Preface

John Charles Fields (1863–1932) is chiefly remembered for his legacy—the international gold medal for outstanding mathematics discoveries that is known as the "Fields Medal." Although he was the foremost Canadian mathematician in his lifetime, in world terms he was a minor mathematician in an age of much greater ones. Within a short time, his own mathematics research was overtaken by a powerful modern abstract algebraic approach, and his work is therefore now seen only as a footnote by those interested in the medal. How did his modest medal become the highest award in mathematics? Who was Fields? Why did he create the medal? And how did he do it?

Although the Fields Medal is well known to mathematicians—who consider it to be the equivalent of the Nobel Prize—it is little known by the general public. There are a number of reasons for this. The accompanying prize money ($CAD 15,000) is small in comparison with the Nobel Prize. Mathematics itself is poorly understood outside its own boundaries, whereas the Nobel Prize recognizes achievements in literature, peace, medicine, physics, chemistry, and economics—disciplines accessible to a wide general audience. The Nobel Prize is given annually in high ceremony, whereas the Fields Medal is awarded with minimal ceremony every four years at the International Congress of Mathematicians (ICM). Mathematicians may also be said to be self-effacing, possessing a high regard for the research that wins the Medal but with a certain indifference to ceremony and publicity. News coverage of the Fields Medal is meagre because most news reporters find it hard to write about discoveries in mathematics. This has always been true.

The Fields Medal is distinctive in other ways. To make it truly international, Fields specified that it should not carry the name of any person, modern language, or country. It is engraved instead with an idealized relief of Archimedes in profile and inscriptions in Greek and Latin, with the name of the winner on the outside rim. There is no national identification, no mention

of Canada, although Fields was Canadian, the sculptor—R. Tait McKenzie—was Canadian, and the medal is struck every four years at the Canadian Mint. Finally, Fields left instructions that it be awarded both to recognize discoveries and to encourage further research. To meet these conditions, over the years the International Mathematical Union (IMU) has set an upper age limit of 40 for winners.

Fields valued scientific research above all things and, like most mathematicians, was quick to recognize and admire the powerful discoveries of others. But this itself does not explain the trouble he took in the three years before his death to negotiate terms for the medal that would make it acceptable to an international scientific community still fractured by World War I. The history of international scientific relations in the first three decades of the twentieth century is a part of Fields' story and a key to the medal.

Before World War I, scientists regarded all science as international, but mathematicians proudly considered mathematics to be the most international of the sciences. It was, they said, the most natural discipline for co-operation without regard to frontiers, language, or race. Hallmarks of these years were great international mathematical gatherings. The first of these that Fields attended was the centenary celebration of the Norwegian mathematician Niels Henrik Abel in Christiania, Norway, in 1902. The most important, however, were the International Congresses of Mathematicians that began in Zürich in 1897 and culminated in Cambridge, England, in 1912. The outbreak of war in August 1914 caused an abrupt schism in all the sciences that persisted after the armistice of 1918, after the 1919 peace treaty, and after Germany had joined the League of Nations in 1925.

Today, many historians of the twentieth century look at the period between the two world wars as an uneasy pause in a single war. The peace of 1919 was not a peace of reconciliation, overburdened as it was with loss—loss of life, loss of political and economic stability, and loss of confidence in old values. It was the same in science. Bitter words spoken and written by leading scientists on all sides during the war were remembered afterwards and repeated under new circumstances, becoming an obstacle to post-war reconciliation.

This was the situation in 1921 when Fields boldly proposed to hold the 1924 International Mathematical Congress (IMC) in Toronto. (All other congresses were called ICMs.) Fields' central involvement in the turbulent politics of mathematics began with this invitation and continued until his death. Endowing the medal in 1932 was his way of doing what he could to heal the "rift" among his colleagues, particularly the French and Germans.

