hegemony and inequality—run throughout international mathematical endeavors in the period in question. The late nineteenth and early twentieth centuries may have felt like a golden era, especially in retrospect, to the few with the privilege to participate, but international efforts tended to be tokenistic, isolated, or overshadowed by local and regional affairs. They were limited, moreover, by cost and class, prejudice and language, and other parameters of global difference. The piecemeal and opportunistic nature of prewar mathematical internationalism comes across clearly in Fields's own story in the first half of the book. It was, as the authors note in various ways, mostly a world of particular men with the resources, capabilities, and identities that allowed them to participate in the dominant settings and languages of Western Europe.

The Great War, meanwhile, was a time not just of ideological conflict but of consequential national mobilization and collaboration along military alliances [1], some of which Riehm and Hoffman leaven into their account of warring ideologies. While persistent conflict between mathematicians of the major European combatants was significant in the discipline's international developments of the 1920s, so too were domestic politics and economics, new geopolitical configurations outside of Europe and its colonial networks, and new nongovernmental organizations with financial and other stakes. Among these latter, large American philanthropies had an outsized effect on the individual careers and institutional capacities of interwar mathematics [6]. The authors' account of Fields's ambitious fundraising effectively illustrates the Canadian dimensions of this broader development.

The book's eighth chapter, “The Politics of Avoidance,” returns in earnest to the Fields paper trail and offers the book's most important insight into the mathematician's historical significance. The authors explain how Fields navigated the complex dynamics that followed the Treaty of Versailles to take over responsibility for the 1924 International Congress of Mathematicians from its prospective American hosts and brought about a congress in Toronto in conjunction with the annual British Association for the Advancement of Science meeting, also in Toronto that summer. Fields confronted the many obstacles to his

Toronto Congress with persistence, resourcefulness, and a willingness to deflect and compromise over the many conflicts and disappointments, large and small, that came his way. Usurping what was to have been Stockholm and then New York's role as the first International Congress of Mathematicians outside of the traditional European mathematical powers, Fields's congress distilled to an extreme the key features of earlier decades of mathematical internationalism in a new and rather unlikely location. These features were less about idealism and collective initiative and much more about the power and limitations of individual mathematicians and their personal and institutional networks, as well as their willingness to celebrate small and compromised achievements as unequivocal triumphs of a universal project.

The subsequent chapter, on the 1924 Congress itself and the effort to fund and produce its *Proceedings*, extends many of the insights about the politics of avoidance and sets up a chapter framing Fields's immediate motivations for an international medal in terms of the politics of the Congress's 1928 successor in Bologna. Here, both historically and historiographically, one must really read between the lines, and Riehm and Hoffman's tendency to take sources at face value here drains nuance from the partisan picture of 1920s mathematical politics characterized above. Unreliable narrators and subtle secondary implications among both historical and analytic sources make the 1928 Congress particularly challenging to explicate, and its treatment here falls into some traps recently highlighted by Reinhard Siegmund-Schultze [7].

Unreliable sources unfortunately continue to mark the following chapter, on the creation of the Fields Medal itself, though the authors' dedication in assembling and integrating valuable historical sources shines through nevertheless. The chapter leans strongly both directly and indirectly on the testimony of Fields's junior colleague John Lighton Synge, whose accounts from long after the events themselves are not always well supported by the limited contemporary evidence to which they can be compared, including sources assembled in the chapter. For example, the authors appear to endorse Synge's claim, uncorroborated by any contemporary correspondence, that Fields explicitly linked his proposed medal to the Nobel Prize [2]. Other puzzling claims derived from Synge, such as the assertion that the medal (which bears an imagined portrait and the name of Archimedes) "bears the name of no person or country, as he [Fields] wished" (p. 196), call at least for some qualification.

A final chapter recounts Fields's final years and the disposition of his estate, both of which figure in the early history of the Fields Medal. Appendices list Fields's publications and offer biographical sketches of the Fields Medalists and of many of Fields's colleagues encountered in the book. The authors note the absence of Canadian Fields Medalists, a void filled in 2014 at the very next International Congress of Mathematicians after the book's publication by Manjul Bhargava, born in Fields's home town of Hamilton, Ontario. The authors elsewhere note the profound male bias in Fields's biography, which features just a few women as secretaries and nurses, but look past

the corresponding bias in the Fields Medal. Maryam Mirzakhani's headline-making medal of 2014, of course, also postdated *Turbulent Times*.