Mathematicians reading this work will recognize their mathematical forebears from the early twentieth century, whose names are found in mathematical terms widely in use today. Non-mathematical readers will encounter them for the first time. Readers familiar with the modern University of Toronto will

meet Fields' contemporaries—his friends and colleagues who left their mark on the development of science in Canada and their names in laboratories and buildings at the University. Wherever possible, we have allowed these people to speak in their own voices, often in their own languages, in order to recreate the international mathematical setting in which Fields lived and worked.

We were struck during our research by the absence of women from the story. This reflects the reality in science and universities during Fields' lifetime. When he attended the University of Toronto, women students were not admitted. As a post-doctoral student in Göttingen, Fields first encountered several women mathematicians who were studying with Felix Klein. It is noteworthy that at the Bologna Congress in 1928, Emmy Noether (1882–1935) was a speaker in the session on Algebra that Fields chaired. When she gave a plenary lecture at the Zürich Congress in 1932, it was the first time a woman had done so.

Previous studies of Fields have emphasized the medal because the man is harder to find. Most of his correspondence and other records at the University of Toronto have disappeared, along with the photographs and lantern slides he is known to have collected. These items were neglected if not destroyed at either his or his brother's request. As he never married, there were no children to conserve them. Had he been a scientist or mathematician of the rank of Einstein, Hilbert, Klein, Picard, or Poincaré, for example, his colleagues and students would have rescued and sorted his personal papers as well as his mathematics notes. While some of his papers remained for a period in the basement of 47 St. George Street, Toronto, which then housed the Department of Applied Mathematics, that building and the records stored there have disappeared. Therefore, we have to come at Fields obliquely.

A few of Fields' correspondents in Canada kept his letters along with copies of their letters to him. The papers of Robert Falconer, President of the University of Toronto from 1907 to 1932, located in the University of Toronto Archives, are a particularly valuable source of information and include third-party letters to Falconer in which there are references to Fields and his work. These references lead in turn to archives elsewhere. Glimpses of Fields may be found in his letters to the Prime Ministers of Canada and Premiers of Ontario to whom he often wrote asking for money. Fragments of his large correspondence as President for five years of the Royal Canadian Institute are preserved among Institute papers, now in the Thomas Fisher Rare Book Library at the University of Toronto.

During his lifetime, Fields also corresponded widely with colleagues outside Canada, and from 1920 to 1932, he was active in the International Mathematical Union (IMU). His correspondence and third-party correspondence related to the international politics of mathematics may be found in the American Mathematical Society papers, Brown University Library; the British Association for the Advancement of Science (BAAS) Collection, Adolph Basser Library, Australian Academy of Science; the papers of George Ellery Hale, Archives,

California Institute of Technology; the E.H. Moore papers, Special Collections Research Center, University of Chicago; the J.L. Synge papers, Library, School of Theoretical Physics, Dublin Institute for Advanced Studies; the records of the Deutsche Mathematiker-Vereinigung, Universitätsarchiv, Universität-Freiburg, Germany; Gösta Mittag-Leffler correspondence, Institut Mittag-Leffler, Djursholm, Sweden; and at the Collège de France, Paris. In the years ahead, other letters by Fields and references to him may come to light in unexpected places and will undoubtedly add shading to his story.

In addition, Fields and a number of his contemporaries whom we meet here published non-scientific pamphlets and books occasioned by World War I: Paul-Émile Appell, Robert Falconer, Jacques Hadamard, Georg F. Nicolai, William Osler, and Émile Picard, among others. These are of great interest.

Fields' Berlin notebooks and the detailed notes he made in 1917–18 during visits to research centres and laboratories in the United States have been preserved at the University of Toronto. His articles and pamphlets record his views about the importance of scientific research in a modern industrial society and the influence of the Johns Hopkins University and the University of Berlin on him. In Hamilton, there are attendance records for him at school. Sparse genealogical information on his family is available in vital records and obituaries. Newspaper reports of scientific meetings he attended are available in many libraries, and his photograph may be found in a number of archives—he is usually standing in the back row wearing a serious expression. Fields' love of travel is well known, and he has left traces of himself in the passenger lists of many steamship lines.