Riehm and Hoffman observe that the Fields Medal's importance grew significantly in the post-World War II period, long after Fields's death and following a war-induced hiatus of fourteen years between its first and second awarding. In fact, it seems likely that mathematicians and historians have misinterpreted some of the pomp and circumstance associated with the prize presentations between 1950 and 1962 as evidence of the prize's elevated status among mathematicians (and implicitly more broadly) in that period. Rather, the balance of other sources from those years corroborates the likelier interpretation that the Fields Medal was in those years a significant but not monumental mid-career award, somewhat artificially inflated by its association with the International Congresses. The political conflict that dramatically elevated the award's profile in 1966 was of a rather different sort from the "politics of avoidance" that explain the medal's original proposal. A somewhat arbitrary change in eligibility criteria that same year inflated expectations of medalists' accomplishments in a way that further distorted retrospective views of the award, whose winners generally won further distinction but were not so clearly at the pinnacle of their fields at the time of their selection.

Such discontinuities in the award's administration and prestige, and the corresponding paucity of documentation from the early years of the prize, make Fields's biography a strikingly limited resource for explaining the history of the medal through which he is quite against his will most remembered. Recently uncovered archival documents, together with the reinterpretations of other available evidence they enable, make clear just how little the post-World War II Fields Medal committees knew or cared about Fields's motivations or intent [3]. These documents indicate that apart from Fields's memorandum proposing an international medal, postwar committees received minimal guidance on the purpose or parameters of the medal and felt considerable latitude to consider principles and priorities that, so long as they were consistent with available precedent, gave whatever outcome the committees found sufficiently expedient or worthwhile for forming a consensus. The 1936 committee, composed of colleagues and associates who knew Fields and may have paid some heed to his history and ideals, was emphatically the exception in the medal's history.

The ambition in *Turbulent Times* to explain the Fields Medal through the biography of John Charles Fields was based on a flawed premise that the medal's later history is a robust embodiment of the mathematician and his intent. The appended material on the medalists and the authors' occasional speculations connecting the biography to well-known features of the present incarnation of the medal, both based on this premise, feel understandably out of step with the rest of the project. Set aside this headline motivation, however, and there remains a rich and valuable study of a pivotal period in international mathematics as well as Canadian science. The authors' interest in Fields rapidly proves its worth for reasons quite separate from the

medal's history, offering rewarding historiographical challenges and opportunities to develop an incisive perspective on the conflicts and compromises of international mathematics from the view of an initially marginal figure clamoring to bring harmony to the discipline's turbulent center. A decade on, this historical contribution shines far brighter than the book's titular medal.

OPEN ACCESS

This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

Michael J. Barany
University of Edinburgh
Edinburgh
Scotland
e-mail: michael@mbarany.com
URL: <https://mbarany.com>

REFERENCES

- [1] David Aubin and Catherine Goldstein, eds. *The War of Guns and Mathematics: Mathematical Practices and Communities in France and Its Western Allies Around World War I*. American Mathematical Society, 2014.
- [2] Michael J. Barany. The myth and the medal. *Notices of the American Mathematical Society* 62:1 (2015), 15–20.
- [3] Michael Barany. The Fields Medal should return to its roots. *Nature* 553 (18 January, 2018), 271–273.
- [4] Guillermo P. Curbera. *Mathematicians of the World, Unite! The International Congress of Mathematicians: A Human Endeavor*. A K Peters, 2009.
- [5] Olli Lehto. *Mathematics Without Borders: A History of the International Mathematical Union*. Springer, 1998.
- [6] Reinhard Siegmund-Schultze. *Rockefeller and the Internationalization of Mathematics Between the Two World Wars: Documents and Studies for the Social History of Mathematics in the 20th Century*. Birkhäuser, 2001.
- [7] Reinhard Siegmund-Schultze. “Mathematics Knows No Races”: a political speech that David Hilbert planned for the ICM in Bologna in 1928. *Mathematical Intelligencer* 38:1 (2016), 56–66.
- [8] Henry S. Tropp. The origins and history of the Fields Medal. *Historia Mathematica* 3 (1976), 167–181.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.